# Department
# of
# Mathematics and Statistics

## School of Mathematical and Physical Science


## Curriculum Framework
## B.Sc./B.A.-Mathematics

## Based on National Education Policy- 2020

**Date of BoS – 16/09/2022**

**Doctor Harisingh Gour Vishwavidyalaya**
**(A Central University)**
**Sagar-Madhya Pradesh-470003**

## About the Department:

The Department of Mathematics & Statistics was established with the very inception of the University in the year of 1946. The founder of the university and the founder vice-chancellor Dr. Harisingh Gour had himself appointed Mr. R.B. Rabugunday as the first Head of the Department. Mr. Rabugunday was a scholar of Madras University and a Wrangler of Cambridge tradition.

## Curriculum Framework based on National Education Policy-2020

NEP-2020 has conceptualized the idea to develop well rounded competent individuals for making the nation a self-reliant and global leader. In the same spirit, we at Department of Mathematics and Statistics have developed a curriculum framework to encompass the goals of NEP 2020. To this end, we have incorporated choice of subject/disciplines of study, creating academic pathways having constructive combinations of disciplines for study with multiple entry and exit points as well as focus on **experiential learning** for students by introducing **multidisciplinary and skill enhancement courses** and actual Hand's on training in the recent and trending aspects of

1. **Mathematical Science**

### Under Graduate Curriculum Framework for Bachelor of Science

1. **Name of the Programme : Certificate in Mathematical Science**
2. **About the Programme:**

   Mathematics is backbone of all discipline. Aim of this programme is to train young minds to handle the critical problems that occur in Mathematical Sciences as well as in real life.

3. **Objectives of the Programme**
   - To develop students' skills in mathematical science through various tools and techniques.
   - To provide rigorous instruction in fundamental mathematical concepts and skills presented in the context of real-world applications.
   - To introduce students to the enormous diversity and complexity of real life problems in Mathematics.
   - To provide the opportunity to gain familiarity with the applications of mathematics.
4. **Programme Learning Outcomes :**

   The programme learning outcomes are attained by learners through the essential learnings acquired on completion of selected courses of study within a programme. The outcomes and attributes described in qualification descriptors are attained by students through learning acquired on completion of a programme of study.

a) After completion of this program of study the students will have an enhanced knowledge and understanding of mathematics.

b) The Mathematical skills learned through this course will provide analytical understanding for approaching problems that the students encounter in real life situations.

c) Students who will pass out this course be better able to draw inferences that rest on mathematical logics.

## 5. Structure of the Programme (B.Sc./B.A.) for : Certificate in Mathematical Sciences

| | Semester I | | | | |
|---|---|---|---|---|---|
| Level 5 | **Nature of Course** | **Course Code** | **Course Title** | **Credits** | **Course Coordinator** |
| | Discipline Specific Major-1 | MTS-DSM-111 | Calculus | 6 | Dr. U.K.Khedlekar<br>Dr. P. Gupta |
| | Multi-Disciplinary Major-3 | MTS-MDM-111 | Matrix Theory | 6 | Dr. KS Mathur |
| | Ability Enhancement Course | MTS-AEC-111 | Graph Theory | 2 | Dr. MK Yadav |
| | Skill Enhancement Course | MTS-SEC-111 | Vector Calculus | 2 | Dr. UK Khedlekar<br>Dr. Bhupendra |
| Level 5 | **Semester II** | | | | |
| | **Nature of Course** | **Course Code** | **Course Title** | **Credits** | **Course Coordinator** |
| | Discipline Specific Major-1 | MTS-DSM-211 | Basic Algebra | 6 | Dr. T Nath |
| | Multi-Disciplinary Major-3 | MTS-MDM-211 | Numerical Methods | 6 | Dr. RK Pandey |
| | Ability Enhancement Course | MTS-AEC-211 | Fundamental of Computer | 2 | Dr.K.S.Mathur |
| | Skill Enhancement Course | MTS-SEC-211 | Boolean Algebra | 2 | Dr. K Shrivastava |

## 6. Exit: Certificate in Mathematical Sciences

## 7. Teaching Learning Approach:

Mainly this programme will transact the under given pedagogic approach-

- Lecture/ Seminar format
- Demonstration
- Readings/written assignments and Field Projects
- Group discussions/tutorial Community visit
- Project work
- Field Visit/Survey/Dissertation

## 8. Assessment

The learner in the programme will be assessed throughout the duration of the programme in a formative and summative evaluations i.e. Mid (I&II) and End Semester examinations. To be eligible to appear in End semester examination a student must appear in Mid semester examinations along with 75 per cent attendance in classroom processes

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**(A Central University)**
**Department of Mathematics and Statistics**
**NEP Syllabus 2022**
**B.Sc./ B.A Sem-I (Mathematics)**

| Level & Semester | Course Code | Title of the Course | Credits | | | | Marks | Course Coordinator |
|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | | |
| **L5 Sem I** | **MTS-DSM-111** | **Calculus** | **5** | **1** | **0** | **6** | **IA(Mid)-40 EA(End Sem)-60** | **Dr.U.K.Khedlekar Dr. Punam Gupta** |

**Lectures/Hrs: 90**

**Learning Objectives:** This course will enable the students to:

Understand the basic tools of Calculus so that they can view and analyze the real world problem. Calculate the limit and examine the continuity and understand the geometricalinterpretation of differentiability. Understand the consequences of various mean value theorems.
Draw curves in Cartesian and polar coordinate systems.

**Course Learning Outcomes:**

**CO 1** After completion of the course students will be able to understand the application of Rolle's Theorem, Mean Value Theorem and Lagrange's Theorem in industry.

**CO 2** Understand the fundamental properties of the real numbers, including completeness and Archimedean, and density property of rational numbers in $\mathbb{R}$.

**CO 3** By plotting (trace) curves, they understand the characteristics of different curves inCartesian and polar coordinates.

**Unit wise Learning Outcomes:**

**UO 1:** This course will enable the students to understand continuity and differentiability in terms of limits and graphs of certain functions.

**UO 2:** To understand higher order derivatives and Applications.

**UO 3:** Describe asymptotic behavior in terms of limits involving infinity. Use derivatives to explorethe behavior of a function.

**UO 4:** The students will be able to use basic tools of analysis related to functions.

**UO 5:** The students will understand how useful double and triple integrals.

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|---|
| **Unit-I:** Continuity, ε-δ definition of limit and continuity of a real valued function; Differentiability and its geometrical interpretation; Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem and their geometrical interpretations, Darboux's theorem. boundedness of continuous function on the closed interval. |
| **Unit-II:** Successive differentiation and Leibnitz theorem, Maclaurin's and Taylor's theorems for expansion of a function, Taylor's theorem in finite form with Lagrange, Cauchy and Roche–Schlömilch forms of remainder |
| **Unit-III: Curvature, Asymptotes and Curve Tracing:** Curvature; Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection,Tangents at origin, Multiple points, Position and nature of double points; Tracing of Cartesian, polar and parametric curves. |
| **Unit-IV:** Limit, continuity and first order partial derivatives, Higher order partial derivatives, Change of variables, Euler's theorem for homogeneous functions, Taylor's theorem, Total differentiation and Jacobians. |
| **Unit-V:** Double integration over rectangular and non rectangular regions, Double integrals in polar coordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals.. |

**Essential Readings**


1. Howard Anton, I. Bivens & Stephan Davis (2016). *Calculus* (10th edition). Wiley India.
2. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). *Thomas'* *Calculus* (14th edition). Pearson Education.


**Suggested Readings**


1. Gabriel Klambauer (1986). *Aspects of Calculus*. Springer-Verlag.
2. Wieslaw Krawcewicz & Bindhyachal Rai (2003). *Calculus with Maple Labs*. Narosa.
3. Gorakh Prasad (2016). *Differential Calculus* (19th edition). Pothishala Pvt. Ltd.
4. Jerrold Marsden, Anthony J. Tromba & Alan Weinstein (2009). *Basic Multivariable Calculus*, Springer India Pvt. Limited.


**Essential e-Resources**

1. Link-NPTEL :: Mathematics - NOC:Basic Calculus 1
2. Link-Calculus Of One Real Variable - Course (nptel.ac.in)

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**B.Sc./ B.A Sem-I (Mathematics)**

| Level & Semester | Course Code | Title of the Course | Credits | | | | Marks | Course Coordinator |
|---|---|---|---|---|---|---|---|---|
| | | | **L** | **T** | **P** | **C** | | |
| **L5 Sem I** | **MTS–MDM - 111** | **Matrix Theory** | **5** | **1** | **0** | **0** | **IA (Mid) – 40 EA (End Sem) - 60** | **Dr. K.S. Mathur** |

**Lecture/Hrs. 60**

**Learning Objectives:**

- To understand the basic concept of matrices and their types
- To familiar with the application of Caley Hamilton theorem in finding inverse of matrix.
- To provide an introduction of Matrices to real life problems

**Course Learning Outcomes:**

**CO 1:** Students should have an enhanced knowledge and understanding of Matrix theory.
**CO 2:** The course skills should provide several methods for approaching problems students encounter in their future endeavors.
**CO 3:** Students should be better able to understand matrix concept in terms of linear map.

**Unit wise Learning Outcomes**

**UO 1:** Students should be able to determine the rank of matrix and elementary operation to convert into Echelon form, normal form, etc.
**UO 2:** Students should be able to evaluate eigen values and eigenvectors of various square matrices.
**UO 3:** Students should be able to solve system of linear equations through matrix methods.
**UO 4:** Students should be able to understand matrix into linear map and vice-versa.
**UO 5:** Students should be acquainted with the knowledge of MATLAB and applications matrices into real life problems.

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| **Unit I:** Matrix algebra, Row and column vectors of a matrix, row rank and column rank, Echelon matrix, reduced Echelon matrix, rank of a matrix, normal form of a matrix, inverse of matrix. |
| **Unit II:** Square matrices, square block matrices, eigen values and eigenvectors of a matrix, relationship between eigen values and eigenvectors, nature of eigen values of special types of matrices, the process of finding eigen values and the eigenvectors. |
| **Unit III:** Cayley-Hamilton theorem and its use in finding of inverse, application of matrices to system of linear equations, consistency and inconsistency, |
| **Unit IV:** Matrix as a linear map: subspace and span, basis and dimension, linear transformation, coordinate vectors, coordinate matrices, change of the basis matrix, equivalence and similarity. |
| **Unit V:** MATLAB basics, practical approach of matrices through MATLAB, applications of matrices in real world problems, |

**Essential Readings**


1. Joel L. Franklin, Matrix theory, Dover Publication 2012.
2. David W.Lewis, Matrix theory. World scientific, 1991.


**Suggested Readings**


1. Fuzhen Zhang, Matrix theory, Basic results and Techniques, Springer 2011.
2. Leonard E Fuller, Basci Matrix theory, Dover Publication 2017.


**Essential e-Resources**

**1.** https://www.scribd.com/book/271620206/Matrix-Theory
**2.** https://link.springer.com/book/10.1007/978-3-030-80481-7

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**Syllabus as per NEP-2020**
**B.Sc./ B.A Sem-I (Mathematics)**

| Level & Semester | Course Code | Title of the Course | Credits | | | | Marks | Course Coordinator |
|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | | |
| **L5 Sem I** | **MTS-AEC-111** | **Graph Theory** | **2** | **0** | **0** | **2** | **IA (Mid)-40 EA (End Sem)- 60** | **Dr. Kavita Shrivastava** |

**Lectures/Hrs: 30**

## Learning Objectives:

1. Students will achieve command of the fundamental definitions and concepts of graph theory.
2. To study proof techniques related to various concepts in graphs.
3. To explore modern applications of graph theory.
4. Able to apply theoretical knowledge acquired to solve realistic problems in real life.

## Course Learning Outcomes:

CO1: Understand the basic concepts of graphs, and different types of graphs.
CO2: Understand the properties, theorems and be able to prove theorems.
CO3: Apply suitable graph model and algorithm for solving applications.
CO4: Understand the Travelling Salesman's problem.
CO5: Form Dijkstra'salgorithm and apply it in various situations.

## Unit Wise Learning Outcomes:

UO1. To learn about graph and its properties.
UO2. To learn about types of graph .
UO3. To learn about travelling salesman problem and its application.
UO4. Aware about planar graph.
UO5. Aware about shortest path, trees and its properties.

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|---|
| **Unit I :** Definition, examples and basic properties of graphs, graph terminology, types of graph, path, trail, circuit, cycle, complementary graph. |
| **Unit II :** Sub graphs, Spanning Subgraph, Isomorphic Graph, Homoeomorphic graph, Connected graph, Disconnected graph, Cut set, Cut point, Complete graph, Labeled graph, Weight graph, Regular graph, Bipartite graph, Complete bipartite graph. |
| **Unit III:** Definitions: Directed and undirected graphs. Hand shaking property and its problems. Real life applications Applications- Konigsberg bridge problem, Utility problem and travelling salesman problem. Euler graphs and Hamiltonian graphs (no theorems) problems. |
| **Unit IV :** Planar graph, Properties of planar graph, Non- planar graph, Euler formula, Kuratowski's theorem, Graph coloring. |
| **Unit V :** Shortest path, Dijkstra's algorithm, Trees and their properties, Spanning tree, Kruskal's algorithms. |

## Essential Reading:


1. Narasingh Deo, Graph Theory with applications to engineering and computer Science, Edition, Printice hall of India Private Limited, 2009.
2. Ralph P. Grimaldi., Discrete and Combinatorial Mathematics, 5th Edition , Pearson, 2006.


## Suggested Reading


1. Geir Agnarsson and Raymond Greenlaw, Graph Theory, Modeling, Applications and Algorithms, 1st Edition, Pearson Education, Inc, New Delhi 2009.
2. John Clark and Holton D.A, A First Look at Graph Theory, Edition, Allied Publishers, 2001.
3. Douglas B West, Introduction to Graph Theory, 2nd Edition, Printice hall of India Private Limited, New Delhi.

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| Level & Semester | Course Code | Title of the Course | Credits | | | | Marks | Course Coordinator |
|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | | |
| L5 Sem I | MTS-SEC-111 | Vector Calculus | 2 | 0 | 0 | 2 | IA (Mid)-40 EA(End Sem)- 60 | Dr.U.K.Khedlekar Dr. Bhupendra |

**Lectures/Hrs: 30**

**Learning Objectives:**

To understand the concept of differentiation of vector function, and applications of Scalar and vector product. To understand the aspects of gradient, divergence and curl.

**Course Learning Outcomes:**

**CO1:** Students capable to understand the vector valued function.
**CO2:** After completion of this course, students should be able to manipulate vectors to perform geometrical calculations in three dimensions.
**CO3:** They will also able to calculate and interpret derivatives in up to three dimensions.

**Unit Wise Learning Outcomes:**

**UO1.** To learn about vectors and Scalar
**UO2.** To learn about partial differentiation of vector function.
**UO3**. To learn about derivative of sum and dot product.
**UO4.** To find out the derivative of cross product of two vectors.
**UO5**. To discuss about gradient, divergence and curl.

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| **Unit – I:** Differentiation of a vector function and Partial differentiation of a vector function. |
| **Unit – II:** Derivative of sum and dot product of two vectors and their properties. |
| **Unit – III:** Derivative of cross product of two vectors and their properties. |
| **Unit – IV:** Work done and moment by force. |
| **Unit – V:** Gradient, divergence and curl. |

**Essential Readings :**

1. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998.

**Suggested Readings :**

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.

**E-resource :**

**https://onlinecourses.nptel.ac.in/noc22_ma03/preview**
https://www.youtube.com/watch?v=M0H1UJbn-V4

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**Syllabus as per NEP-2020**
**B.Sc./ B.A Sem-II (Mathematics)**

| Level & Semester | Course Code | Title of the Course | Credits | | | | Marks | Course Coordinator |
|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | | |
| **L5 Sem II** | **MTS–DSM-211** | **Basic Algebra** | **4** | **2** | **0** | **6** | **IA(Mid) - 40 EA(End Sem) - 60** | **Dr. U.K.Khedlekar Dr.T. Nath** |

**Lectures/Hrs: 30**

**Learning Objectives**

To explain the construction of integers and properties. The polynomial equations and De Moivre's Theorem.
To introduce Basic notions of abstract algebra and related theorems.

**Course Learning Outcomes:** This course will enable the students to:

**CO1:** Employ De Moivre's theorem in a number of applications to solve elementary problems.
**CO2:** To understand the group and its properties.
**CO3:** To understand the cyclic group and its properties.

**Unit wise Learning Outcomes:** After completion of this course successfully, the students will be able to:

**UO1:** Interpret the basic results on division algorithm, Euclidean algorithm and solve elementary problems on them and to learn group forming by roots of polynomial.
**UO2:** To understand the group and subgroup.
**UO3:**. Understand about the fundamental concepts of groups, subgroups, normal subgroups, isomorphism theorems, and observe the interesting applications.
**UO4:** Learn about the fundamental concepts of cyclic groups, Classifications of subgroup of cyclic groups, permutation groups and Cayley's theorem.
**UO4:** Learn the fundamental concepts of vector spaces, basis and dimension and to solve elementary problems on them.

| |
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| **Unit-I:** Sets, Relations, Equivalence relations, Equivalence classes; Finite, countable and uncountable sets; The division algorithm, Divisibility and the Euclidean algorithm, Modular arithmetic and basic properties of congruence, Elementary theorems on the roots of polynomial equations, Imaginary roots. The fundamental theorem of algebra (statement only); The $n^{th}$ roots of unity, De Moivre's theorem for integer and rational indices and its applications |
| **Unit-II:**Definition and properties of a group, Abelian groups, Examples of groups. including $D_n$(dihedral groups),$Q_8$(quarternian group), $GL(n,\mathbb{R})$ (general linear groups) and $SL(n,\mathbb{R})$(special linear groups), $\mathbb{z}_n, U(n)$; Subgroups and examples. |
| **Unit-III** Cosets and their properties, Lagrange's theorem and its applications. |
| **Unit-IV:**. Cyclic groups and propertie. Normal subgroups and their properties, Simple groups, Factors groups; Group homomorphisms and isomorphisms with properties; First, second and third isomorphism theorems for groups |
| **Unit-V**: Classifications of subgroup of cyclic groups, Cauchy theorem for finite Abelian groups; Centralizer, Normalizer, Center of a group, Product of two subgroups, Permutation group and properties, Even and odd permutations, Cayley's theorem. |

**Essential Readings:**


1. Michael Artin (2014). Algebra (2nd edition). Pearson.
2. John B. Fraleigh (2007). A First Course in Abstract Algebra (7th edition). Pearson.
3. Stephen H. Friedberg, Arnold J.Insel& Lawrence E. Spence (2003). Linear Algebra ($4^{th}$ edition).Prentice-Hall of India Pvt. Ltd.


**Suggested Readings:**


1. Joseph A. Gallian (2017). Contemporary Abstract Algebra (9th edition). Cengage.
2.Kenneth Hoffman& Ray Kunze (2015). Linear Algebra (2nd edition). Prentice-Hall.
3. I. N. Herstein (2006). Topics in Algebra (2nd edition).Wiley India.
4. Nathan Jacobson (2009). Basic Algebra I (2nd edition).Dover Publications.


**E- Resource :**

**1.**https://nptel.ac.in/courses/106104149
**2.**https://nptel.ac.in/courses/111102011
**3.**https://nptel.ac.in/courses/111108098
Modern Algebra | Mathematics - MIT OpenCourseWare

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**Department of Mathematics and Statistics**
**Syllabus as per NEP-2020**
**B.Sc./ B.A Sem-II (Mathematics)**

| Level & Semester | Course Code | Title of the Course | Credits | | | | Marks | Course Coordinator |
|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | | |
| **L5 Sem II** | **MTS-MDM-211** | **Numerical Methods** | **4** | **2** | **0** | **6** | **IA (Mid)-40 EA (End Sem)- 60** | **Dr. R.K.Pandey** |

**Lectures/Hrs: 90**

**Learning Objectives**

1. To explain the construction of numerical method for the solution of algebraic and transcendental equations.
2. To introduce convergence and stability criteria for various numerical method.
3. To explain the numerical methods for solution of system of linear and nonlinear equations.
4. To explain the relaxation and iterative methods.
5. To explain the concept of interpolation, Lagrange and Newton's interpolation.

**Course Learning Outcomes:** This course will enable the students to:

**CO-1** Obtain numerical solutions of algebraic and transcendental equations.

**CO-2** Find numerical solutions of system of linear equations and to check the accuracy of the solutions.

**CO-3** Learn about various interpolating methods to find numerical solutions initial value problems in differential equations

**Unit wise Learning Outcomes:** After completion of this course students will be able to:

**UO1**: Obtain the approximate solution of algebraic and transcendental equations.
**UO2:** Know the alternative numerical method to find the solutions of system of linear equations and able to know the way to check the accuracy of the solutions.
**UO3:** Interpret the interpolation to find the missing value form the given set of points. They should also know the concept of finite difference.
**UO4:** Know the derivation of trapezoidal and Simpson's rule and capable to evaluate the integrals numerically using these methods.
**UO5:** Understand application of various numerical methods to find the solution of differential equations.

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|---|
| **Unit-I:** Round-off error and computer arithmetic, Local and global truncation errors, Algorithms and convergence; Intermediate value theorem and Fixed point theorem (without proof). Bisection method, method of false position, fixed point iteration method. |
| **Unit-II:** Newton Raphson and secant method for solving equations. Partial and scaled partial pivoting, LU decomposition and its applications, Gauss Elimination, Gauss Jordan method, Indirect method: Jacobi and Gauss-Seidel methods. |
| **Unit-III:** Finite differences; Interpolation; Newton's forward and backward interpolation, Lagrange's interpolation, Newton's divided difference; Piecewise interpolation, Spline. |
| **Unit-IV:** First order and second order approximation for first derivative, Approximation for second derivative; Numerical integration: Trapezoidal rule, Simpson's rule and error, Gauss Quadrature. |
| **Unit-V:** Picard method, Euler's method (Forward, Backward and Modified), Runge-Kutta methods (explicit); Error term of Euler method. |

**Essential Readings:**


1. Brian Bradie (2006), A Friendly Introduction to Numerical Analysis. Pearson.
2. M.K. Jain, S. R. K. Iyengar & R. K. Jain (2012). Numerical Methods for Scientific and Engineering Computation (6th edition), New Age International Publishers.
3. Robert J. Schilling & Sandra L. Harris (1999). Applied Numerical Methods for Engineers Using MATLAB and C. Thomson-Brooks/Cole.
4. Melvin J. Maron, Numerical Analysis A Practical Approach, Macmillan Publishing Company Inc., New York, 1982.


**Suggested Readings:**


1. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited, New Delhi, 2010.
2. C. F. Gerald & P. O. Wheatley (2008). Applied Numerical Analysis (7th edition), Pearson Education, India


**E- Resource :**

Numerical methods - Course (nptel.ac.in)
Introduction to Numerical Methods | Mathematics | MIT OpenCourseWare

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|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | | |
| **L5 Sem II** | **MTS-AEC - 211** | **Fundamentals of Computer** | **2** | **0** | **0** | **2** | **IA (Mid) – 40 EA (End Sem) - 60** | **Dr. K.S. Mathur** |

**Lecture/Hrs. 60**

**Learning Objectives:**

- To confidently operate computers to carry out computational tasks
- To understand working of Hardware and Software, the importance of programming languages, number systems.
- To describe the organization and operation of a computer processor, primary and secondary memory, peripheral devices and to give computer specifications

**Course Learning Outcomes:**

**CO 1:** Students should enhance knowledge of computer, structure of computer and its generation.
**CO 2:** Students should be familiar with conversion of number systems.
**CO 3:** Students should be able to understand the basic concept of programming languages.

**Unit wise Learning Outcomes:** After the completion of course students should be able

**UO 1:** To enhance the basic knowledge of computer and its generation.
**UO 2:** To understand the basic structure and types of computer.
**UO 3:** To familiar with the number system and conversion from one to another.
**UO 4:** To understand various types of computer memory.
**UO 5:** To gain the basic knowledge of computer programming.

| | |
|---|---|
| **Unit I:** | Introduction to Computers - Computer Characteristics, Concept of Hardware, Software, Evolution of computer and Generations, |
| **Unit II:** | Types of Computer – Analog and Digital computers, Hybrid Computers, General Purpose and Special Purpose Computer, Limitations of Computer, Functional Block Diagram of Computer. CPU, ALU, Memory Unit. |
| **Unit III:** | Number Systems – different types, conversion from one number system to another,Input Device – Keyboard, Mouse, Scanner, MICR, OMR. Output Devices – VDU, Printers – Dot Matrix, Daisy-wheel, Inkjet, Laser, Line Printers and Plotters. |
| **Unit IV:** | Memory Concept, Memory Cell, Memory Organization, Semiconductor Memory – RAM, ROM, PROM, EPROM, Secondary Storage Devices – Magnetic Tape, Magnetic Disk (Floppy Disk and Hard Disk.), Compact Disk. |
| **Unit V:** | Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler. |

**Essential Readings**


1. P.K. Sinha and P. Sinha, Computer Fundamentals, BPB Publishers, 2007.
2. Sheema Thareja, Fundamental of Computers Oxford University Press, 2019.


**Suggested Readings**


1. E. Balagurusamy, Fundamental of Computers and Programming, McGraw Hill Education 2011.
2. A. Geol, Computer Fundamentals, Pearson Education, 2010.


**Essential e-Resources**

- https://www.amazon.in/Fundamentals-Computers-Manaullah-Abid-ebook/dp/B07YZ36XHM
- https://www.mheducation.co.in/fundamentals-of-computers-9780070141605-india

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**B.Sc./ B.A Sem-II (Mathematics)**

| Level & Semester | Course Code | Title of the Course | Credits | | | | Marks | Course Coordinator |
|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | | |
| **L5 Sem II** | **MTS-SEC-211** | **Boolean Algebra** | **2** | **0** | **0** | **2** | **IA (Mid)-40 EA (End Sem)- 60** | **Dr. Kavita Shrivastava** |

**Lectures/Hrs: 30**

**Learning Objectives:**

1. Students will achieve command of the fundamental definitions and concepts of Boolean Algebra.
2. To explore the concept of logic gates.
3. To explore modern applications of Switching circuits.
4. Able to apply theoretical knowledge acquired to solve realistic problems in real life.

**Course Learning Outcomes:**

CO1: Understand the basic concepts of Boolean algebra and Boolean functions
CO2: Understand the properties, theorems and be able to prove new theorems.
CO3: Understand the concept of lattice.
CO4: Understand the application of switching circuits.
CO5: Understand the logic gates and its application in real life.

**Unit Wise Learning Outcomes:**

UO1. To learn about Partial ordered set, Hasse diagrams.
UO2. To learn about lattice.
UO3. To learn about Boolean algebra.
UO4. Aware about Switching circuits.
UO5. Aware about logic getes and its applications.

| |
|---|
| **Unit I:** Introduction partial ordered set, well ordered set, Chain, Hasse diagram, Maximal and Minimal elements, Lower and Upper bound, Joint and Meet in poset. |
| **Unit II:** Lattice as ordered sets, Complete lattice, Lattice as algebraic structure, Sub lattice, Properties of lattice, semi lattice, Lattice isomorphism, complement of an element, Complemented lattice. |
| **Unit III:** Introduction Boolean algebra, General properties of Boolean algebra, Boolean algebra as a lattice, Isomorphic Boolean algebra . |
| **Unit IV :** Boolean Expressions, Boolean functions, Switching circuits and its application. |
| **Unit V :** Basic logical operations, law of logic, logic gates and its application. |

**Essential Readings :**


1. J.P.Tremblay & R. Manobar, Discrete Mathematical Structures, McGraw Hill, New Delhi.
2. Narsingh Deo, Graph Theory with applications, Prentice-Hall, New Delhi.


**Suggested Readings :**


1. C.L.Liu, Elements of Discrete Mathematics, McGraw Hill, New Delhi.
2. J.L.Gresting, Mathematical Structures for Computer Science, Computer Science Press, New York.
3. R. L. Goodstein, Boolean Algebra, Dover Publication, Inc. Minola, New York.
4. Steven Givant and Paul Halmos, Introduction to Boolean Algebras, Springer; 2009th edition.


**E book links: National Digital Library**

1. https://www2.southeastern.edu/Academics/Faculty/kyang/2018/Spring/CMPS375/ClassNotes/CMPS375ClassNotesChap03.pdf
2. https://www.hzu.edu.in/csit/Boolean%20Algebra%20%20computer%20fundamentals.pdf
3. https://www.youtube.com/watch?v=gqv2t7YzPRw
4. https://www.youtube.com/watch?v=KergVtV3SxU
5. https://www.youtube.com/watch?v=K73N9ES_8nI
6. https://www.youtube.com/watch?v=CeD2L6KbtVM&list=PL803563859BF7ED8C