SHRI MATA VAISHNO DEVI UNIVERSITY

Kakryal, Katra–182320 (J&K) INDIA

(A Statutory Technical University of J&K Legislature; recognized u/s 2(f) & 12(B) of UGC)

School of Mathematics

SMVDU|SoM|23|313

Minutes of Meeting of 11thBoard of Studies (BoS) of School of Mathematics

Date: 03/08/2023

Online Meeting of Board of Studies (BoS) of School of Mathematics (SoM) was held on 03rd August. 2023. at 03:00PM. During the meeting following were present.

S. No.	Name / BoS Participants	Affiliation
1.	Dr. Kuldip Raj	I/c Head. SoM and Chairman. BoS.
2.	Dr. Gauree Shanker	Professor & Head. Department of Mathematics. Central University. Punjab **(External Expert member)**
3.	Dr. Wali Mohamad Shah	Professor & Head. Department of Mathematics. Central University. Kashmir. **(External Expert member)**
3.	Prof. V K Bhat	Professor. School of Mathematics (SoM)
5.	Dr. A K Das	Associate Professor. SoM
6.	Dr. Sandeep Bhougal	Assistant Professor & Member Secretary of BoS, SoM
7.	Dr. Surender Singh	Assistant Professor, SoM
8.	Dr. Sandeep Sharma	Assistant Professor. SoM
9.	Dr. Sunil Kumar Sharma	Assistant Professor. SoM
10.	Dr. Nitin Bisht	Assistant Professor. SoM

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As per the agenda of BoS meeting, following were discussed and recommended:

Item:11.1	To confirm the minutes of the 10th meeting of Board of Studies (BoS), held on 18th November, 2022.
	Chairman BoS, welcomed external expert members and appraised the house about the compliance status of decisions taken during 10th BoS meeting and efforts made towards the same were appreciated. Minutes of last BoS meeting were confirmed.
Item: 11.2	To discuss / review the programme structure and syllabus of existing Integrated B.Sc.(Hons)-M.Sc. Mathematics programme including revision in courses i.e, Advanced Linear Algebra(6234) and Linear Algebra (MTL3232) and inclusion of details of Lab component for course Fuzzy Logic and Applications Lab (MTP3242) of five year programme. *(The same is Annexed as Annexure-I)*
	Course structure and curriculum of the presently running Integrated B.Sc. (Hons)-M.Sc. Mathematics programme was reviewed and the revision of courses i.e, Advanced Linear Algebra(6234) and Linear Algebra (MTL3232)) was approved. Also inclusion of list of Lab component for course Fuzzy Logic and Applications Lab (MTP3242) was approved by BoS. It was recommended to be included in the next meeting of the Academic Council. *(The finalized syllabus with course code (Semester-I to Semester-X) of the said programme is Annexed as Annexure-I)*
Item: 11.3	To discuss / review the programme structure and syllabus of Integrated B.Sc. (Hons)-M.Sc. Mathematics programme under CBCS in accordance with NEP, 2020 (CHOICE BASED CREDIT SYSTEM) and to finalize the course structure for the III and IV semester.

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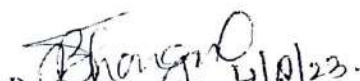(A Statutory Technical University of J&K Legislature; recognized u/s 2(f) & 12(B) of UGC)

School of Mathematics

The Syllabus and Course structure for III and IV semester Integrated B.Sc. (Honours) Mathematics-M.Sc. (Mathematics) programme under CBCS in accordance with NEP, 2020 (CHOICE BASES CREDIT SYSTEM) was discussed and approved by BoS. It was recommended to be included in next meeting of Academic Council.

(Syllabus with courses code for First Year and Second Year is annexed as Annexure-II)

Item: 11.4   Any other item with the permission of chair

The meeting ended with vote of thanks to Chair.

Dr. Sandeep Bhougal 4/8/23.
(Member Secretary, BoS)

Dr. Kuldip Raj 4/8/23
(Chairman, BoS)

ANEXURE-I

Course Structure with Course Code of Integrated B.Sc. (Honours) Mathematics-M.Sc. Mathematics Programme

Semester I   **First Year**

Course Code	Course Title	L-T-P	Credits
MTL-1231	Differential Calculus	4-0-0	4
MTL-1241	Elements of Discrete Mathematics	4-0-0	4
PHL-1151	Basic Optics	4-0-0	4
PHP-1151	Basic Optics Lab	0-0-4	2
BTL-1113/ BTL-1101	Basics of Biology/Conceptual Organic Chemistry	4-0-0	4
BTP-1113/ BTP-1101	Basics of Biology Lab/Conceptual Organic Chemistry Lab	0-0-4	2
LNL-1411	Professional Communication	2-0-2	3
	Total Credits	**16-2-10**	**23**

Semester II   **First Year**

Course Code	Course Title	L-T-P	Credits
MTL-1232	Integral Calculus	4-0-0	4
MTL-1233	Analytical Geometry of 3-D and Trigonometry	4-0-0	4
MTL-1242	Fundamental of Computers	2-0-0	2
MTP-1242	Fundamental of Computers Lab	0-0-4	2
PHL-1073	Electromagnetics	4-0-0	4
PHP-1073	Electromagnetics Lab	0-0-4	2
BTL1201/BTL-1114	Chemical bonding, Transition Metal & Coordination Chemistry / Molecules and Basic Processes of Life	4-0-0	4
BTP1201/BTP-1114	Chemical bonding, Transition Metal & Coordination Chemistry / Molecules and Basic Processes of Life	0-0-4	2
LNP-1142	Language Lab	0-0-2	1
	Total Credits	**18-0-14**	**25**

Semester III   **Second Year**

Course Code	Course Title	L-T-P	Credits
MTL-2231	Fundamentals of Algebra	4-1-0	5
MTL-2232	Real Analysis	4-1-0	5
MTL-2241 **MTP-2241**	**Computer Programming** **Computer Programming Lab**	**3-0-0** 0-0-4	**3** 2
BTL-2301/ BTL-2528	Fundamentals of Physical Chemistry / Nutrition and Health	4-0-0	4
BTP-2301/ BTP-2528	Fundamentals of Physical Chemistry Lab/ Nutrition and Health Lab	0-0-4	2
PCE-2021/ LNE 2043	Metaphysics of Human Existence/ Analyzing Sentence Structure	4-2-0	6
	Total Credits	**19-4-8**	**27**

Semester IV   **Second Year**

Course Code	Course Title	L-T-P	Credits
MTL-2242	Combinatorial Mathematics	4-1-0	5
MTL-2251	**Probability and Statistics**	**4-0-0**	**4**
MTP-2251	**Probability and Statistics Lab**	**0-0-2**	**1**
MTL-2243	Vector Calculus	4-1-0	5
PHL-2044/ BTE- 2041/ BTE -2529	Foundations of Modern Physics / Analytical Methods in Chemistry / Applications of Biology	4-0-0	4
PHP-2044/ BTP- 2041 / BTP -2529	Foundations of Modern Physics Lab / Analytical Methods in Chemistry Lab / Applications of Biology Lab	0-0-4	2
BTL-2805	Studies on Environmental Biology	4-0-0	4
	Total Credits	**20-2-6**	**25**

Semester V   **Third Year**

Course Code	Course Title	L-T-P	Credits
MTL-3231	Multivariable Calculus	4-1-0	5
MTL-3241	Coding Theory	4-1-0	5
MTL-3242	**Fuzzy Logic and Applications** **Fuzzy Logic and Applications Lab**	**4-0-0** 0-0-2	4 1
MTL-3243	Integral Transforms	4-1-0	5
MTE-3XXX	Elective-I	5-0-0	5
	Total Credits	**21-3-2**	**25**

Semester VI   **Third Year**

Course Code	Course Title	L-T-P	Credits
MTL-3244	**Ordinary Differential Equation**	**4-0-2**	**5**
MTL-3245	Number Theory & Cryptography	4-1-0	5
MTL-3232	Linear Algebra	4-1-0	5
MTL-3261	Linear Programming and Game Theory	4-1-0	5
MTE-3XXX	Elective-II	5-0-0	5
	Total Credits	**21-3-2**	**25**

Semester VII   **Fourth Year**

Course Code	Course Title	L-T-P	Credits
MTL-6231	Abstract Algebra	4-0-0	4
MTL-6232	Advanced Real Analysis	4-0-0	4
MTL-6241	**Partial Differential Equations**	**4-0-2**	**5**
MTL-6242	Advanced Calculus and Special Functions	4-0-0	4
MTE-6XXX	Elective-III	5-0-0	5
MTP-6243	MATALAB	0-0-4	2
	Total Credits	**19-2-6**	**24**

Semester VIII   **Fourth Year**

Course Code	Course Title	L-T-P	Credits
MTL-6233	Complex Analysis	4-1-0	5
MTL-6234	Advanced Linear Algebra	4-1-0	5
MTL-6244	Differential and Integral Equations	4-1-0	5
MTL-6245	**Numerical Methods**	**4-0-2**	**5**
MTE-6XXX	Open Elective-I	3-0-0	3
MTP-6246	LATEX	0-0-4	2
	Total Credits	**19-3-6**	**25**

Semester IX   **Fifth Year**

Course Code	Course Title	L-T-P	Credits
MTL-7261	**Optimization Techniques**	**4-0-2**	**5**
MTL-7231	Topology	4-1-0	5
MTL-7241	Calculus of Variations and Mechanics	4-1-0	5
MTL-7242	Modern Applied Algebra	4-1-0	5
MTE-7XXX	Open Elective-II	3-0-0	3
	Total Credits	**19-3-2**	**23**

Semester X   **Fifth Year**

Course Code	Course Title	L-T-P	Credits *
MTL-7251	**Statistical Inference**	**4-0-2**	**5**
MTL-7232	Differential Geometry	4-0-0	4
MTL-7233	Functional Analysis	4-0-0	4
MTE-7XXX	Elective-IV	5-0-0	5
MTD-7281	**Project/Research Article[#]**	**-------**	**8+2**
	Total Credits	**17-0-2**	**28**

LIST OF ELECTIVE AND OPEN ELECTIVE COURSES:

Course Code	Course Name	L-T-P **	Credits
ELECTIVE-I			
MTE-3231	Non-Linear Analysis	5-0-0	5
MTE-3241	Graph Theory	5-0-0	5
MTE-3242	Theory of Reliability	5-0-0	5
ELECTIVE-II			
MTE-3243	Information Theory	5-0-0	5
MTE-3244	Biomathematics	5-0-0	5
MTE-3281	Financial Mathematics	5-0-0	5
ELECTIVE-III			
MTE-6281	Decision Theory	5-0-0	5
MTE-6282	Intelligent Systems and Control	5-0-0	5
MTE-6283	Econometrics	5-0-0	5
MTE-6241	Algebraic Number Theory	5-0-0	5
MTE-6251	Stochastic Process	5-0-0	5
ELECTIVE-IV			
MTE-7241	Partial Differential Equations and Special Functions	5-0-0	5
MTE-7231	Advanced Topics in Algebra	5-0-0	5
MTE-7261	Queuing Theory	5-0-0	5
MTE-7232	Advanced Topics in Topology	5-0-0	5
MTE-7242	Fluid Mechanics	5-0-0	5
MTE-7243	Numerical Solution of Ordinary and Partial Differential Equations	5-0-0	5
OPEN ELECTIVES			

MTE-6242	Fuzzy Systems	3-0-0	3
MTE-6231	Complex Dynamics	3-0-0	3
MTE-6252	Statistical Techniques	3-0-0	3
MTE-6243	Techniques in Numerical Analysis	3-0-0	3
MTE-6284	Soft Computing	3-0-0	3
MTE-6235	Commutative Algebra	3-0-0	3

Subsidiary Courses from Mathematics for other departments/ disciplines:

Semester	Course Code	Course Title	L-T-P	Credits
I	MTL-1234	Differential Calculus and It's Applications	4-2-0	6
II	MTL-1235	Integral Calculus and It's Applications	4-2-0	6
III	MTL-2244	Fundamentals of Computer Programming	4-0-4	6
IV	MTL-2245	Fundamentals of Probability and Statistics	4-2-0	6

* Credit to be earned from seminar presentations on the project during the semester
** Depends on the choice of the electives
# Contact hours with the project supervisor

Fuzzy Logic and Applications Lab

MTP-3242   L-T-P: 0-0-2

(Credits=01)

Practical: (Fuzzy Logic and Applications)

1. 2D and 3D plots in MATLAB

2. Write programs to draw Triangular and Trapezoidal Membership functions

3. Write programs to draw Gaussian and Sigmoid Membership functions

4. Write programs/Simulate fuzzy operations

5. Simulate the Fuzzy Inference System (Washing Machine)

6. Write programs to model a fuzzy decision-making problem

7. Write programs to model a fuzzy clustering analysis problem

8. Simulate Fuzzy Control

Recommended Books:

1. Fuzzy Logic Toolbox User's Guide, The Mathworks, Inc., 2020
2. S. N. Sivanandan, S. Sumathi, S. N. Deepa, Introduction to Fuzzy Logic using MATLAB, Springer, 2007
3. Ismail H. Altaş, Fuzzy Logic Control in Energy Systems, with design applications in MatLab/Simulink, The Institution of Engineering and Technology, United Kingdom, 2017

Linear Algebra

MTL-3232   L-T-P: 4-1-0

(Credits=5)

UNIT-I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension, Homomorphism and isomorphism of vector spaces, Linear transformations, Vector space of all the linear transformations.

UNIT–II

Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimensional vector spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem, Algebra of Linear Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations.

UNIT–III

Matrix of a linear Transformation, Diagonal, permutation, triangular, and symmetric matrices. Rectangular matrices and column vectors, Non-singular transformations, Inverse of LT, Change of basis, Eigen values and Eigen vectors of linear transformations, Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt, Orthogonalization process.

Recommended Books:

1. S.Axler, Linear Algebra Done Right, 2nd Edition, John-Wiley, 1999.
2. K.Hoffman and R.Kunze, Linear Algebra, 2nd Edition, Prentice- Hall of India, 2005
3. S. Lang, Linear Algebra, Springer UTM, 1997.
4. S.Kumaresan, Linear Algebra:A Geometric Approach, Prentice-Hall of India, 2004

Linear Algebra(REVISED)

MTL-3232   L-T-P: 4-1-0

(Credits=5)

UNIT-I

Matrices: Symmetric, Skew- Symmetric, Hermitian, Skew- Hermitian, Unitary and Orthogonal. Rank of a matrix, characteristic polynomial of a matrix, eigen values, eigen vectors. Cayley – Hamilton theorem and its applications, Determinant and its properties.

UNIT–II

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vector space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension, Homomorphism and isomorphism of vector spaces, Linear transformations, Vector space of all the linear transformations.

UNIT–III

Linear transformation on vector space and their examples, algebra of linear transformation on a vector space, Null space and range of linear transformation, Rank - Nullity theorem. Inverse of a linear transformation on finite dimensional vector space. Matrix representation of linear transformation, Bilinear forms.

Recommended Books:

5. I. K. Rana, An Introduction to Linear Algebra, Ane Books Pvt. Ltd., 2010
6. Shanti Narayan, P.K. Mittal, A Textbook of Matrices, S. Chand Publishing, 2010
7. S.Axler, Linear Algebra Done Right, 2nd Edition, John-Wiley, 1999.
8. S.Kumaresan, Linear Algebra:A Geometric Approach, Prentice-Hall of India, 2004

(Credits=5)

UNIT-I

Review of basics of Inner product Space, The Riesz representation theorem, The Adjoint of a linear operator. Orthogonal projections, Quadratic maps. Symmetric forms, orthogonal bases. Symmetric forms over ordered fields. Hermitian forms. The spectral theorems in Hermitian and Symmetric cases.Alternating forms. Matrix groups: definition and examples, examples of compact linear groups, examples of connected linear groups.

UNIT-II

Normal operators.Spectral theorem for normal operators (statement only).Self-adjoint operators, unitary operators and Isometries.The polar decomposition of an operator.Singular Value Decomposition.Similar linear transformations, Invariant subspaces of vector spaces.Reduction of a linear transformation to triangular form.Nilpotent transformations.Index of nilpotency of a nilpotent transformation.

UNIT-III

Cyclic subspace with respect to a nilpotent transformation. Uniqueness of the invariants of a nilpotent transformation.Eigen values and Eigen vectors, Geometric and Algebraic Multiplicities, The Jordan Canonical Form, Rational Canonicals form of a linear transformation and its elementary divisiorTriangularizability and Schur's Theorem, Diagonalizable Operators, Trace and transpose.

Recommended Books:

1. Roman, Steven. Advanced Linear Algebra. 3rd Edition. Springer. 2011
2. I.N. Herstein,: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
3. Hoffman &Kunze, Linear Algebra, Prentice Hall PTR,3rd revised ed., 1999
4. S. Lang, Linear Algebra, Springer New York, 1997

MTL-6234   L-T-P: 4-1-0
(Credits=5)

UNIT-I

Linear functionals and the dual space, Dual basis, Second dual space, Annihilators, Inner product spaces, Cauchy-Schwarz inequality, orthogonality, orthonormal sets, Gram-Schmidt orthogonalization process,Characteristic and minimum polynomials of linear operators.

UNIT-II

Hermitian, Unitary and Normal Transformations.Similar linear transformations, Invariant subspaces of vector spaces.Reduction of a linear transformation to triangular form.Nilpotent transformations.Index of nilpotency of a nilpotent transformation.Cyclic subspace with respect to a nilpotent transformation.Uniqueness of the invariants of a nilpotent transformation.

UNIT-III

Algebraic multiplicity, Geometric multiplicity, Diagonalizability, Necessary & Sufficient condition of diagonalizability, Specttral Theorem, Canonical forms,   Jordan blocks and Jordan canonical forms.Companion matrix of a polynomial f(x).Trace and transpose.

Recommended Books:

5. Hoffman &Kunze, Linear Algebra, Prentice Hall PTR,3rd revised ed., 1999
6. I.N. Herstein,: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
7. Roman, Steven. Advanced Linear Algebra. 3rd Edition. Springer. 2011
8. S. Lang, Linear Algebra, Springer New York, 1997

SCHOOL OF MATHEMATICS

Course structure for Integrated B.Sc. (Hons) Mathematics-M.Sc. Mathematics ProgrammeUnder CBCS in accordance with NEP, 2020 CHOICE BASED CREDIT SYSTEM

B.Sc. (Hons) Mathematics I YEAR (APPROVED)

SEMESTER I

Broad Category of Course	Course Title	L-T-P	Credits
Core	Differential Calculus (MTL1231)	4-0-0	4
Core	Elements of Discrete Mathematics(MTL1241)	4-0-0	4
Multi-disciplinary	Fundamentals of Calculus and Applications(MTL1236) (For students of other schools) For the students of Five year program of Mahematics, the multidisciplinary course shall be offered by other schools.	3-0-0	3
AEC (Ability Enhancement)	Modern Indian Language/English Language/ Hindi Language / Communication Skills/Professional communication (Students can choose one of the Subjects)		3
SEC (Skill Enhancement Course)	Computer Applications/ Presentation Skills/ Personality Building/Modern Office Management/Financial Literacy and Banking/ Critical Thinking (Students can choose one of the Subjects)		2
Value Added Courses (2+2)	Understanding India/ Sports and Fitness/Yoga Education/Health and Wellness/ EVS/Digital Technology (Students can choose one of the Subjects)		2
	Understanding India/ Sports and Fitness/Yoga Education/Health and Wellness/ EVS/Digital Technology (Students can choose one of the Subjects)		2
Total Credits			**20**

SEMESTER II(APPROVED)

Broad Category of Course	Course Title	L-T-P	Credits
Core	Integral Calculus(MTL1232)	4-0-0	4
Core	Analytical Geometry of 3D and Trigonometry(MTL1233)	4-0-0	4
Multi-disciplinary	Probability & Statistics with applications (MTL1243) (For students of other schools) For the students of Five year program of Mahematics, the multidisciplinary course shall be offered by other schools.	3-0-0	3
AEC (Ability Enhancement)	Modern Indian Language/English Language/ Hindi Language/ Communication Skills (Students can choose one of the Subjects)		3
SEC (Skill Enhancement Course)	Computer Applications/ Presentation Skills/ Personality Building/Modern Office Management/Financial Literacy and Banking/ Critical Thinking (Students can choose one of the Subjects)		2
Value Added Courses (2+2)	Understanding India/ Sports and Fitness/Yoga Education/Health and Wellness/ EVS/Digital Technology (Students can choose one of the Subjects)		2
	Understanding India / Sports and Fitness/Yoga Education/Health and Wellness/ EVS/Digital Technology (Students can choose one of the Subjects)		2
Total Credits			**20**

B.Sc. (Hons) Mathematics II YEAR

SEMESTER III

Broad Category of Course	Course Title	L-T-P	Credits
Core	Fundamentals of Algebra (MTL2231)	4-1-0	5
Core	Real Analysis (MTL2232)	4-1-0	5
Core	Computer Programming(MTL-2241)	3-0-0	3
	Computer Programming Lab(MTP-2241)	0-0-4	2
Multi-disciplinary	Elements of Thermodynamics(PHE2024) (Offered by School of Physics)	3-0-0	3
	Food and Nutrition (BTE2533)	3-0-0	3
AEC (Ability Enhancement)	Modern Indian Language/English Language/ Hindi Language / Communication Skills/Professional communication (Students can choose one of the Subjects)	3-0-0	3
SEC (Skill Enhancement Course)	Computer Applications/ Presentation Skills/ Personality Building/Modern Office Management/Financial Literacy and Banking/ Critical Thinking (Students can choose one of the Subjects)	2-0-0	2
Total Credits			23

Multi-disciplinary (For Students of Schools other than Mathematics)	Discrete Structures with Applications (MTL2246)	3-0-0	3

SEMESTER IV

Broad Category of Course	Course Title	L-T-P	Credits
Core	Combinatorial Mathematics (MTL2242)	4-1-0	5
Core	Probability and Statistics (MTL2251)	4-0-0	4
	Probability and Statistics Lab(MTP2251)	0-0-4	2
Core	Vector Calculus(MTL2243)	4-1-0	5
Minor Vocational	To be offered by other School(s)	4-0-0	4
Total Credits			20

Multi-disciplinary (For Students of Schools other than Mathematics)	Linear Algebra and its applications(MTL2247)	3-0-0	3

SEMESTER THREE

CORE(4CREDITS)

Fundamentals of Algebra

MTL-2231   **L-**

T-P: 4-1-0 (Credits=5)

UNIT-I

Introduction of Set Theory, Cartesian Products of Sets, Injections, Surjections, Bijections   Binary Operations on Sets, Identities, Inverses, and Closure, Equivalence Relations, Divisibility, Primes, GCDs, and the Euclidean Algorithm, Congruence, Division Modulo n and Linear Congruence Equations, Fermat's and Euler's theorems, Matrix Algebra.

UNIT-II

Introduction to Groups, Groups of transformations, General and special linear groups, Dihedral groups, Subgroups, Cyclic Groups, Homomorphisms, Isomorphism and homomorphism, Kernels, Permutation Groups, The alternating groups A_n, Normal Subgroups, Quotient Groups, Fundamental Theorem of Group Homomorphism, Coset decomposition, Lagrange's theorem and its consequences, Cayley's theorem.

UNIT-III

Introduction to Rings, Subrings, Integral Domains, Ideals, Prime and Maximal Ideals, Fields, Fields of Fractions and Quotient Rings, Fundamental Theorems of Ring Homomorphism, Finite Fields.

Recommended Books:

1. D. Dummit and R. Foote, Abstract Algebra, 3rd edition, Wiley, 2003
2. Thomas W. Hungerford, Abstract Algebra: An Introduction, Third Edition, 2014
3. Thomas Judson's Abstract Algebra: Theory and Applications, 2013 edition
4. Rajendra Kumar Sharma, SudeshKumari Shah and AshaGauri Shankar, Alegebra I: A Basic Course in Algebra, Pearson Education, 2011
5. I.N. Herstein, Topics in Algebra, 2nd Edition, 1975

MTL-2232   **L-T-P:**

4-1-0 (Credits=5)

UNIT-I

Idea of countable sets, uncountable sets and uncountability of R, Order Properties of Q and its order incompleteness, Order Completeness of R, The least upper bound property and equivalent conditions including the nested interval property, Archimedean property of R, Bounded sets and their properties, sup and inf of sets.

UNIT-II

Sequences, Bounded sequences, monotone sequences and their convergence, lim-sup and lim-inf and convergence criterion using them, subsequences, Cauchy sequences and their convergence criterion, Sandwich rule. Nested interval theorems, Cauchy's first and second limit theorems, testsfor convergence: comparison test, limit comparison test, ratio test, Cauchy's n-th root test, Kummer's test and Gauss test (statements only), Alternating series, Leibniz test, Absolute and conditional convergence.

UNIT-III

Interior points and limit points, open, closed and perfect sets, Compact sets, Limit and continuity, Basic properties of continuous functions, sequential criterion for continuity & discontinuity, Algebra of continuous functions, Uniform continuity, Bounded functions, Continuous functions defined on a compact set: Their boundedness, attainment of bounds and uniform continuity, Intermediate Value Theorem.

Recommended Books:

1. T. Apostol, Mathematical Analysis.
2. R. Courant and F. John, Introduction to Calculus and Analysis, Volume I.
3. Goldberg, Methods of Real Analysis.
4. Rudin, Principles of Mathematical Analysis.
5. S. Narayan, A Course in Mathematical Analysis.

ComputerProgramming

MTL-2241   **L-T-P:3-0-**
4(Credits=5)

UNIT-I

Introduction to C Language: Introduction, Basic block diagram and functions of various components of computer, Compiler and Interpreter. Basic Difference between Procedure Oriented Language and Object-Oriented Language, Data Types, Variables, Constants, Input / Output, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associatively, Expression Evaluation, Type conversions.

UNIT-II

Fundamentals and Control Structures of 'C': Features of C language, structure of C program, comments, Selection Statements (Decision making decisions)–if and switch statements, Repetition statements (loops)-while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Simple C Program examples.

UNIT-III

Array and Functions: Basic concept of array, 1-D and 2-D arrays, declarations & Initializations of 1-D and 2-D array, String, String Input / Output functions, string manipulation functions, string /data conversion. Concept of user defined functions, prototype, definition of function, parameters, parameter passing, calling a function, call by value, call by reference, Pointers–Introduction, Arrays and Pointers, Pointer Arithmetic, pointers to void, pointers to functions, Introduction to structures and unions.

Text Books:

1. C: The Complete Reference, Herbert Schildt, McGrawHill
2. Programming in ANSI C, Forth Edition, E Balagurusamy, TMH
3. Let us C, YashwantKanitkar
4. Computer fundamentals and Programming in C, Pradipdey and ManasGhosh, Oxford

MULTIDISCIPLINARY(3 CREDITS)

Discrete Structures with Applications

MTL-2246   **L-**

T-P: 3-0-0 (Credits=3)

UNIT-I

Sets, subsets, Set operation and the laws of set theory, Venn diagram, Power set of a set, difference and symmetric difference of two sets, set identities, Family of sets, generalized union and intersection, ordered pair, Cartesian product, relation, types of relation, equivalence relations.

UNIT-II

Unary and Binary operations, partial order relation, chains and anti-chains, Structure theorem, Lattices, Boolean algebra, order relation in Boolean algebra, Boolean polynomials, Block diagrams for gating network, Connections with logic. Boolean subalgebra, Application of Boolean Algebra to switching circuit.

UNIT-III

Basic concepts of graph theory: vertices, edges, degree, paths, circuits, cycles, complete graphs and trees. Multi-graphs, weighted graphs and directed graphs, Adjacency matrix of a graph, Connected and disconnected graphs, K-connected and K-edge connected graphs. Shortest path in weighted graphs, Eulerian path and circuits, Hamiltonian path and circuits, Planar graphs, chromatic number, edge colouring of graphs, Application to network flow problem, matching problem.

Recommended Books:

1. C.L. Liu, Elements of Discrete Mathematics, McGraw Hill International editions, 2006.
2. J.P Tremblay & R. Manohar, Discrete Mathematical Structures with applications to Computer Science, Tata McGraw Hill Book Co. 1988
3. N. Iyengar, Discrete Mathematics, Vikas Publishing House Pvt Ltd, 2003.
4. Richard Johnson Baugh, Discrete Mathematics, 7th ed., pearsons, 2009.
5. NarsinghDeo, Graph Theory, Prentice Hall of India, 2004.
6. K.D. Joshi, Foundations of Discrete Mathematics, Wiely Eastern Ltd., 1989

1. ABILITY ENHANCEMENT COURSES(SEC) (3CREDITS)

Modern Indian Language/English Language/ Hindi Language/Communication*Skills(Students can choose one of the Subjects)*

2. SKILL ENHANCEMENT COURSE (2CREDITS)

Computer Applications/ Presentation Skills/ Personality Building/Modern Office Management/Financial Literacy and Banking/ Critical Thinking *(Students can choose one of the Subjects)*

SEMESTER FOUR

CORE(4CREDITS)

Combinatorial Mathematics

MTL-2242   L-T-P: 4-1-0

(Credits=5)

UNIT-I

Set identities, Relation and function, Composition of relations and functions, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations,   binary and n-ary relations, Pigeonhole principle, Basic counting principles, Permutations and Combinations, Binomial and Multinomial theorems,Principle of Inclusion and Exclusion, Derangements, Inversion formulae, Pairing problems, Pairing within a set, Pairing between sets, an optimal assignment problem, Gale's optimal assignment problem.

UNIT-II

Generating functions: Generating function models, calculating generating functions, Exponential generating functions. Recurrence relations: Recurrence relation models Divide and conquer relations, Solution of recurrence relations, Solutions by generating functions. Integer partitions, Systems of distinct representatives.

UNIT-III

Polya theory of counting: Necklace problem and Burnside's lemma, cyclic index of a permutation group, Polya's theorems and their immediate applications. Latin squares, Hadamard matrices, combinatorial designs, Symmetric designs.

Recommended Books:

1. Ian Anderson, A First course in Combinatorial Mathematics, Springer, 1989
2. P. J. Cameron, Combinatorics: Topics, Techniques, Algorithms, Cambridge University Press, 2001.
3. J.H. van Lint and R.M. Wilson, A Course in Combinatorics, 2nd Ed., Cambridge University Press, 2001.
4. V. Krishnamurthy, Combinatorics, Theory and Application, Affiliated East-West Press 1985.
5. P.J. Cameron, Combinatorics, Topics, Techniques, Algorithms, Cambridge University Press, 1995.
6. M. Jr. Hall, Combinatorial Theory, 2nd Ed., John Wiley & Sons, 1986.
7. S.S. Sane, Combinatorial Techniques, Hindustan Book Agency, 2013.
8. R.A. Brualdi, Introductory Combinatorics, 5th Ed., Pearson Education Inc., 2009.

T-P: 4-0-2 (Credits=5)

UNIT-I

Definitions, Scope and importance of statistics, General nature of statistical data, qualitative and quantitative data, discrete and continuous data, Primary and secondary data, classification & Tabulation, frequency distribution and their graphical and diagrammatic representations histogram, frequency curves, bar diagram, Ogive and measures of central tendency (A.M.,G.M.,H.M.) Median and mode, their merits and demerits. Measures of Dispersion: Range. Inter Quartile range, Mean Deviation, Standard Deviation, Variance & Coefficient of Variation. Skewness and Kurtosis meaning and measures.

UNIT-II

Probability: Random experiment, events, algebra of events, definitions of Probability, conditional Probability. Independent events, simple illustrations, Bayes Theorem and its applications.Probability mass function and Probability density function, joint marginal and conditional pmf and pdf.Independence of random variables, Discrete and continuous random variables.

UNIT-III

Mathematical expectation, expectation of sum of two random variables and product of two independent random variables, conditional expectation and conditional variance, moment generating function and its properties. Bivariate data: Correlation and Regression, Karl Pearson and Spearman Rank Correlation coefficient. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.

Recommended Books:

1.   Erwin Kreyzig, Advanced Engineering Mathematics.
2.   S. Ross, A First Course in Probability,
3.   W. Feller, An introduction to Probability Theory and its applications
4.   S.P. Gupta, Statistical Methods, Sultan Chand and sons.
5.   S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
6.   B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Vector Calculus

MTL-2243

L-T-P: 4-1-0 (Credits=5)

UNIT-I

Scalar and vector product of three vectors, product of four vectors, Reciprocal vectors. Vector differentiation, Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives, Gradient of a scalar point function, geometrical interpretation of grad, Divergence and curl of vector point function, characters of Divergence and Curl of a vector point functions, Gradient, divergence and curl related vector identities.

UNIT-II

Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical coordinates.

UNIT-III

Vector integration, Line integral, Surface integral, Volume integral.Theorems of Gauss, Green & Stokes and problems based on these theorems.

Recommended Books:

1. Murrary R. Spiegal : Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2. Murrary R. Spiegal : Vector Analysis, SchaumPublisghing Company, New York.
3. N. Saran and S.N. NIgam. Introduction to Vector Analysis, PothishalaPvt. Ltd., Allahabad.
4. Shanti Narayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.