DEPARTMENT OF MATHEMATICAL SCIENCES

COURSE STRUCTURE

for

B.Sc. (Hons) Mathematics

Eight Semesters (Four Years)

Programme

Based on

National Education Policy (NEP) 2020
(As per ordinance-14A)

I & II Semester 2023-24

III & IV Semester 2024-25

V & VI Semester 2025-26

VII & VIII Semester 2026-27

AWADHESH PRATAP SINGH UNIVERSITY, REWA (M.P.)

DEPARTMENT OF MATHEMATICAL SCIENCES
AWADHESH PRATAP SINGH UNIVERSITY, REWA

<u>Semester Course of B.Sc. (Hons) Mathematics Based on NEP-2020</u>

About the Department:

The department came into existence in September 1984 with its initial name 'Department of Mathematics & Statistics'. The foundation stone of the building where the department came into existence was laid down by the then chief minister of Madhya Pradesh Shri Motilal Vora. However, from April 1999, its name has been changed to be known now onwards as the 'Department of Mathematical Sciences'. Initially Prof. R. B. Misra (Professor & Head), Dr. C. K. Sharma (Reader), Dr. N. P. Singh and Dr. J. P. Singh (Lecturers) joined as faculty members in the year 1985. In 1989, Dr. R. N. Singh joined the department as a lecturer. Dr. (Mrs.) Kavita Shrivastava and Dr. Akhileshwar Prasad were appointed as lecturer in the department in years 1994 and 1996 respectively. Prof. R. B. Misra had been the Vice-Chancellor of Avadh University, Faizabad during 1989-92. Prof. C. K. Sharma served as acting Vice-Chancellor of Awadhesh Pratap Singh University, Rewa in the year 2003.

The department runs M.A./M.Sc., M.Phil. and Ph.D. programs in Mathematics. Currently around one hundred fifty students are studying in the department. The department has made notable research contributions in the areas of Special Functions, General Relativity, Cosmology and Differential Geometry. Researchers of the department have been visiting and interacting with various research institutions of the country. The department received library grant from 'National Board for Higher Mathematics, Mumbai'. More than 250 research papers and articles have been published by the faculty of the department in National/International journals. The research papers of the faculty members are also cited in reference books and journals of high impact factor. Four students of the department have qualified NET/SET examination. Since the inception of the department, more than 45 students have been awarded Ph. D. degree and over 250 students have obtained M. Phil. degree.

The department received international recognition in the year 1987 when it was selected under federation scheme of the "International Centre for Theoretical Physics, Trieste (Italy)" Since then the federation was renewed annually till 1992. It provided rare opportunity to the faculty members and students of the department to visit the I.C.T.P. for the improvement of their knowledge with the financial support offered by the Centre. The department successfully organized the 65th Annual Conference of Indian Mathematical Society during Dec. 20-23 1999. Some of the notable personalities who visited the department from time to time are Prof. Franco Fava (Italy), Prof. P. C. Vaidya, Prof. Nand Lal, Prof. B. B. Sinha, Prof. K. K. Azad, Prof. J. B. Rao, Prof. Nand Kishor, Prof. K. P. Singh, Prof. S. R. Roy, Prof. H. C. Khare, Prof. David Gauld (New Zealand), Prof. A. N. Roy, Prof. T. Pati, Prof. Bill Fieldman (U. S. A.), Prof. U. C. De, Prof. M. A. Pathan, Prof. P. N. Pandey and Prof. S. D. Tripathi et al.

DEPARTMENT OF MATHEMATICAL SCIENCES
AWADHESH PRATAP SINGH UNIVERSITY, REWA

The department has organised Invited Talks, Workshops and Seminars to improve the knowledge of students regarding the latest developments in the field of Mathematical Sciences.

Faculty:

1. Dr. Shravan K. Pandey   Assistant Professor

Aims:

1. Developing the Mathematical Skills among the students and preparing them to take up a career in research.
2. Create more interest in the subject and motivate students for self-learning.
3. Strengthening the logical reasoning which is the main ingredient to understand Mathematical concepts.

Objectives:

1. To develop deep understanding of the fundamental axioms/concepts in Mathematics and capability of developing ideas based on them.
2. To encourage students for research studies in Mathematics and related fields.
3. To enable the students being life-long learner who are able to independently expand their mathematical expertise when needed.

Programme: **B.Sc. (Hons) Mathematics**

Programme Code: **570**

Duration: **8 Semesters (Four Years)**

Number of Seats: **60**

Eligibility: 10+2 with 50% marks aggregate in Maths Stream.

Age Limit: No age limit.

Admission Procedure:

The admission will be done as per merit of qualifying examinations.

DEPARTMENT OF MATHEMATICAL SCIENCES
AWADHESH PRATAP SINGH UNIVERSITY, REWA

COURSE STRUCTURE FOR B.SC. (HONS) MATHEMATICS AT A GLANCE

Semester-I

Core Courses								
S. No.	Course Code	Title of the Course	Credit	Maximum Marks		Total	Minimum Pass Marks	
				Theory	Cont. Evln.		Theory	Cont. Evln.
1.	570-CC-101	Algebra, Vector Analysis and Geometry	6	60	40	100	21	14
2.	570-CC-102	Computer System Architecture	4	60	40	100	21	14
	570-Lab-102	Computer Architecture Lab	2	Exam 60	Viva-Voce 40	100	21	14
3.	570-GEC-103	Mathematical Logic and Sets	4	60	40	100	21	14
4.	570-AEC-104	English Language and Indian Culture	4	60	40	100	21	14
		Total Core Credits	20	300	200	500	-	-

*CC- Core Course
*Lab- Practical
*GEC- Generic Elective Course
*AEC- Ability Enhancement Course

Semester-II

Core Courses								
S.No.	Course Code	Title of the Course	Credit	Maximum Marks		Total	Minimum Pass Marks	
				Theory	Cont. Evln.		Theory	Cont. Evln.
1.	570-CC-201	Calculus and Differential Equations	6	60	40	100	21	14
2.	570-CC-202	Programming Methodologies & Data Structures	4	60	40	100	21	14
	570-Lab-202	Office Tools & Programming Methodologies Lab	2	Exam 60	Viva-Voce 40	100	21	14
3.	570-GEC-203	Matrices, Geometry & Vector Algebra	4	60	40	100	21	14
4.	570-AEC-204	Environmental Education	4	60	40	100	21	14
		Total Core Credits	20	300	200	500	-	-

*CC- Core Course
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DEPARTMENT OF MATHEMATICAL SCIENCES
AWADHESH PRATAP SINGH UNIVERSITY, REWA

Semester-III

Core Courses

S.No.	Course Code	Title of the Course	Credit	Maximum Marks		Total	Minimum Pass Marks	
				Theory	Cont. Evln.		Theory	Cont. Evln.
1.	570-CC-301	Abstract Algebra and Linear Algebra	6	60	40	100	21	14
2.	570-CC-302	Computer Networks & Information Security	4	60	40	100	21	14
	570-Lab-302	Computer Networks Lab	2	Exam 60	Viva-Voce 40	100	21	14
3.	570-GEC-303	Trigonometry, Calculus & Differential Equations	4	60	40	100	21	14
4.	570-SEC-304	Entrepreneurship Development	4	60	40	100	21	14
		Total Core Credits	**20**	**300**	**200**	**500**	**-**	**-**

*CC- Core Course
*Lab- Practical
*GEC- Generic Elective Course
*SEC- Skill Enhancement Course

Semester-IV

Core Courses

S.No.	Course Code	Title of the Course	Credit	Maximum Marks		Total	Minimum Pass Marks	
				Theory	Cont. Evln.		Theory	Cont. Evln.
1.	570-CC-401	Advanced Calculus and Partial Differential Equations	6	60	40	100	21	14
2.	570-CC-402	Object Oriented Programming with Java	4	60	40	100	21	14
	570-Lab-402	Java Programming Lab	2	Exam 60	Viva-Voce 40	100	21	14
3.	570-GEC-403	History of Indian Mathematics & Vedic Mathematics	4	60	40	100	21	14
4.	570-SEC-404	Women Empowerment	4	60	40	100	21	14
		Total Core Credits	**20**	**300**	**200**	**500**	**-**	**-**

*CC- Core Course
*Lab- Practical
*GEC- Generic Elective Course
*SEC- Skill Enhancement Course

COURSE STRUCTURE

Under CBCS

B.Sc. MATHEMATICS

SEMESTER-I

Core Courses								
S. No.	Course Code	Title of the Course	Credit	Maximum Marks		Total	Minimum Pass Marks	
				Theory	Cont. Evln.		Theory	Cont. Evln.
1.	570-CC-101	Algebra, Vector Analysis and Geometry	6	60	40	100	21	14
2.	570-CC-102	Computer System Architecture	4	60	40	100	21	14
	570-Lab-102	Computer Architecture Lab	2	Exam 60	Viva-Voce 40	100	21	14
3.	570-GEC-103	Mathematical Logic and Sets	4	60	40	100	21	14
4.	570-AEC-104	English Language and Indian Culture	4	60	40	100	21	14
		Total Core Credits	**20**	**300**	**200**	**500**	**-**	**-**

*CC- Core Course
*Lab- Practical
*GEC- Generic Elective Course
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B.Sc. (Honors) MATHEMATICS

	Max. Marks	Min. Pass Marks
Credit: 4		
Theory	60	21
Cont. Evln.	40	14

SEMESTER-I
Course Code: 570-CC-101 Algebra, Vector Analysis and Geometry

Course Objectives: The objective of this course is to study the Historical background: Development of Indian Mathematics; concepts of Matrix: Echelon and Normal form of a matrix, Characteristic equations of a matrix, Eigen-values, Eigen-vectors; Cayley Hamilton theorem, inverse of a matrix, linear equations, Scalar and Vector products, Derivatives of Triple Products, Gradient, Divergence and Curl, Directional derivatives, Gauss theorem, Green's theorem, Stoke's theorem, General equation of second degree, System of conics, Cone, Cylinder: Equation of cylinder and its properties, Right Circular Cylinder, and Enveloping Cylinder.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Historical background: Development of Indian Mathematics: Later Classical Period (500-1250), A brief biography of Varahamihira and Aryabhatta, Rank of a Matrix: Echelon and Normal form of a matrix, Characteristic equations of a matrix, Eigen-values, Eigen-vectors.

Unit 2-
Cayley Hamilton theorem, Application of Cayley Hamilton theorem to find the inverse of a matrix, Application of matrix to solve a system of linear equations, Theorems on consistency and inconsistency of a system of linear equations, Solving linear equations up to three unknowns.

Unit 3-
Scalar and Vector products of three and four vectors: Reciprocal vectors, Vector differentiation, Rules of differentiation, Derivatives of Triple Products, Gradient, Divergence and Curl, Directional derivatives, Vector Identities, Vector Equations.

Unit 4-
Vector Integration, Gauss theorem (without proof) and problems based on it, Green's theorem (without proof) and problems based on it, Stoke's theorem (without proof) and problems based on it.

Unit 5-
General equation of second degree: Tracing of conics, System of conics, Cone: Equation of cone with given base, Generators of cone, Condition for three mutually perpendicular generators, Right-circular cone, Cylinder: Equation of cylinder and its properties, Right Circular Cylinder, Enveloping Cylinder.

Recommended Books:
[1] K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi 2000.
[2] Shanti Narayan: A Text Book of Vector Calculus, S. Chand & Co., New Delhi, 1987.
[3] S. L. Loney: The Elements of Coordinate Geometry Part-1, New Age International (P) Ltd., Publishers, New Delhi, 2016.
[4] P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Three Dimensions, Willey Eastern Ltd, 1999.

[5] Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.

Reference Books:
[1] Chandrika Prasad: A Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad, 2017.
[2] N. Jocobson: Basic Algebra Vol. I and II, W. H. Freeman, 2009.
[3] I. S. Luther and I. B. S. Passi: Algebra Vol. I and II, Narosa Publishing House, 1997.
[4] N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad, 1990.
[5] Murray R. Spiegel: Vector Analysis, Schaum Publishing Company, New York, 2017.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using the rank of matrix.

CO2: To find the Eigen values and corresponding Eigen vectors for a square matrix.

CO3: Using the knowledge of vector calculus in geometry.

CO4: Enhance the knowledge of three-dimensional geometrical figures (eg. cone and cylinder).

B.Sc. (Honors) MATHEMATICS
SEMESTER-I
Course Code: 570-CC-102   Computer System Architecture

	Credit: 4	Max. Marks	Min. Pass Marks
Theory		60	21
Cont. Evln.		40	14

Course Objectives: The objective of this course is to study the concepts of Fundamentals of Digital Electronics, Fixed-Point Representation, Binary and other Codes, Logic Gates, Boolean Algebra, Map Simplification, Circuits, Basic Computer Organization, Instruction Codes, Instruction Formats, Machine Language, Assembly Language, Program Control, RISC, CISC, Pipelining, Control-Handling Data Hazards, Memory and I/O Systems, I/O Interface, I/O Processor, Memory Hierarchy.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Fundamentals of Digital Electronics: Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Binary and other Codes, Error Detection Codes; Logic Gates: Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits, Simple Combinational Circuit Design Problems; Circuits: Adder-Subtractor, Multiplexer, Demultiplexer, Decoders, Encoders Flip-Flops, Registers, Counters.

Unit 2-
Basic Computer Organization: Instruction Codes, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input-Output & Interrupts, Complete Computer Description & Design of Basic Computer.

Unit 3-
Instructions: Instruction Formats, Addressing Modes, Instruction Codes, Machine Language, Assembly Language; Register Transfer and Micro Operations Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations.

Unit 4-
Processor and Control Unit: Hardwired vs. Micro Programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, Introductory Concept of RISC, CISC, Advantages and Disadvantages of both; Pipelining: Concept of Pipelining, Introduction to Pipelined data path and Control-Handling Data Hazards & Control Hazards.

Unit 5-
Memory and I/O Systems: Peripheral Devices, I/O Interface; Data Transfer Schemes: Program Control, Interrupt, DMA Transfer, I/O Processor; Memory Hierarchy: Processor vs. Memory Speed, High-Speed Memories, Main Memory, Auxiliary Memory, Cache Memory, Associative Memory, Interleaving, Virtual Memory, Memory Management.

Recommended Books:
[1] M. Morris Mano, "Computer System Architecture", PHI.

Reference Books:
[1] Heuring Jordan, "Computer System Design & Architecture" (A. W. L.)

DEPARTMENT OF MATHEMATICAL SCIENCES
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[2] William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
[3] V. Carl Hamacher, "Computer Organization", TMH.
[4] Tannenbaum, "Structured Computer Organization", PHI.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Understand the basic structure, operation and characteristics of digital computer.

CO2: Be able to design simple combinational digital circuits based on given parameters.

CO3: Familiarity with working of arithmetic and logic unit as well as the concept of pipelining.

CO4: Know about hierarchical memory system including cache memories and virtual memory.

B.Sc. (Honors) MATHEMATICS
SEMESTER-I
Course Code: 570-Lab-102   **Computer Architecture Lab**

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: The objective of this course is to study of basic gates (AND, OR, NOT) and verifying their truth tables, converting a given binary number to Graycode using IC 7486, verifying NAND as Universal gate using IC 7400, Half and Full adder using basic gates and verifying its truth table, Verifying truth table of 4-bit adder using IC 7483, Design and construct RS and JK flip Flop using gates and verifying truth table and Verifying De-Morgan's Theorem.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

List of Practical's

1. To study basic gates (AND, OR, NOT) and verify their truth tables.

2. To convert a given binary number to Graycode using IC 7486.

3. To study and verify NAND as Universal gate using IC 7400.

4. To study half adder using basic gates and verify its truth table.

5. To study Full Adder using basic gates and verify its truth table.

6. To realize basic gates (AND, OR, NOT) from Universal gates (NAND and NOR).

7. To verify truth table of 4-bit adder using IC 7483.

8. To design and construct RS flip Flop using gates and verify truth table.

9. To design and construct JK flip Flop using gates and verify the truth table.

10. To verify De-Morgan's Theorem.

Recommended Books:
[1] M. Morris Mano, "Computer System Architecture", PHI.

Reference Books:
[1] Heuring Jordan, "Computer System Design & Architecture" (A. W. L.)
[2] William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
[3] V. Carl Hamacher, "Computer Organization", TMH.
[4] Tannenbaum, "Structured Computer Organization", PHI.

Course Learning Outcomes: After studying this work student will be able to:
CO1: Realization of the basic logic and universal gates.

CO2: Verify the behavior of logic gates using truth tables.

CO3: Implement Binary-to-Gray, Gray-to-Binary code conversions.

CO4: Design half and full adder circuit using basic gates.

CO5: Design and construct flip flops and verify the excitation tables.

B.Sc. (Honors) MATHEMATICS
SEMESTER-I
Course Code: 570-GEC-103   **Mathematical Logic and Sets**

	Credit: 4	Max. Marks	Min. Pass Marks
Theory		60	21
Cont. Evln.		40	14

Course Objectives: The objective of this course is to study the concepts of Truth table, Negation, Conjunction and Disjunction, Implications and Double implication, Bi-conditional propositions, Contrapositive Implication and converse, Contrapositive and inverse propositions, Precedence of logical operators, Logical equivalences, Predicates and quantifiers, Set Theory and Relations.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Propositions and Truth table, Negation, Conjunction and Disjunction, Implications and Double implication, Bi-conditional propositions.

Unit 2-
Contrapositive Implication and converse, Contrapositive and inverse propositions, Precedence of logical operators, Tautology and Contradiction.

Unit 3-
Propositional equivalence: Logical equivalences, Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

Unit 4-
Set Theory: Introduction to sets, Finite and infinite sets, Counting-principle, Standard set operations: Classes of sets, Power set of a set, Difference and Symmetric difference of two sets, Set identities, Generalized union and intersections, Principle of Inclusion and Exclusion, Cardinality, Fuzzy Sets and it's basic operations.

Unit 5-
Relations: Cartesian product of sets, Composition of relations, Types of relations, Partitions, Equivalence relations, Partial ordering relations, Congruence modulo relation

Recommended Books:
[1] R. M. Somasundaram: Discrete Mathematical Structures, PHI Learning Pvt. Ltd., 2003.
[2] Samar Ballav Bhoi: A Text Book of Logic and Sets, Educreation Publishing, 2018.
[3] Ganesh: Introduction to Fuzzy Sets and Fuzzy Logic, Prentice Hall India Learning Private Limited, 2006.

Reference Books:
[1] Ajit Kumar, S. Kumaresan, Bhaba Kumar Sarma: A Foundation Course in Mathematics, Alpha Science International Ltd, 2018.
[2] R. P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998.
[3] Jean-Paul Tremblay , R Manohar: Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill Education, 1st edition, 2017.
[4] G. J. Klir and B. Yuan: Fuzzy sets and Fuzzy logic, Pearson, 2015.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Using the principles of logic to distinguish between sound and unsound reasoning in discourse of everybody.

CO2: Construct truth tables for logical expressions; test statements for logical equivalence and represent mathematical statements in the language of predicate language.

CO3: Using the appropriate set theoretic concepts, thinking process, tools and techniques in the solution to various conceptual or real-world problems.

B.Sc. (Honors) MATHEMATICS
SEMESTER-I
Course Code: 570-AEC-104 **English**
Language and Indian Culture

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: The objective of this course is to learn Reading, Writing and Interpretation Skills, Comprehension Skill, Basic Language Skills and Basic Grammar.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Reading, Writing and Interpretation Skills: Where the Mind is Without Fear- Rabindranath Tagore [Key Word: Patriotism], National Education -M. K. Gandhi [Key Word: Edification], The Axe- R.K. Narayan [Key Word: Environment], The Wonder That Was India- A.L Basham (an excerpt) [Key Word: Indianness], Preface to the Mahabharata C. Rajagopalachari [Key Word: Indian Mythology].

Unit 2-
Comprehension Skill: Unseen Passage followed by Multiple choice questions.

Unit 3-
Basic Language Skills: Vocabulary Building: Suffix, Prefix, Synonyms, Antonyms, Homophones, Homonyms and One-word substitution.

Unit 4-
Basic Grammar: Noun, Pronoun, Adjective, Verb, Adverb, Prepositions, Articles.

Unit 5-
Time and Tense and Voice.

Recommended Books:
[1] Essential English Grammar-Raymond Murphy, Cambridge University Press.

[2] Practical English Grammar Exercises 1- A. J. Thomson & A. V. Martinet, Oxford India.

Reference Books:
[1] Practical English Usage - Michael Swan, Oxford.

[2] English Grammar in Use - Raymond Murphy, Cambridge University Press.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Prepare for various competitive exams by developing their English language competence.

CO2: Promote their comprehension skills by being exposed to a variety of texts and their interpretations.

CO3: Build and enhance their vocabulary.

CO4: Develop their communication skills by strengthening grammar and usages.

CO5: Inculcate values which make them aware of national heritage and environmental issues, making them responsible citizens.

SEMESTER-II

S.No.	Course Code	Title of the Course	Credit	Maximum Marks		Total	Minimum Pass Marks	
				Theory	Cont. Evln.		Theory	Cont. Evln.
1.	570-CC-201	Calculus and Differential Equations	6	60	40	100	21	14
2.	570-CC-202	Programming Methodologies & Data Structures	4	60	40	100	21	14
	570-Lab-202	Office Tools & Programming Methodologies Lab	2	Exam 60	Viva-Voce 40	100	21	14
3.	570-GEC-203	Matrices, Geometry & Vector Algebra	4	60	40	100	21	14
4.	570-AEC-204	Environmental Education	4	60	40	100	21	14
		Total Core Credits	**20**	**300**	**200**	**500**	**-**	**-**

Core Courses (table title)

*CC- Core Course
*Lab- Practical
*GEC- Generic Elective Course
*AEC- Ability Enhancement Course

B.Sc. (Honors) MATHEMATICS
SEMESTER-II
Course Code: 570-CC-201 Calculus and Differential Equations

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: The objective of this course is to study the concepts Successive differentiation, Leibnitz theorem, Maclaurin's series expansion, Taylor's series expansion, Partial Differentiation, Euler's theorem, Asymptotes, Curvature, Tracing of curves, Introduction to Double and Triple Integral, Quadrature, Linear differential equations, First order and higher

degree differential equations, Linear differential equation with constant coefficients Transformation of equations by changing the dependent/ independent variable and Method of variation of parameters.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Historical background: Development of Indian Mathematics: Ancient and Early Classical Period (till 500 CE), A brief biography of Bhāskaracharya (with special reference to Lilavati) and Madhava, Successive differentiation: Leibnitz theorem, Maclaurin's series expansion, Taylor's series expansion, Partial Differentiation: Partial derivatives of higher order, Euler's theorem on homogeneous functions, Asymptotes: Asymptotes of algebraic curves, Condition for Existence of Asymptotes, Parallel Asymptotes, Asymptotes of polar curves.

Unit 2-
Curvature: Formula for radius of Curvature, Curvature at origin, Centre of Curvature, Concavity and Convexity: Concavity and Convexity of curves, Point of Inflexion, Singular point, Multiple points, Tracing of curves: Curves represented by Cartesian equation, Curves represented by Polar equation.

Unit 3-
Integration of transcendental functions, Introduction to Double and Triple Integral, Reduction formulae, Quadrature: For Cartesian coordinates, For Polar coordinates, Rectification: For Cartesian coordinates, For Polar coordinates.

Unit 4-
Linear differential equations: Linear equation, Equations reducible to the linear form, Change of variables, Exact differential equations, First order and higher degree differential equations: Equations solvable for x, y and p, Equations homogenous in x and y, Clairaut's equation, Singular solutions, Geometrical meaning of differential equations, Orthogonal trajectories.

Unit 5-
Linear differential equation with constant coefficients, Homogeneous linear ordinary differential equations, Linear differential equations of second order, Transformation of equations by changing the dependent/ independent variable, Method of variation of parameters.

Recommended Books:
[1] Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahabad, 2016.
[2] Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
[3] M. D. Raisinghania: Ordinary and Partial Differential Equations, S Chand & Co Ltd, 2017.
[4] Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.

Reference Books:
[1] N. Piskunov: Differential and Integral Calculus, CBS Publishers, 1996.
[2] G. F. Simmons: Differential Equations, Tata McGraw Hill. 1972.
[3] E. A. Codington: An Introduction to ordinary differential Equation, Prentice Hall of India, 1961.

[4] D. A. Murray: Introductory Course in Differential Equations, Orient Longman (India) 1967.
[5] H. T. H Piaggio: Elementary Treatise on Differential Equations and their Application,
C. B.S. Publisher & Distributors, Delhi. 1985.
[6] Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Using the derivatives in Optimization, Social sciences, Physics and Life sciences etc.
CO2: Sketch curves in a plane using its Mathematical properties in the different coordinate systems of reference.
CO3: Formulate the Differential equations for various Mathematical- models.
CO4: Using techniques to solve and analyze various Mathematical- models.

B.Sc. (Honors) MATHEMATIC

SEMESTER-II

Course Code: 570-CC-202   Programming Methodologies & Data Structures

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: The objective of this course is Introduce to Programming, C++ Programming, Understanding operators precedence in expressions, Iterative statements, Functions, Arrays, Data Structure, Stack, Queue, Trees, Hashing Binary search trees and AVL trees.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Introduction to Programming: Program concept, characteristics of programming, stages in program development, algorithms, notations, design, flowchart, types of programming methodologies; Introduction to C++ Programming: Basic program structure in C++, data type, variables, constants, operations and basic I/O; Variables: Declaring, defining and initializing variables, scope of variables, using named constants, keywords, casting of data types, operations (arithmetic, logical and bitwise), using comments in program, character I\O (gets, getcher, putc, putchar etc.), formatted and console I/O (printf( ), scanf( ), cin, cout), using basic header files (stdio.h, iostream.h, conio.h etc). Simple expressions in C++ (including unary operator expressions, binary operator expression), Understanding operators precedence in expressions, Conditional statements if construct, Switch case construct.

Unit 2-
Iterative statements: While, do-while, and for loops, use of break and continue in loops, using nested statements (conditional as well as iterative); Functions: Top down design, pre-defined functions, programmer defined functions, local variable and global variables functions with default arguments, call by value and call by reference parameters, recursion; Introduction to arrays: Declaration and referring arrays, arrays in memory, initializing arrays, arrays in functions, multi- dimensional arrays.

Unit 3-
Structures: Member accessing, pointers to structures, structures and functions, arrays of structures; Unions: Declaration and initialization; Strings: Reading and writing strings, arrays of strings, strings and functions, string and structure, standard string library functions; Searching algorithms: Linear search, binary search; File handling: Use of files for data input and output, merging and copying files.

Unit 4-
Data Structure: Basic concepts, linear and non-linear data structure; Algorithms specification: Introduction, Recursive algorithms, data abstraction, performance analysis; Linked list: Singly linked lists, operations, concatenating; Circularly linked lists: Operations for circularly linked lists, doubly linked lists operations; Array: Representation of single, two dimensional arrays, sparse matrices array and linked representations; Stack: Operations, array and linked implementations, applications- infix to postfix conversion, postfix expression, evaluation, recursion implementation.

Unit 5-
Queue: Definition, operations, array and linked implementations, circular queue - insertion and deletion operations, dequeue (double ended queue), priority queue-implementation; Trees: Representation of trees, binary tree, properties of binary trees, binary tree representations- array and linked representations, binary tree traversals, threaded binary trees; Heap: Definition, insertion and deletion; Graphs: Graphs ADT, graph representations, graph traversals, searching.

Hashing: Introduction, hash tables, hash functions, overflow handling; Sorting methods: Comparison of sorting method; Search trees: Binary search trees, AVL trees- definition and examples; Indian contribution to the field: Innovations in India, origin of Julia programming language, Indian engineers who designed new programming languages, open-source languages, Dr. Sartaj Sahni - computer scientist - pioneer of data structures, other relevant contributors and contributions.

Recommended Books:

[1] R. Lafore, Object Oriented Programming C++.
[2] J. R. Hanly and E. B. Koffman, Problems Solving and Program Design in C, Pearson, 2015.

Reference Books:

[3] N. Dale and C. Weems, Programming and Problems Solving with C++: Brief edition, Jones & Bartlett Learning.
[4] Sartaj Sahni, Data Structure, Algorithms and Applications with C++, McGraw Hill.
[5] D. S. Malik, Data Structure using C++, Second edition, Cengage Learning.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Develop simple algorithms and flow charts to solve a problem with programming using top-down design principles.
CO2: Writing effective and well-structured computer algorithms/programms.
CO3: Learn to formulate iterative solutions and array processing algorithms for problems use recursive techniques, pointers and searching methods in programming.
CO4: Have knowledge of complexity of basic operations like insert, delete, search on these data structures.
CO5: Implement and know the applications of algorithms for searching and sorting etc. Know the contributions of Indians in the field of programming and data structures.

B.Sc. (Honors) MATHEMATICS
SEMESTER-II
Course Code: 570-Lab-202   Office Tools & Programming Methodologies Lab

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: The objective of this course is to learn Using a Text Editor Tool, Using a Spreadsheet Tool, Using a Presentation Tool and Formulating Problem based on it.

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Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Using a Text Editor Tool: Create a document and apply different editing options, Create Banner for your University/ Department/ College, Design a greeting card using Word Art for different festivals, Design your Bio- data and use page borders and shading, Create a document and insert header and footer, page title, date, time, apply various page formatting features etc, Implement mail merge, Insert a table into a document and try different formatting options for the table.

Using a Spreadsheet Tool: Design your class Time Table, Prepare a Mark Sheet of your class result, Prepare a Salary Slip of an employee of an organization, Prepare a bar chart & pie chart for analysis of Election Results, Prepare a generic Bill of a Super Market. Edu**,** Work on the following exercises on a Workbook: Copy an existing Sheet, Rename the old Sheet, Insert a new Sheet into an existing Workbook, Delete the renamed Sheet, Prepare an Attendance sheet of 10 students for any 6 subjects of your syllabus. Calculate their total attendance, total percentage of attendance of each student & average of attendance, Create a worksheet of Students list of any 4 faculties and perform following database functions on it: Sort data by Name, Filter data by Class, Subtotal of no. of students by Class.

Using a Presentation Tool: Design a presentation of your institute using auto content wizard. design template and blank presentation**,** Design a presentation illustrating insertion of pictures, Word Art and ClipArt. Design a presentation, learn how to save it in different formats copying and opening an existing presentation**,** Design a presentation illustrating insertion of movie, animation and sound, Illustrate use of custom animation and slide transition (using different effects), Design a presentation using charts and tables of the marks obtained in class.

Given the problem statement, students are required to formulate: Problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following:

1. a. To learn elementary techniques involving arithmetic operators and mathematical expressions, appropriate use of selection (if switch, conditional operators) and control structures

   b. Learn how to use functions and parameter passing in functions, writing recursive programs.
2. Write a program to swap the contents of two variables.
3. Write a program for finding the roots of a Quadratic Equation.
4. Write a program to find area of a circle, rectangle, square using switch case.
5. Write a program to check whether a given number is even or odd.
6. Write a program to print table of any number.
7. Write a program to print Fibonacci series.
8. Write a program to find factorial of a given number.
9. Write a program to convert decimal (integer) number into. equivalent binary number.
10. Write a program to check given string is palindrome or not.
11. Write a program to perform multiplications of two matrices. Reverse
12. Write a program to print digits of entered number in order.
13. Write a program to print sum of two matrices.
14. Write a program to print multiplication of two matrices.
15. Write a program to generate even/odd series from 1 to 100.

16. Write a program whether a given number is prime or not.
17. Write a program for call by value and call by reference.
18. Write a program to generate a series 1+1/1!+2/21+3/31+---+n/n!
19. Write a program to create a pyramid structure.
20. Write a program to create a pyramid structure.

              1
              12
              123
              1234

21. Write a program to check entered number is Armstrong or not.
22. Write a program for traversing an Array.
23. Write a program to input N numbers, add them and find average.
24. Write a program to find largest element from an array.
25. Write a program for Linear search.
26. Write a program for Binary search.
27. Write a program for Bubble son.
28. Write a program for Selection sort.

Keywords Tags: Programming, C++, Data Structures, if, else, for, while, do, File Handling, call by value call by reference, recursion, Arrays, Union, Hash, Linear search, Binary search, Bubble son, Selection.

Recommended Books:

[1] Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015.

[2] E. Balguruswamy, "C++ TMH Publication ISBN 0-07-462038-X.

[3] Herbertz Shield, "C++ The Complete Reference TMH Publication ISBN 0-07-463880-7.

[4] R. Lafore, Object Oriented Programming C++ N. Dale and C. Weems, Programming and problem solving with C++ brief edition, Jones & Bartlett.

Reference Books:
[1] Learning Adam Drandek, "Data Structures and algorithm in C++, Third Edition, Cengage Leaming Sartaj Sahani, Data Structures, Algorithms and Applications with C++, McGraw-Hill.

[2] Robert L. Kruse, "Data Structures and Program Design in C++", Pearson. D. S. Malik, Data Structure using C++, Second edition, Cengage Learning.

[3] M.A. Weiss, Data structures and Algorithm Analysis in C. 2nd edition, Pearson.

[4] Lipschutz Schaum's outline series Data structures, Tata McGraw-Hill.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Develop simple algorithms and flow charts to solve a problem with programming using top-down design principles.

CO2: Writing efficient and well-structured computer algorithms/programs.

CO3: Learn to formulate iterative solutions and array processing algorithms for problems.

CO4: Use recursive techniques, pointers and searching methods in programming.

CO5: Possess ability to choose a data structure to suitably model any data used in computer applications.

B.Sc. (Honors) MATHEMATICS
SEMESTER-II
Course Code: 570-GEC-203   Matrices, Geometry & Vector Algebra

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

DEPARTMENT OF MATHEMATICAL SCIENCES
AWADHESH PRATAP SINGH UNIVERSITY, REWA

Course Objectives: The objective of this course is to study the concepts of Matrices, Determinant, Two-dimensional coordinate geometry, Three-dimensional coordinate geometry, Section formula, Vectors and scalars, Properties and application of Scalar (dot) product of vectors and Vector (cross) product of vectors.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Determinant, Basic Properties of Determinants, Minor determinant, Co-factors, Applications of determinants in finding the area of a triangle.

Unit 2-
Matrices: Concept of Matrices, Notation, order and equality of Matrices, Types of Matrices, Transpose of a Matrix. Operations on Matrices: Addition and multiplication, Multiplication with a scalar, Simple properties of addition, multiplication and scalar multiplication, Adjoint and inverse of a square Matrix.

Unit 3-
Two-dimensional coordinate geometry: Shifting of origin, Slope of a line, Angle between two lines. Various forms of equations of a line in two-dimension: Parallel to axes, Point slope form, Slope-intercept form, Two-point form, Intercept form and normal form, General equation of a line.

Unit 4-
Distance of a point from a line in two-dimension, Three-dimensional coordinate geometry: Coordinate axes and coordinate planes, Coordinates of a point, Distance between two points and section formula.

Unit 5-
Vectors and scalars, Magnitude and direction of a vector, Direction cosines and direction ratios of a vector, Types of vectors and position vector of a point, Negative of a vector and components of a vector, Operations on Vectors: Addition of vectors, Multiplication of a vector by a scalar. Position vector of a point dividing a line segment in a given ratio, Properties and application of Scalar (dot) product of vectors and Vector (cross) product of vectors.

Recommended Books:

[1] P. K. Mittal and Shanti Narayan: Vector Algebra. S. Chand Publishing, 2005.

[2] Nita H. Shah. Foram A Thakkar: Matrix and Determinant Fundamentals and Applications, CRC Press, 2020.

[3] G. Prasad Coordinate Geometry of Two and Three Dimensions, Axis Publications, 2010.

Reference Books:
[1] Hari Kishan: A Textbook of Matrices. Atlantic Publishers & Dist., 2008.

[2] Hari Kishan: Vector Algebra and Calculus, Atlantic Publishers & Dist., 2007.

[3] K. C. Mathew., S. Veeraraghavan: A Textbook of Co-ordinate Geometry of Two and Three Dimensions, Chand Publication, 1972.

[4] Shanti Narayan and PK Mittal.: A Textbook of Matrices, S. Chand Publishing, 1953.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Students will be able to use the Matrices, Determinants, Geometry and Vector approach in different areas of business and science like budgeting, sales projection, cost estimation, analysing the results of an experiment etc.

B.Sc. (Honors) MATHEMATICS

SEMESTER-II

Course Code: 570-AEC-204 **Environmental Education**

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: The objective of this course is to study the Environment and Natural Resources, Components of Environment, Biome, Ecosystem and Biodiversity, Environmental Pollution, Communication and public awareness programme, Role of information technology in environment and human health.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Environment and Natural Resources: Multidisciplinary nature, Scope and Importance of Environment, Components of Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere, Brief account of Natural Resources and associated problems: Land Resource, Water Resource, Energy Resource, Concept of Sustainability and Sustainable Development.

Unit 2-
Biome, Ecosystem and Biodiversity: Major Biomes: Tropical, Temperate, Forest, Grassland, Desert, Tundra, Wetland, Estuarine and Marine, Ecosystem: Structure function and types their Preservation & Restoration, Biodiversity and its conservation practices.

Unit 3-
Environmental Pollution, Management and Social Issues, Pollution: Types, Control measures, Management and associated problems, Environmental Law and Legislation. Protection and conservation Acts, International Agreement & Programme, Environmental Movements.

Unit 4-

Communication and public awareness programme, National and International organizations related to environment conservation and monitoring, Role of information technology in environment and human health.

Unit 5-
Visit to an area to document environmental assets: rivers / forest / flora / fauna, Visit to a local polluted site Urban/Rural/ Industrial / Agricultural, Study of simple ecosystem.

Recommended Books:

[1] Singh, J.S. Singh S.P and Gupta, S.R., "Ecology; Environment Science and Conservation S Chand publishing, New Delhi, (2018).

[2] Divan, S. and Rosencranz, A., "Environmental Law and Policy in India Cases, Material & Status" Oxford University Press, India. (2002) 2nd Edition.

[3] Odum, E.P, "Fundamentals of Ecology", Philadelphia Saundres, (1971).

[4] Bharucha, Erach, "Environmental studies" Universities Press India Pvt. Ltd. Hyderabad (2014) (Hindi Edition also available).

Reference Books:
[1] Kaushik, Anubha, Kaushik. CP "Perspectives in Environmental Studies "New age International Publishers, (2018), 6th Edition.

[2] Asthana, D. K Asthana Meera, "A Textbook of Environmental Studies". S. Chand Publishing New Delhi, (2007).

[3] National Digital Library (https://ndl.iitkgp.ac.in/homestudy/science)

[4] Epg-pathshala (https://epgp.inflibnet.ac.in/Home/Download NPTEL (https://nptel.ac.in/course.html)

[5] Coursera (https://www.coursera.org/search?query=environmental+science&page=1).

Course Learning Outcomes: After studying this work student will be able to:

CO1: To understand various aspects of life forms, ecological processes, and the impacts on them by the human during Anthropocene era.

CO2: To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate the practices and policies, and develop framework to make inform decisions.

CO3: To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation.

CO4: To develop the critical thinking for shaping strategies such as; scientific, social, economic, administrative & legal environmental protection, conservation of biodiversity, environmental equity and sustainable development.

CO5: To prepare for the competitive exams.

SEMESTER-III

Core Courses								
S.No.	Course Code	Title of the Course	Credit	Maximum Marks		Total	Minimum Pass Marks	
				Theory	Cont. Evln.		Theory	Cont. Evln.
1.	570-CC-301	Abstract Algebra and Linear Algebra	6	60	40	100	21	14
2.	570-CC-302	Computer Networks & Information Security	4	60	40	100	21	14
	570-Lab-302	Computer Networks Lab	2	Exam 60	Viva-Voce 40	100	21	14
3.	570-GEC-303	Trigonometry, Calculus & Differential Equations	4	60	40	100	21	14
4.	570-SEC-304	Entrepreneurship Development	4	60	40	100	21	14
		Total Core Credits	**20**	**300**	**200**	**500**	-	-

*CC- Core Course
*Lab- Practical
*GEC- Generic Elective Course
*SEC- Skill Enhancement Course

B.Sc. (Honors) MATHEMATICS
SEMESTER-III
Course Code: 570-CC-301   Abstract
Algebra and Linear Algebra

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: To familiarize with the basic tools of Abstract Algebra and Linear Algebra involving Group and their basic properties, Homomorphism and Isomorphism of groups, Ring, Ideals, Vector space and Linear transformation and its representation as a matrix.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Historical background: A brief historical background of the Algebra in the context of India and Indian heritage and culture, A brief biography of Brahmagupta, Groups, Subgroups and their basic properties, Cyclic groups, Coset decomposition, Lagrange's and Fermat's theorem, Normal subgroups, Quotient groups.

Unit 2-

Homomorphism and Isomorphism of groups, Fundamental theorem of homomorphism, Transformation and permutation group Sn (n<5), Cayley's theorem, Group automorphism, Inner automorphism, Group of automorphisms.

Unit 3-

Definition and basic properties of rings, Ring homomorphism, Subring, Ideals, Quotient ring, Polynomial ring, Integral domain, Field.

Unit 4-

Definition and examples of Vector space, Subspaces, Sum and direct sum of subspaces, Linear span, Linear dependence, linear independence and their basic properties, Basis, Finite dimensional vector space and dimension: Existence theorem, Extension theorem, Invariance of the number of elements.

Unit 5-

Linear transformation and its representation as a matrix, Algebra of linear transformation, Rank-Nullity theorem, Change of basis, dual space, bi-dual space and natural isomorphism, Adjoint of a linear transformation, Eigenvalues and Eigenvectors of a linear transformation, Diagonalization.

Recommended Books:

[1] I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd. New Delhi. 1977.

[2] K. B. Datta: Matrix and Linear Algebra, Prentice-hall of India Pvt. Ltd. New Delhi. 2000.

[3] Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.

Reference Books:
[1] Surjeet Singh and Qazi Zameeruddin: Modern Algebra, Vikas Publishing House Pvt Ltd; Eighth edition, 2006.

[2] N. Jacobson: Basic Algebra. Vol. I and II, W. II Freeman, 1980.

[3] I. S. Luther and I. B. S. Passi: Algebra. Vol. I and II, Narosa Publishing House, 1997. 4. Shanti Narayan: A text Book of Modem Abstract Algebra, S. Chand and Company. New Delhi, 1967.

[5] A. K. Vasishtha and A. R. Vasishtha: Modem Algebra, Krishna Publication; 68th edition, 2015.

[6] K. Hoffiman and R. Kunze: Linear Algebra. 2nd Edition, Prentice Hall Englewood Cliffs, New Jersey, 1971.

[7] A. R. Vasishtha and J. N. Sharma: Linear Algebra, Krishna Prakashan Media (P) Ltd., 2019.

[8] Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Recognize the algebraic structures as a group, and classify them as abelian, cyclic and permutation groups, etc.

CO2: Link the fundamental concepts of groups and symmetrical figures.

CO3: Analyze the subgroups of cyclic groups.

CO4: Explain the significance of the notion of cosets, normal subgroups, and quotient groups.

CO5: The fundamental concept of rings, fields, subrings, integral domains and the corresponding morphisms.

CO6: Analyse whether a finite set of vectors in a vector space is linearly independent. Explain the concepts of basis and dimension of a vector space.

CO7: Understand the linear transformations, rank and nullity, matrix of linear transformation, algebra of a transformations and change of basis.

CO8: Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.

B.Sc. (Honors) MATHEMATICS

SEMESTER-III
Course Code: 570-CC-302   Computer
Networks & Information Security

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: To familiarize with the basic tools of Computer Networks & Information Security involving Computer Network, Physical Layer, Data Link Layer, Network Layer and Security Technology.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Introduction to Computer Network: Use of computer network: Access to information, person to person communication, electronic commerce, internet of things; Types of computer network: Broadband access network, Mobile and wireless network, content delivery network, transit network, Enterprise network. Network Technology: Personal Area Network, Local Area Network Metropolitan Area Network, Wide Area Network, internetworks, example of network (Internet, Mobile network, wireless network-Wi-Fi); Reference Model: OSI, TCP/IP, Critique of the OSI and TCP/IP reference models; Policy, Legal & Social Issues: Online speech, net neutrality, security & privacy, disinformation.

Unit 2-
Physical Layer: Guided Transmission Media: Twisted pairs, coaxial cable, Fiber Optics; Wireless Transmission: The electromagnetic spectrum, frequency hopping spread spectrum, direct sequence, spread spectrum, ultra-Wideband communication; Cellular Network: Common concepts-cells, handoff, paging 1G, 2G, 3G, 4G & 5G technology.

Unit 3-
Data Link Layer: Service Provided to Network Layer: Data Link Control: Framing, Flow and Error Control; Error detecting codes, Error correcting codes? Data Link Protocols: Basic transmission and receipt, simplex link layer protocol, Full duplex, Sliding window protocol, Packet over SONET, ADSL, Point-to-Point Protocol, Switching Techniques: Packet Switching, Circuit Switching, Datagram Networks, Virtual-Circuit Networks, and Structure of a Switch, Network Devices & Drivers: Router, Modem, Repeater, Hub, Switch, Bridge and Gateways (fundamental concepts).

Unit 4-
Network Layer: Network Layer Issues, Routing Algorithm: Optimality, principle of shortest path algorithm, Flooding, Distance Vector Routing, Broadcast Routing; congestion in network, traffic management approaches; IP Addresses, IPv4 Addresses IPv6 Addresses, Virtual Circuit Networks: Frame Relay and ATM; Transport Layer: Process-Process Delivery: UDP, TCP. Application layers: DNS, SMTP, POP, ftp, http and https. Basics of Wi-Fi (Fundamental concepts only), Streaming audio and video: digital audio and video, streaming stored media, real-time streaming. Network Security and Information Security: Fundamentals of network and information security: principles of security and attack. Security Goals (Confidentiality, Integrity, and Availability), Non-Repudiation, Overview of Security Threats and Vulnerability: Types of attacks on Confidentiality, Integrity and Availability; Vulnerability and Threats: Phishing Attacks, E-mail threats, Web-threats, Intruders and Hackers, Insider threats, SQL injection Attacks, Ransomware; Malware: Worms, Virus, Spams, Adware, Spyware, Trojans.

Unit 5-
Security Technology: Firewalls, Intrusion detection and prevention systems, Scanning and Analysis Tools: Biometric access controls, Cipher methods, Cryptographic algorithms, Cryptographic tools, Protocols for secure communication. Computer and Cyber-crimes: Cyber-crimes and related concepts, distinction between cyber-crimes and conventional crimes, Cyber criminals and their objectives. Kinds of cyber-crimes, cyber stalking, forgery and fraud, crime related to IPRs, cyber terrorism, Ransom ware attacks, computer vandalism.

Cyber Laws: Introduction to IT laws & Cyber Crimes Internet, Hacking, Cracking, Viruses, Virus Attacks, Software Piracy Intellectual property, Legal System of Information Technology, Social Engineering Mail Bombs, Bug Exploits. Scope of cyber laws: e-commerce, online contracts, IPRS (copyright, trademarks and software patenting), e-taxation e-governance and cyber-crimes, Cyber law in India, with special reference to Information Technology Act, 2000 and Recent amendments.

Recommended Books:

[1] Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, Computer Networks, 6th Edition, (2021), Pearson.
[2] Michael E Whitman and Herbert J Mattord, Principles of Information Security, Fourth Edition, CENGAGE Learning, 6th Indian Reprint.
[3] M. Merkow, J. Breithaupt, Information Security Principles and Practices, Edition, 2014, Pearson Education 2nd.
[4] G.R.F. Snyder, T. Pardoe, Network Security, Cengage Learning.
[5] Praveen Kumar Shukla, Surya Prakash Tripathi, Ritendra Goel "Introduction to Information Security and Cyber Laws", 2014, Dreamtech Press.
[6] Faiyaz Ahamad, KLSI "Cyber Law and Information Security", 2013, Dreamtech Press. [7] Books published by M.P. Hindi Granth Academy, Bhopal.

Reference Books:
[1] Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, Computer Networks, 6th Edition, (2021), Pearson.
[2] Michael E Whitman and Herbert J Mattord, Principles of Information Security, Fourth Edition, CENGAGE Learning, 6th Indian Reprint.
[3] M. Merkow, J. Breithaupt, Information Security Principles and Practices, Edition, 2014, Pearson Education 2nd.
[4] G.R.F. Snyder, T. Pardoe, Network Security, Cengage Learning.
[5] Praveen Kumar Shukla, Surya Prakash Tripathi, Ritendra Goel "Introduction to Information Security and Cyber Laws", 2014, Dreamtech Press.
[6] Faiyaz Ahamad, KLSI "Cyber Law and Information Security", 2013, Dreamtech Press. [7] Books published by M.P. Hindi Granth Academy, Bhopal.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Define and describe the components of Data Communications System such as various protocols, OSI Model, data transmission in analog and digital format.
CO2: Identify and differentiate among the network devices and drivers.
CO3: Learn and describe various error detection and correction methods. Define the various terminologies used in Network and Application layers.
CO4: Compare the various network technologies and can decide the suitable technology installation as per requirement and environment at any work place.
CO5: Describe the various protocols and can identify the application areas of each protocol.
CO6: Know the fundamentals of network and information security issues, laws, and various security technologies which can be applied on work place.

B.Sc. (Honors) MATHEMATICS
SEMESTER-III

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Code: 570-Lab-302   **Computer Networks Lab**

Course Objectives: To familiarize with the basic tools of Computer Networks Lab involving UTP network cable, Structured Cabling and its components, Optical Fiber cable, Crimping Tool, Punching Tool and Management of Local Area Network.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Suggestive List of Practical's

1. Study of UTP network cable: Study the color code of UTP cable**,** High Categories of UTP n/w cable Shielding of n/w cable**,** Electricity interference with n/w cable**,** Maximum length for which data cable can be used**,** Crimping of RJ45 connector and Punching of data n/w cable**,** Penta scanning of cabling work Rules of UTP laying.

2. Knowledge of Structured Cabling and its components: Information outlet with box, Network Rack (4U, 6U, 9U, 12U, 24U, 32U, 42U)**,** Patch Panel**,** Rack Management.

3. Study of Optical Fiber cable: Different cores of OFC (6 core, 12, 24 core), Multimode & Single mode OFC cable, Shielding of OFC Splicing/Termination of OFC, OTDR Testing, LIU fixing, LIU management (pigtail/fiber patchcord), Media Convertor, SFP module Rules of OFC laying.

4. Use of tools: Crimping Tool Punching Tool, Nose plier, Wire Stripping and Cable Cutter, Multimeter, RJ45 RJ11 RJ12 Cat5 Cat6 Network Cable Tester In-Line Coupler (RJ45 F/F), RJ45 NETWORK SPLITTER ADAPTER 2-way.

5. Configuration/ Management of Local Area Network: Implementation of file and printer sharing, Installation of ftp server and client, Connect the computers in Local Area Network, Configuring Class A IP Address on LAN Connection in Computer LAB and then use following tools: ping, ipconfig, getmac, hostname, nslookup, tracert, arp, pathping, systeminfo, Configure static routing using packet tracer software, Configure Dynamic routing using packet tracer Configure VLAN using Managed switch Device/Packet tracer, Implementation of Subnetting in Class A, B and C, Ping between 2 systems using IPv6, Configuration of NAT for incoming packet request, Configuration of Software/Hardware firewall to block outgoing requests to facebook.com.

Recommended Books:

[1] Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, Computer Networks, 6th Edition, (2021), Pearson.
[2] Michael E Whitman and Herbert J Mattord, Principles of Information Security, Fourth Edition, CENGAGE Learning, 6th Indian Reprint.
[3] Books published by M.P. Hindi Granth Academy, Bhopal.

Reference Books:
[1] Hacking Exposed, Stuart McClure, Joel Scrambray, George Kurtz, TMH.
[2] Computer Security Art and Science, Matt Bishop, Pearson/PHI.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Learn and identify various cables used in the networking.

CO2: Learn, identify various connectors used to connect different cables.

CO3: Use the various tools for preparing the connectors for cables.

CO4: Configure and manage various local area networks at home and at work place.

	Max. Marks	Min. Pass Marks
Theory	60	21

B.Sc. (Honors) MATHEMATICS

Credit: 4   40   14

SEMESTER-III

Course Code: 570-GEC-303   **Trigonometry, Calculus & Differential Equations**

Course Objectives: To familiarize with the basic tools of Trigonometry, Calculus & Differential Equations involving Trigonometric Functions, Derivative and Integration of functions, Applications of derivatives and Differential Equations.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Trigonometric Functions: Positive and negative angles, Measuring angles in radians and in degrees and conversion of one into other, Definition of trigonometric functions with the help of unit circle, Truthness of the $Sin^2x + Cos^2x = 1$, for all x, Signs of trigonometric functions, Domain and range of trigonometric functions and their graphs, Expressing $sin(x \pm y)$ and $cos(x \pm y)$ in terms of $sinx, siny, cosx$ and $cosy$ and their simple application.

Unit 2-
Calculus-I: Definition of derivative, Derivative of sum, difference, product and quotient of functions, The derivative of polynomial and trigonometric functions.

Unit 3-
Calculus-II: Integration of various functions by using substitution, partial fractions and by parts, Evaluation of simple integrals, Basic properties of definite integrals, Evaluation of definite integrals.

Unit 4-
Applications of Derivatives: Rate of change of bodies, Increasing/decreasing function, Tangents and normal, Use of derivatives in approximation, Maxima and minima Simple problems related to real-life situations.

Unit 5-
Differential Equations: Definition, order and degree, General and particular solutions, Formation of differential equation whose general solution is given, Solution of differential equations by method of separation of variables, Solutions of homogeneous differential equations of first order and first-degree, Application of differential equations of first order and first degree.

Recommended Books:

[1] S. L. Loney: Plane Trigonometry Part-1. G.K. Publications Private Limited, Second edition, 2016.
[2] Gorakh Prasad: Differential Calculus, Pothishasla Pvt. Ltd., Allahabad, 2016.
[3] Gorakh Prasad: Integral Calculus, Pothishasia Pvt. Ltd., Allahabad, 2015.

Reference Books:

[1] Judith A. Beecher, Judith A. Penna, Marvin L. Bittinger: Algebra and Trigonometry Pearson; 5th edition, 2015.
[2] Shanti Narayan: Differential and Integral Calculus, S. Chand & Company, 1942.
[3] D. A. Murray: Introductory Course in Differential Equations, Andesite Press 2017

Course Learning Outcomes: After studying this work student will be able to:

CO1: Understand the trigonometrical functions.

CO2: Find out Maxima and minima of various functions.

CO3: Solve simple problems related to real-life situations.

CO4: Use of differential equations approach in different areas of business and science.

CO5: Formulate the differential equations of first order and first degree for various mathematical problems.

B.Sc. (Honors) MATHEMATICS
SEMESTER-III
Course Code: 570-SEC-304
Entrepreneurship Development

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: To familiarize with the basic tools of Entrepreneurship Development involving Entrepreneurship Development, Sources of Business Ideas and Tests of Feasibility, Contents of business plan, Regulatory Institutions and Schemes, Commercial banks and various Self Employment Oriented grant and schemes.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Introduction: Entrepreneurship Development, Concept, types and Importance of entrepreneurs and significance of entrepreneurship in economic development, Startup process Need, Problems, Challenges and solutions-women entrepreneurship and rural entrepreneurship; Report preparation: Profiling of entrepreneurs after visiting Small Scale Entrepreneurs.

Unit 2-

Sources of Business Ideas and Tests of Feasibility: Generation of startup ideas, Innovation vs Creativity Significance of writing the business plan/ project proposal.

Unit 3-

Contents of business plan/ project proposal/DPR (Detail Project Report), Project submission/presentation and appraisal thereof by external agencies, such as financial/non-financial institutions.

Unit 4-

Regulatory Institutions and Schemes: Role of Regulatory Institutions; Micro, Small & Medium Enterprises, District Industries Centers, Khadi and Village Industries Commission, National Small Industries Corporation, Small Industries Development Bank of India.

Unit 5-

Commercial banks and various Self Employment Oriented grant and schemes; The concept, role and functions of self-help groups, business incubators, angel investors, venture capital and private equity fund in startup ideas.

Recommended Books:

[1] Kuratko and Rao, Entrepreneurship: A South Asian Perspective, Cengage Learning.

[2] Robert Hisrich, Michael Peters, Dean Shepherd, Entrepreneurship, McGraw-Hill Education.
[3] Desai, Vasant. Dynamics of Entrepreneurial Development and Management, Mumbai, Himalaya Publishing House.

Reference Books:
[1] Dollinger, Mare J. Entrepreneurship: Strategies and Resources. Illinois, Irwin.
[2] Holt, David H. Entrepreneurship: New Venture Creation, Prentice-Hall of India, New Delhi.
[3] Plsek, Paul E. Creativity, Innovation and Quality. (Eastern Economic Edition), New Delhi: Prentice-Hall of India, ISBN-81-203-1690-8.
[4] Singh, Nagendra P. Emerging Trends in Entrepreneurship Development, New Delhi: ASEED.
[5] SS Khanka, Entrepreneurial Development, S. Chand & Co, Delhi.
[6] K Ramachandran, Entrepreneurship Development, McGraw-Hill Education.

Course Learning Outcomes: After studying this work student will be able to:

CO1: This course introduces the students to the basics of entrepreneurship and small business management. Students gain an understanding of how to establish and manage a small business.
CO2: Helps in building the skills, framework and knowledge of entrepreneurship and venture creation.
CO3: Helps the students in understand the importance of the planning process and learn how to develop, write and present an effective-business plans for a new venture.

SEMESTER-IV

		Core Courses						
S.No.	Course Code	Title of the Course	Credit	Maximum Marks		Total	Minimum Pass Marks	
				Theory	Cont. Evln.		Theory	Cont. Evln.
1.	570-CC-401	Advanced Calculus and Partial Differential Equations	6	60	40	100	21	14
2.	570-CC-402	Object Oriented Programming with Java	4	60	40	100	21	14
	570-Lab-402	Java Programming Lab	2	Exam 60	Viva-Voce 40	100	21	14
3.	570-GEC-403	History of Indian Mathematics & Vedic Mathematics	4	60	40	100	21	14
4.	570-SEC-404	Women Empowerment	4	60	40	100	21	14
		Total Core Credits	20	300	200	500	-	-

*CC- Core Course
*Lab- Practical
*GEC- Generic Elective Course
*SEC- Skill Enhancement Course

B.Sc. (Honors) MATHEMATICS
SEMESTER-IV

	Credit: 4	Max. Marks	Min. Pass Marks
Theory		60	21
Cont. Evln.		40	14

Course Code: 570-CC-401 Advanced Calculus and Partial Differential Equations

Course Objectives: To familiarize with the basic tools of Advanced Calculus and Partial Differential Equations involving Historical background, Sequence of real numbers, Limit of a sequence, Series of non-negative terms, Limit and continuity of functions of two variables, Partial differential equations.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Historical background: A brief historical background of Calculus and partial differential equations in the context of India and Indian heritage and culture, A brief biography of Bodhayana, Field structure and ordered structure of R, intervals, bounded and unbounded sets, supremum and infimum, completeness in R, absolute value of a real number, Sequence of real numbers, Limit of a sequence, Bounded and monotonic sequences, Cauchy's general principle of convergence, Algebra of sequence and some important theorems.

Unit2-

Series of non-negative terms, Convergence of positive term series, Alternating series and Leibnitz's test, Absolute and Conditional Convergence of Series of real terms, Uniform continuity, Chain rule of differentiability, Mean value theorems and their geometrical interpretations.

Unit3-

Limit and continuity of functions of two variables, Change of variable, Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobians, Maxima and Minima of functions of two variables, Lagrange's multiplier method, Beta and Gamma Functions.

Unit4-

Partial differential equations of the first order, Lagrange's solution, Some-special types of equations which can be solved easily by methods other than the general method, Charpit's general method, Partial differential equations of second and higher orders.

Unit5-

Classification of partial differential equations of second order, Homogeneous and non-homogeneous partial differential equations of constant coefficients, Partial differential equations reducible to equations with constant coefficients.

Recommended Books:

[1] Devi Prasad: Advanced Calculus, Prentice Hall India Learning Private Limited, 2009.

[2] S C Malik and Savita Arora: Mathematical Analysis, New Age International Private Limited, 1st edition, 2017.

[3] M. D. Raysinghania: Ordinary and Partial Differential Equations, S. Chand & Company, New Delhi, 2017.

[4] Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.

Reference Books:

[1] R. R. Goldbeg: Methods of Real Analysis, Oxford & I.B.H. Publishing co. New Delhi, 2020.

[2] T. M. Apostol: Mathematical Analysis, Narosa Publishing House. New Delhi. 1985.

[3] D. Soma Sundaram and B. Choudhary: A first Course in mathematical Analysis, Narosa Publishing, House, New Delhi, 1997.

[4] Murray R. Spiegel: Theory and problems of advance Calculus, Schauma Publishing Co. New York, 1974.

[5] Donald R. Sherbert, Robert G. Bartle: Introduction to Real Analysis, Wiley, 4th edition, 2011.

[6] Shah Nita H.: Ordinary and Partial Differential Equations: Theory and Applications, PHI Learning Private Limited, Second edition, 2015.

[7] Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd. Allahabad, 2015.

[8] K. Sankara Rao: Introduction to Partial Differential Equations, PHI, 3rd edition, 2010.

[9] Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Understand many properties of the real line R and sequences.

CO2: Calculate the limit superior, the limit inferior, and the limit of a bounded sequence.

CO3: Apply the mean value theorems and Taylor's theorem.

CO4: Apply the various tests to determine convergence and absolute convergence of an infinite series of real numbers.

CO5: Formulate, classify and transform partial differential equations into canonical form.

B.Sc. (Honors) MATHEMATICS
SEMESTER-IV
Course Code: 570-CC-402   Object   Oriented
Programming with Java

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: To familiarize with the basic tools of Object-oriented Programming with Java involving Java statements, Constants, Variables, Data types, Class, Java API Packages, HTML Tags.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
OOPS: Object Oriented Paradigm, Benefits of OOP, Applications of OOP; Java: History, Java Features, How Java Differs from C and C++, Java and internet, Java and World Wide Web, Web Browsers, Hardware and Software Requirements, Java Supports Systems, Java Environment; Java Program Structure: Java Tokens, Java Statements, Implementing Java Program, Java Virtual Machine, Command Line Arguments, and Programming Style.

Unit 2-

Java Basics: Constants, Variables, Data Types, Declaration of Variables, Giving Values to Variables, Scope of Variable, Symbolic Constants, Type Casting, Getting Values of Variables Standard Default Values. Education; Operators: Arithmetic Operator, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators; Arithmetic Expressions: Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversions in Expressions, Operator Precedence and Associativity Mathematical Functions. Decision Making with if Statement, Simple if Statement, if.......Else Statement, Nesting of if ...else Statement if els Ladder, The Switch Statement, The? Operator. Her; Loops: While Statement, Do Statement, For Statement, Jump in Loops, Labeled Loops.

Unit 3-

Class: Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members; Constructors: definition and types, Methods Overloading, Static Members, Nesting of Methods; Inheritance: Extending a Class, Overloading Methods, Final Variables and Methods, Final Classes, Finalize Methods, Abstract Methods and Classes, Visibility Control Arrays, One Dimensional Array, Strings, Vectors, Wrapper Classes. Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables.

Unit 4-

Java API Packages: Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package, and Hiding Classes. Creating Threads, Extending the Thread Class, Stopping and Blocking a Threads, Life Cycle of a Thread, Using Threads Methods, Threads Exceptions, Threads Priority, Synchronization, Implementing the 'Runnable' interface; Types of Errors: Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using Finally Statements, Throwing Our Own Exceptions, Using Exceptions for Debugging, Creating an Executable Applet, Designing a Web Page, Applet Tag, Adding Applet to

DEPARTMENT OF MATHEMATICAL SCIENCES

B.Sc. (Honors) MATHEMATICS
SEMESTER-IV
Course Code: 570-Lab-402 Java
Programming Lab

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: To familiarize with the basic tools of Java Programming Lab, involving conditional-operator, command line argument, arrays, area of rectangle & volume of cube.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Suggestive List of Practical's

1. Find greater number between two numbers-using conditional-operator.
2. Find the factorial of number if number is given by user using command line argument.
3. Write a program to check if a number is prime or not.
4. Write a program to display tables from 2 to 10.
5. Write a program to print Fibonacci series.
6. Enter a no. and check whether it is even or odd.
7. Write a Program to find sum & average of 10 no. using arrays.
8. Write a program to display reverse of a digit no. using array.
9. Write a program to demonstrate function overloading.
10. Write a program to display grade according to the marks obtained by the student.
11. Write a program to calculate the salary of an employee if salary is greater than or equal to 20000 and year of service is greater than or equal to 5 years then bonus will be 2000 otherwise 1000 and print grass salary of employee.
12. Write a program to convert the given no. of days into months & days using with classes, objects and method.
13. Write a program to convert given string into Uppercase and lowercase and get the length of string using array.
14. Create a package called "Arithmetic" that contains methods to deal all arithmetic operations. Also write a program to use the package.
15. Write a program to demonstrate use of constructor and destructor.
16. Define an exception called "Marks out of Bound" exception that is thrown if the entered marks are greater than 100.
17. Write a program using application of single inheritance. Find the area of rectangle & volume of cube.
18. Develop a simple real-life application to illustrate the use of multithreading.
19. Write a program using multiple inheritance to calculate area and perimeter of a circle using interface.
20. Write an applet program to draw a Rectangle (color = orange) and a right oval.
21. Develop an applet that receives 3 numeric values as inputs from the user and then displays the largest no. on the screen.
22. Write a Java Program to read data from the inputted text file name and print its content on the console.

23. Write a Java Program to merge two files into third file.
24. Write a Java program to delete duplicate lines in text file.
25. Write a Java Program to implement File Input Stream class to read binary data from any image file.

Recommended Books:

[1] E. Balguruswami, Programming with Java, Tata McGraw-Hill F Books published by M.P. Hindi Granth Academy, Bhopal.

Reference Books:
[1] Bruce Eckel, Thinking in Java (4e) Herbert Schildt, Java: The Complete Reference (9).

[2] Y. Daniel Liang, Introduction to Java Programming (10e).

[3] Paul Deitel, Harvey Deitel, Java: How to Program (100) Cay S. Horsttnarin, Core Java Volume 1- Fundamentals (10e).

[4] Java Projects, BPB Publication. Dr. S.S. Kandare, Programming in Java, S Chand Publication.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Implement Object Oriented programming concept using basic syntaxes of control Structures, strings and function for developing skills of logic building activity.

CO2: Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to a specific problem.

CO3: Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved.

CO4: Demonstrate understanding and use of different exception handling mechanisms and concepts of multi-threading for robust faster and efficient application development.

CO5: Identify and describe common abstract user interface components to design GUI in Java using Applet & AWT along with response to events.

CO6: Identify, Design & Develop complex Graphical user interfaces using principal Java Swing classes based on MVC architecture.

B.Sc. (Honors) MATHEMATICS
SEMESTER-IV
Course Code: 570-GEC-403   History of Indian Mathematicians & Vedic Mathematics

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: To familiarize with the basic tools of History of Indian Mathematicians &Vedic Mathematics involving Ancient History and Biography of Indian Mathematicians, Vedic Arithmetic, Vedic Algebra and Vedic Geometry.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-
Ancient History and Biography of Indian Mathematicians: Ancient history of Indian Mathematics, Vedic period, Classical period, Medieval period; Contribution and biography of Indian Mathematicians: Katyayana and Pingala, Baudhayana and Madhavan, Aryabhata and Brahmagupta, Mahaviracharya and Bharti Krishna Tirtha, Bhaskaracharya-Il and Shridharacharya, Varahamihira, Srinivasa Iyengar Ramanujan.

Unit 2-
Vedic Arithmetic: Thematic analysis on Vedic mathematics and its importance, Vedic maths formulae, 16 sutras, 13 sub sutras, terms and operations; Multiplication method**:** Ekadhikena Purvena, Ekanyunena Purvena, Urdhva-tiryagbhyam, Nikhilam Navatascaramam Dasatah; Division method: Nikhilam Navatascaramam Dasatah**,** Paravartya Yojayet; Divisibility method: Ekadhikena Purvena**,** Ekanyunena Purvena.

Unit 3-
Vedic Algebra-I: Multiplication (Quadratic expressions of single variable), Urdhva-tiryagbhyam method, Combined operations Division and Factorization

Unit 4-
Vedic Algebra-I: Division (Divisor: Linear expression of single variable), Factorization (Quadratic expression of single variable), LCM and HCF.

Unit 5-
Vedic Geometry: Bodhayan numbers, Introduction to triples, Addition and subtraction of triples, Triple for double angles, Triple for half angle, Triple for quadrants, Trigonometric identities.

Recommended Books:

[1] Bibhuthusham Datta, Avadesh Narayan Singh: History of Hindu Mathematics, Bharatiya Kala Prakashan, 2nd edition, 2001.

[2] Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.

[3] Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaja: Vedic Mathematics: Sixtee Simple Mathematical Formulae from the Vedas, Motilal Banarsidass Publishers, 2015.

[4] Kenneth Williams: Astronomical Applications of Vedic Mathematics, Motilal Banarasida Publishers Private Limited, Delhi, 2003.

Reference Books:

[1] C. S. Seshadri: Studies in the History of Indian Mathematics, Hindustan Book Agency, 2010.

[2] Carl B. Boyer, Uta C. Merzbach: A History of Mathematics, Wiley, 3rd edition, 2011.

[3] James T. Glover: Vedic Mathematics for schools, Motilal Banarasidas Private Ltd., Delhi, 2015.

[4] V. G. Unkalkar: Excel with Vedic Mathematics, Vandana Publishers, Bangalore, 2016.

[6] Kenneth Williams: Triples: Applications of Pythagorean Triples, Motilal Banarasida Private Ltd., Delhi, 2009.

[7] Robert Kanigel: The Man Who Knew Infinity: A Life of the Genius Ramanujan, Abacus 1992.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Develop the understanding of scopes and features of Vedic mathematics.
CO2: Enhance computational skills. Develop analytical thinking through Vedic mathematics.
CO3: Understand the meaning of mathematical sotras in Sanskrit. Solve the multiplication by using Vedic sutras & distinguish between modern and Vedic aquaring methods and make to simplify algebraic squaring.
CO4: Identify cube and cube roots and understand the concept of division by using straight division.
CO5: Develop the interest of the research in the field of Indian mathematics.

B.Sc. (Honors) MATHEMATICS
SEMESTER-IV
Course Code: 570-SEC-404   **Women Empowerment**

Credit: 4	Max. Marks	Min. Pass Marks
Theory	60	21
Cont. Evln.	40	14

Course Objectives: To familiarize with the basic tools of Women Empowerment involving History of Women Empowerment in India, Women Empowerment Policy and Schemes, Financial awareness among women, Identification of expenditure on self.

Note: The question paper will consist of two sections A & B. Section A will consist of short answer type questions each carrying 6 marks and section B of long answer type questions each carrying 10 marks. In each section there will be five questions, one from each unit with internal choice. All questions will be compulsory.

Unit 1-

History of Women Empowerment in India: Ancient Period, Medieval and Modern Period, Concept of Women Empowerment: Meaning, forms, Need and Importance, Dimensions of Women Empowerment: Social, Religious, Economic, Educational and Political.\

Unit 2-

Women Empowerment: Constitutional Provisions and Laws, Women Empowerment Policy and Schemes: Central Level, State Level (With Special Reference to Madhya Pradesh).

Unit 3-

Women Empowerment: Issues and Challenges, Supporting Agencies: NGOs, Self Help Groups and Panchayati Raj Institutions, Powerful Women Leadership of India: Ahilya Bai Holkar, Rani Durgavati, Savitri Bai Phule, Mary Kom, Sindhutai Sakpal, Tessy Thomas, Indira Nooyi, Gaura Devi.

Unit 4-

Financial Awareness Among Women: Budget: Determination of objectives, establishment of goals plan for achieving goals, Formulation of family budget, action, A realistic budget: The rule (50 percent needs, 30 percent wants, 20 percent savings).

Unit 5-

Identification of expenditure on self, identification of unnecessary expenditure, method of control over expenditure, Indebtedness and savings priorities Debt-Circle Trap (Moneylender/Mahajan/Private Institutional Loan/Mortgage) Possible reasons and solutions for Debt, Emergency Savings Wise Investment-Sukanya Yojana, Mahila Samman Savings, Certificate (Effective from 01 April 2023) Action plan to achieve, "Earn, Save and Spend" Key Words: Expenditure, Realistic Budget, Indebtedness, Wise Investment.

Recommended Books:

[1] Ansari Road New Delhi, 2013 11. Tripathi, Madhusoodan, Women Rights in India, Omega Publications, Ansari Road New Delhi, 2011.

Reference Books:

[1] Samiuddin, Abida, and Khanam, R., Women Socio-Economic Empowerment, Globa Vision Publishing House.

Course Learning Outcomes: After studying this work student will be able to:

CO1: Understand the history, concept and various dimensions of women empowerment in India.

CO2: Will be able to understand the constitutional provisions, laws and policies related to women empowerment.

CO3: Get knowledge of various issues, challenges and agencies supporting women empowerment. With this, you will be able to get acquainted with the glory story of the powerful women leadership of India.

CO4: Present study related to women empowerment will provide employment opportunities to the students in government, private and non-government organizations.