SHRI MATA VAISHNO DEVI UNIVERSITY

SUB POST OFFICE – 182320, J & K

Faculty of Sciences

School of Mathematics

MINUTES OF THE 15TH MEETING OF BOARD OF STUDIES OF SCHOOL OF MATHEMATICS, HELD ON 15th OF JANUARY, 2026 IN ROOM NO. D-207

During the meeting following were present:

S. No.	Name / BoS Participants	Affiliation
1.	Dr. Rakesh Kumar	Head, SoM and Chairman, BoS.
2.	Prof. Sartaz Ul Hasan	Professor, Department of Mathematics, IIT, Jammu.(Through Online mode)
3.	Prof. Ajay Sharma	Professor, Department of Mathematics, Central University, Jammu.(Through Online mode)
4.	Prof. V. K. Bhat	Professor, School of Mathematics (SoM)
5.	Prof. A. K. Das	Professor, SoM
6.	Dr. Kuldip Raj (On Medical Leave)	Associate Professor, SoM
7.	Dr. Surender Singh(On EoL)	Associate Professor, SoM
8.	Dr. Abhishek Singh	Associate Professor, SoM
9.	Dr. Sandeep Bhougal	Assistant Professor & Member Secretary of BoS, SoM
10.	Dr. Sandeep Sharma	Assistant Professor, SoM
11.	Dr. Sunny Kr. Sharma	Assistant Professor, SoM
12.	Dr. Vivek Kumar	Assistant Professor, SoM
13.	Dr. Sunil Kr. Sharma	Assistant Professor, SoM (On Contract)
14.	Dr. Anu Choudhary	Assistant Professor, SoM (On Contract)
15.	Dr. Rohit Verma	Assistant Professor, SoM (On Contract)
16.	Dr. Sonali Magotra	Assistant Professor, SoM (On Contract)

Welcome and Introduction

The Chairman of the Board of Studies introduced all faculty members of the school to the external member experts. He welcomed all the members to the 15th meeting of Board of Studies and thanked Prof. Ajay Sharma & Prof. Sartaz Ul Hasan (Both Online) for attending the Board of Studies in spite of their busy schedule.

The agenda of BoS meeting is to consider the item-wise deliberations, as per the following detail

Item:15.1	**To confirm the minutes of the 14th meeting of Board of Studies (BoS), held on 31st of July, 2025.** ***(As no further comments/suggestions received from the members, the house approved the minutes of last meeting of BoS.)***
Item:15.2	**To discuss / review the programme structure of Post Graduate Course Curriculum of Mathematics as per NEP 2020 @ SMVDU** ***(The same is Annexed as Annexure-I)*** **Thorough discussions were held on the proposed program, with valuable input and insights provided by the external experts. The course structure of the said programme was discussed, approved and recommended to be included in the next meeting of Academic Council.**
Item:15.3	**To discuss / review the Pre-Ph.D courses and the inclusion of NPTEL courses related to Engineering Mathematics for Pre-Ph.D course work** ***(The same is Annexed as Annexure-II)*** **Course credits of All Pre-Ph.D courses are increased from three (03) to four (04) and it was decided that the NPTEL courses related to Engineering Mathematics for Pre-Ph.D course work may be included.**
Item:15.4	**To discuss / review the Syllabus of B.Tech ((R&AI) course Probability & Statistics (MTL BS 104)** ***(The same is Annexed as Annexure-III)*** **For B.Tech in Robotics & AI, a new course on Probability & Statistics is introduced in the second semester.**
Item:15.5	**Any other item with the permission of chair**

The Meeting ended with a vote of thanks to the Chair.

Bhougal 30/01/2026

Dr. Sandeep Bhougal

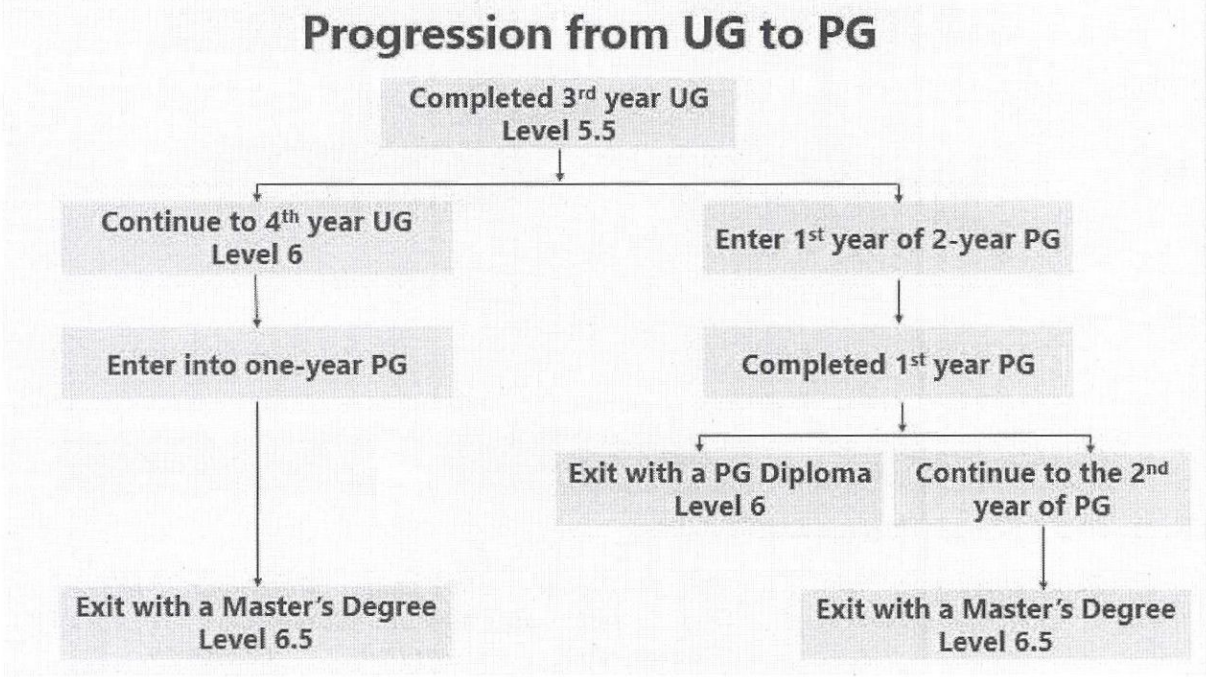
(Member Secretary, BoS)

R Kumar 30/01/2026

Dr. Rakesh Kumar

(Chairman, BoS)

Post Graduate Course Curriculum as per NEP 2020 @ SMVDU



Programme of Study and the corresponding qualification levels

First year UG programme – Level 4.5

Second Year UG Programme – Level 5

Third Year UG Programme – Level 5.5

Fourth Year UG Programme – Level 6

First year of Two Year PG Programme – Level 6

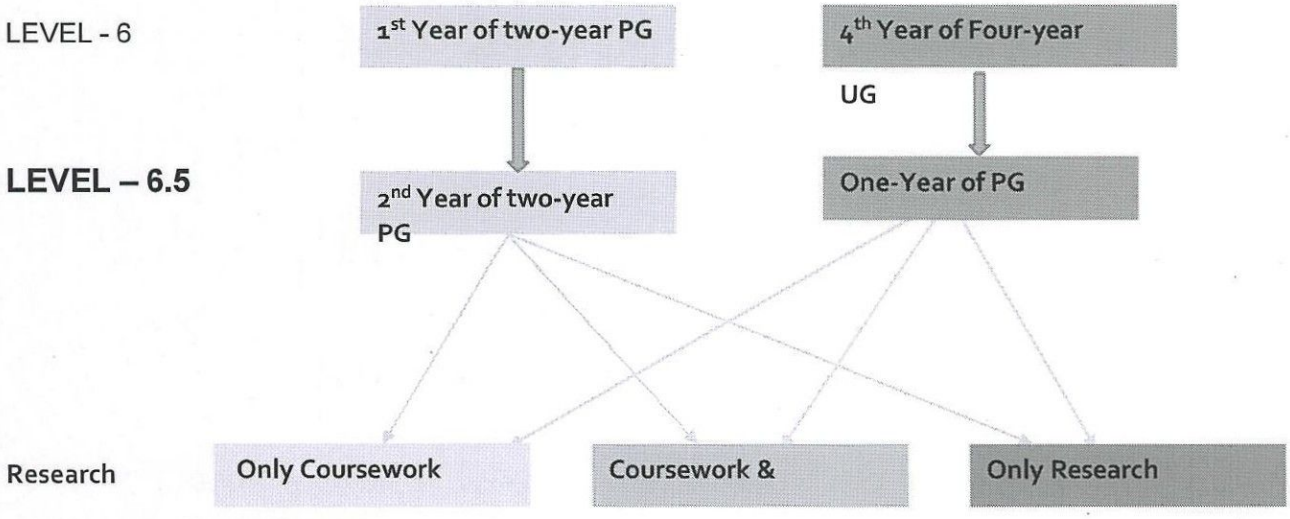
Second Year of Two Year PG Programme – Level 6.5

One year of PG Programme after 4 Year UG – Level 6.5

First year of Two Year PG Programme after 4 Year UG – Level 6.5

Second year of Two Year PG Programme after 4 Year UG – Level 7

Postgraduate Curricular Framework 2025 (based on NEP 2020)



Credit Distribution Plan for 2-year Post-graduate Program

S.No.	*Course Category*	*Credit Per Course*	*2-year PG with course work*	*2-year PG with Corse work + Research*	*2-year PG with Research*
1.	**Discipline-Specific Core (DSC)**	4	40	32	24
2.	**Discipline Specific Elective**	4	40	24	16
3.	**Research thesis/project/Patent/Intensive Research Work**	----	-------	24	40
Total Credits			**80**	**80**	**80**

Credit Distribution Plan for 1-Year Post-graduate Program

S.No.	*Course Category*	*Credit Per Course*	*1 year PG with course work*	*1 year PG with Corse work + Research*	*1 year PG with Research*
1.	**Discipline-Specific Core (DSC)**	4	16	8	--------
2.	**Discipline-Specific Elective**	4	24	8	----------
3.	**Research thesis/project/Patent/Intensive Research Work**	----	-------	24	40
Total Credits			**40**	**40**	**40**

1st Year of PG curriculum structure for 2-year PG Programme (3+2)

1st Semester

Sr.	Course Category	Category	Course Code	Course Title	L-T-P	C
1	Discipline-Specific Core (DSC)	DSC-1	MTL DC601	Basic Research Methodology for Beginners	4-0-0	4
		DSC-2	MTL DC603	Abstract Algebra	4-0-0	4
		DSC-3	MTL DC605	Advanced Real Analysis	4-0-0	4
2	Discipline Specific Elective (DSE)	DSE-1	x	x	4-0-0	4
		DSE-2	x	x	4-0-0	4
		Total Credits				20

	Discipline Specific Elective (DSE-1)		
MTL DE601	Partial Differential Equations	4-0-0	4
	Decision Theory	4-0-0	4
	Discipline Specific Elective (DSE-2)		
MTL DE605	Numerical Methods	4-0-0	4
MTL DE603	Advanced Calculus and Special Functions	4-0-0	4

1(one) DSC in Semester-I to be offered on Research Methodology.

2nd Semester

Sr.	Course Category	Category	Course Code	Course Title	L-T-P	C
1	Discipline-Specific Core (DSC)	DSC-4	MTL DC602	Complex Analysis	4-0-0	4
		DSC-5	MTL DC604	Advanced Linear Algebra	4-0-0	4
		DSC-6	MTL DC606	Differential and Integral Equations	4-0-0	4
2	Discipline Specific Elective (DSE)	DSE-3	x	x	4-0-0	4
		DSE-4	x	x	4-0-0	4
		Total Credits				20

	Discipline Specific Elective (DSE-3)		
MTL DE602	Algebraic number theory	4-0-0	4
MTL DE608	Econometrics	4-0-0	4
	Discipline Specific Elective (DSE-4)		
MTL DE606	Commutative Algebra	4-0-0	4
MTL DE604	Numerical Solution of Ordinary and Partial Differential Equations	4-0-0	4

Curricular Structure of 2nd Year of PG for Two-year PG Programme (3+2)

OR

One-year PG Programme after completion of a Four-Year UG Programme (4+1)

Structure 1 (Level 6.5): PG Curricular Structure with only coursework

3rd Semester

Sr.	Course Category	Category	Course Code	Course Title	L-T-P	C
1	Discipline-Specific Core (DSC)	DSC-7	MTL DC701	Topology	4-0-0	4
		DSC-8	MTL DC703	Calculus of Variations and Mechanics	4-0-0	4
2	Discipline Specific Elective (DSE)	DSE-5	x	x	4-0-0	4
		DSE-6	x	x	4-0-0	4
		DSE-7	x	x	4-0-0	4
		Total Credits				20

	Discipline Specific Elective (DSE-5)		
MTL DE701	Optimization Techniques	4-0-0	4
MTL DE703	Survey Sampling	4-0-0	4
	Discipline Specific Elective (DSE-6)		
MTL DE705	Modern Applied Algebra	4-0-0	4
MTL DE707	Stochastic Process	4-0-0	4
	Discipline Specific Elective (DSE-7)		
MTL DE709	Theory of Reliability	4-0-0	4
MTL DE711	Biomathematics	4-0-0	4

4th Semester

Sr.	Course Category	Category	Course Code	Course Title	L-T-P	C
1	Discipline-Specific Core (DSC)	DSC-9	MTL DC702	Differential Geometry	4-0-0	4
		DSC-10	MTL DC704	Functional Analysis	4-0-0	4
2	Discipline Specific Elective (DSE)	DSE-8	x	x	x	4
		DSE-9	x	x	x	4
		DSE-10				4
		Total Credits				20.0

	Discipline Specific Elective (DSE-8)		
MTL DE702	Advanced topics in Algebra	4-0-0	4
MTL DE708	Fluid Mechanics	4-0-0	4
	Discipline Specific Elective (DSE-9)		
MTL DE706	Queuing Theory	4-0-0	4
MTL DE710	Measure Theory	4-0-0	4
	Discipline Specific Elective (DSE-10)		
MTL DE704	Statistical Inference	4-0-0	4
MTL DE712	Advanced Topics in Topology	4-0-0	4

Structure 2 (Level 6.5): PG Curricular Structure with coursework and Research

3rd Semester

Sr.	Course Category	Category	Course Code	Course Title	L-T-P	C
1	Discipline Specific Elective (DSE)	DSC-7	MTL DC701	Topology	4-0-0	4
		DSC-8	MTL DC703	Calculus of Variations and Mechanics	4-0-0	4
2	Research thesis/project/Patent	Project-1	MTR PR701	x	x	12
		Total Credits				20

4th Semester

Sr.	Course Category	Category	Course Code	Course Title	L-T-P	C
1	Discipline Specific Elective (DSE)	DSE-5	x	x	x	4
		DSE-6	x	x	x	4
2	Research thesis/project/Patent	Project-2	MTR PR702	x	x	12
		Total Credits				20.0

	Discipline Specific Elective (DSE-5)		
MTL DE701	Optimization Techniques	4-0-0	4
MTL DE703	Survey Sampling	4-0-0	4
	Discipline Specific Elective (DSE-6)		
MTL DE705	Modern Applied Algebra	4-0-0	4
MTL DE707	Stochastic Process	4-0-0	4

Structure 3 (Level 6.5): PG Curricular Structure with Research

3rd Semester

Sr.	Course Category	Category	Course Code	Course Title	L-T-P	C
1	Research thesis/project/Patent	Project-1	MTR PR701	x	x	20
		Total Credits				20

4th Semester

Sr.	Course Category	Category	Course Code	Course Title	L-T-P	C
1.	Research thesis/project/Patent	Project-2	MTR PR702	x	x	20
		Total Credits				20.0

NOTE: *The* **Research thesis/project/Patent** *chosen should be an original work and* ***not a repetition of work done in the 4th Year of the UG programme.*** *It may be an extension of the work done in the 4th Year of the UG programme.*

Outcomes expected of Research thesis/project/Patent **in the 2nd Year of PG Programmes** **Semester III**

The following **four** outcomes must be achieved by the end of the III Semester:
Research Problem Identification
Review of literature
Research design formulation
Commencement of experimentation, fieldwork, or similar tasks

Semester IV

The following **three** outcomes must be achieved by the end of the IV Semester:
Completion of experimentation/ fieldwork
Submission of dissertation
Research output in the form of **any one** of the following –
Prototype or product development/ patent
Publication/Presentation of research work in National/International Conference/conference proceedings
Publication in a reputed journal such as Scopus-indexed journals or other similar quality journals
Book or Book Chapter in a publication by a reputed publisher.
Any other scholastic work as recommended by the School Research Committee and approved by the competent authority.

Note:

The detailed Curriculum to be prepared as per the Graduate Attributes of PG Programme available in the UGC document "Curriculum & Credit Framework for Postgraduate Programs"
(https://www.ugc.gov.in/pdfnews/4682468_Curriculum-and-Credit-Framework-for-Postgraduate-Programmes.pdf)

Courses on AI/Machine Learning, entrepreneurship, and cutting-edge technologies as applicable to the relevant discipline to be included in the course structure under DSC/DSE course categories.

Annexure-II

Pre-Ph.D Courses:

Course Code	Course Title	Credit
MTL MD 901	Research Methodology	4-0-0
MTL MD 902	Graph Theory and Numeric Functions	4-0-0
MTL MD 903	Coding Theory	4-0-0
MTL MD 904	Advanced topics in Algebra and its applications	4-0-0
MTL MD 905	Operator Theory	4-0-0
MTL MD 906	Stochastic processes and Queuing Theory	4-0-0
MTL MD 907	Advanced Topology	4-0-0
MTL MD 908	Introduction to generalized functions	4-0-0
MTL MD 909	Entire Functions	4-0-0
MTL MD 910	Skew Polynomial rings and their applications	4-0-0
MTL MD 911	Sample Surveys	4-0-0
MTL MD 912	Geometry of manifolds	4-0-0
MTL MD 913	Sequence Spaces	4-0-0

Course Code : MTL MD 901
Course Title : Research Methodology
L-T-P/S=Credits : 4 (4-0-0)
Course Category : Major
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Research: Meaning and Objectives of Research, Criteria of good research, Significance of research, Types of research, Research methods: Historical method, case study method, survey method, and experimental method. Research process, Identification and formulation of a research problem, Relevance of literature review. Hypothesis: types and characteristics. Research Design: need, features and characteristics of a good research design. Different research designs: descriptive, exploratory and experimental.	16
2	Measurement and Scaling Techniques: Scales of measurement for qualitative and quantitative data, Scaling techniques: comparative and non-comparative, Multi-dimensional scaling. Collection of data: Method of collection of primary and secondary data, Questionnaire design. Data preparation process: editing, coding, classification, tabulation and graphical representation. Descriptive Statistics: Measures of central tendency, Measures of dispersion, and Measures of relationship. Association of Attributes. Concept of probability distribution, Normal, Binomial and Poisson distributions. Design of Sample surveys: concept of census and sample survey, Sampling and non-sampling errors, Probabilistic and non-probabilistic sampling designs and their types.	16
3	Inferential Statistics: Point and Interval estimation, determination of sample size. Sampling distribution. Type-I and Type-II errors. Hypothesis testing procedure, t-test, z-test, chi square test, F-test, ANOVA. Regression Analysis: Simple linear regression, multiple linear regression, Logistic regression. Problem of multicollinearity. Factor Analysis: Centroid and Principal Components Method. Writing Scientific Report in LaTeX.	16

Reference Books:

1	Research in education, By J W Best and J V Kahn, Pearson/ Allyn and Bacon.
2	Research Methodology – Methods and Techniques, C K Kothari, New Age International.
3	Design and Analysis of Experiments, D C Montgomery, Wiley.
4	Applied Statistics & Probability for Engineers, D C Montgomery & G C Runger, Wiley.
5	Management Research Methodology: Integration of Principles, Methods and Techniques, K N Krishnaswamy, A I Sivakumar and M Mathiranjan, Pearson Education.

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the meaning, objectives and method of Research	CO1
2	Analyze the different scaling techniques and methods of Data collection	CO2
3	Apply the different measures of central tendency, dispersion, relationship and distributions.	CO3
4	Create and solve the different tests of inferential statistics.	CO4

Course Code : **MTL MD 902**
Course Title : **Graph Theory and Numeric Function**
L-T-P/S=Credits : **4 (4-0-0)**
Course Category : **Major**
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	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.	16
2	Shortest path in weighted graphs, Eulerian path and circuits, Hamiltonian path and circuits. Planner graphs, Chromatic number, edge colouring of graphs, Vizing's Theorem. Trees and cut sets: Trees, spanning tree and cut set, minimum & panning tree.	16

3	Pigeon hole Principle: Inclusion-Exclusion principle. Generating functions and Discrete numeric functions-manipulation of numeric functions. Asymptotic behavior of numeric function. Recurrence relations, Linear recurrence relation with constant coefficients and their solutions, Homogeneous solution, particular solutions and total solutions. Solution by the method of generating functions.	16

Reference Books:

1	Elements of Discrete Mathematics, C. L. Liu, Mc Graw Hill International Editions, 1985.
2	Discrete Mathematical Structures for Computer Science, Bernard Kolman & Robert C. Bushy, Prentice Hall of India, 1988.
3	Discrete Mathematical Structures with applications to Computer Science, J.P. Tremblay & R. Manohar, Tata Mc Hill Book Co. 1988.
4	Discrete Mathematics, Richard Johnson Baugh, Macmillan Publishing Co. 1989.
5	Applied Discrete Structures for Computer Science, Alan Doer, Galgotia Publications, 1987.
6	Graph Theory, Narsinngh Deo, Prentice Hall of India, 1986.
7	Foundations of Discrete Mathematics, K. D. Joshi, Wiley Eastern Ltd., 1989.

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the concept of Graph Theory	CO1
2	Analyze the different Graphs.	CO2
3	Apply the different principle of Graph Theory.	CO3
4	Create and solve the problems related to Homogeneous solution and method of generating functions.	CO4

Course Code : MTL MD 903
Course Title : Coding Theory
L-T-P/S=Credits : 4 (4-0-0)
Course Category : Major
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Introduction to algebraic structures, Field extensions, Quadratic Residuals, Krawtchouk Polynomials, Combinatorial Theory, Probability Theory, Shannon's Theorem, Coding Gain, Problems. Linear and Good Codes.	16
2	Block Codes, Linear codes, Hamming codes, Majority Logic decoding, Weight enumerators, The Lee Metric, Hadamard codes and generalizations, Binary Golay code, The Ternary Golay code, Constructing codes from other codes, Reed-Muller codes, Kerdock codes.	16
3	Bounds on Codes and Cyclic Codes, Gilbert Bound, Asymptotic Plorkin bound, Griesmer bound, The Linear Programming bound, Cyclic codes, Zeros of a Cyclic codes, The Inmpotent of a cyclic codes, Other representations of a Cyclic codes.	16

Reference Books:

1. Introduction to Coding Theory, J. H. Van Lint, Springer, 2009.

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the concept of Field Extensions	CO1
2	Analyze the Linear codes, Hamming codes, Hadamard codes and generalizations, Binary Golay code	CO2
3	Apply the different codes to study Bounds on codes.	CO3
4	Create and solve Linear Programming Problem	CO4

Course Code : MTL MD 904
Course Title : **Advanced Topics in Algebra and Applications**
L-T-P/S=Credits : **4 (4-0-0)**
Course Category : **Major**
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Rings, Matrix rings, Polynomial rings, Skew Polynomial rings, Laurent rings. Applications in coding. Ideals, homomorphism of rings, Endomorphism rings. Field of fractions, Prime fields, PIDS and UFDS.	16
2	Modules Direct product, Direct sum of modules, Free modules, homomorphisms, Maximal submodule, Minimal Submodule, Simple modules, Schurs lemma, Annihilator of a Subset of a module. Modules over PID's, Torsion modules, torsion free modules.	16
3	Chain conditions, Artinian modules, Northerian modules, Composition series, Modules of finite length, Jordan Holder Theorem. Artinian rings, Noetherian rings, Hilbert Basis Theorem, I.S.Cohen's Theorem. , Prime radical, Nil radical, Jacobson radical and their relationship.	16

Reference Books:

1	Introduction to rings and modules, C. Musili, Narosa.
2	Introduction to Non-commutative rings, K.R. Gooderal and R.B. Warfield.
3	Ring Theory, N. McCoy.
4	Noncommutative Noetherian rings, J.C.McConnell and J.C.Robson, American Mathematical Society 2001.

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the concept of modules over rings.	CO1
2	Analyze skew-polynomial ring and its various types.	CO2
3	Apply the chain conditions on modules, length of modules, and Noetherian & Artinian rings.	CO3
4	Create various radicals and their relations with applications.	CO4

Course Code : MTL MD 905
Course Title : Operator Theory
L-T-P/S=Credits : 4 (4-0-0)
Course Category : Major
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Banach spaces: Banach spaces of continuous functions, Abstract Banach spaces, Examples of Banach spaces, The conjugate paace of continuous linear functionals, The conjugate space of $C[0, 1], $ Weak Topologies on Banach spaces, The Aloglu Theorem, The open mapping Theorem.	16
2	Banach Algebras: Banach algebra, The space of multiplicative linear functions, The Gelfand Transform, The Glfand-Mazur Theorem, The Spectral radius formula, C^* algebra, Gelfand-Naimark Theorem.	16
3	Operators on Hilbert spaces: Hilbert spaces, The adjoint operator, Normal and Self-adjoint operator, Projections and subspaces, The idea of Finite rank and Compact operators, Integral operators, Calkin algebra and Fredholm operators, Volterra Integral operators, Multiplication and Composition operators.	16

Reference Books:

1	Banach Algebra Techniques in Operator Theory, Ronald. G. Douglas, Springer.

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the concept of Banach spaces of continuous functions.	CO1
2	Analyze the concept of Banach algebra and Glafand-Mazur Theorem.	CO2
3	Apply the operatosr on Hilbert spaces	CO3
4	Create and solve the problems on Fredholm operators, Volterra Integral operators, Multiplication and Composition operators.	CO4

Course Code : MTL MD 906
Course Title : Stochastic processes and Queuing Theory
L-T-P/S=Credits : 4 (4-0-0)
Course Category : Major
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Stochastic processes: Classification and applications; Markov processes with discrete and continuous state space; Branching processes; Renewal process and renewal equation. Poisson process and its applications; Birth-death process; Kolmogorov equations.	16
2	Queuing models and their applications, Steady state and transient solutions of Markovian queuing models. Non-Markovian queuing models and their steady state solutions.	16
3	Queuing Networks; Simulation of Queuing Systems; Optimization of Queuing systems.	16

Reference Books:

1	Medhi, J., Stochastic Processes, New Age International Publishers, 2009, 2nd Edition.
2	Allen, A.O., Probability, Statistics and Queuing Theory, Academic Press, 2010, 2nd Edition.
3	Medhi, J., Stochastic Models in Queuing Theory, Academic Press, 2006, 2nd Edition.
4	Gross, D. and Harris, C. M., Fundamentals of Queuing Theory, Wiley, 2008. 3rd Edition.
5	Trivedi, K. S., Probability and Statistics with Reliability, Queuing and Computer Science Applications, PHI, 2008, 2nd Edition.

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand stochastic processes and their applications	CO1
2	Analyze Markovian and Non-Markovian queuing models	CO2
3	Apply Queuing network models	CO3
4	Create Simulation models for queuing systems, and perform optimization of queuing models.	CO4

Course Code : **MTL MD 907**
Course Title : **Advanced Topology**
L-T-P/S=Credits : **3-1-0 =4**
Course Category : **Major**
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Metrizable spaces: Tychonoff Lemma, Urysohn lemma, embedding lemma, Metric and Pseudo-metri spaces, countability, Urysohn Mertization theorem, locally finite, countably locally finite, Nagata-Smirnov metrization theorem, paracompact spaces, locally metrizable spaces, Smirnov metrization theorem.	16
2	Uniform spaces, neighbourhoods, bases, subbases, Uniform continuity, product uniformities, metrization lemma, metrization theorem, Cauchy nets, extension of functions, complete uniform spaces.	16
3	Function spaces: pointwise convergence, compact open topology and joint continuity, uniform convergence on a family of sets, completeness, uniform convergence on compacta, compactness and equicontinuity, Ascoli theorem.	16

Suggested Books:

Sr.	Name of Book, Author, Publisher	Year of Publication / Reprint
1	J. L. Kelley, General Topology, Springer, 1995, International Edition.	1995
2	Stephen Willard, General Topology, Dover Publications, 2004, Imported Edition.	2004
3	J. Dugundji, Topology, Allyn and Bacon, Boston, Indian Edition by UBS books, 1999	1999

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the concepts of Metrizability and Paracompactness.	CO1
2	Learn the notions of Uniform spaces.	CO2
3	Understand the convergence and uniform convergence in function spaces.	CO3
4	Analyze and apply the concepts of Metrizability and convergence.	CO4

Course Code : **MTL MD 908**
Course Title : **Introduction to generalized functions**
L-T-P/S=Credits : **3-1-0 =4**
Course Category : **Major**
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Generalized Functions: Definition and example, local properties and non-linear properties, Complex Test functions and Generalized functions, Other Test Function Spaces, Generalized number and point values of generalized functions, Integration on compact sets of generalized functions for the case of single and several variables.	16
2	Some Linear Cauchy Problems: Introduction, Existence and uniqueness results, Approximate and Asymptotic expansions of Generalized Functions. The Fourier Transform and the Tempered Generalized Functions, Convolution product, Computation, on Tempered Generalized Functions.	16
3	New Solutions of partial Differential Equations: the -equation, a Cauchy problem for linear wave equation, an existence result for wave equations including non-linear term with a bounded property, uniqueness and regularity results, an existence result for wave equations with unbounded second members. .	16

Suggested Books:

Sr.	Name of Book, Author, Publisher	Year of Publication / Reprint
1	R. P. Kanwal, Generalized Functions: Theory and Technique, Birkhauser, Verlaeg, 1998, 2nd Edition.	1998
2	I. M. Gelfande and G. E. Shilov, Generalized Functions (Vol: I & II), Academic Press, (1964, 1968).	1964,1968
3	J. F. Colomneau, Elementary Introduction to New Generalized Functions, NH publication, 1985	1985

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the meaning of Generalized Functions and its properties.	CO1
2	Analyze the Fourier Transform and the Tempered Generalized Functions	CO2

3	Apply the different Generalized Functions to solve partial Differential Equations	CO3
4	Create and solve uniqueness and regularity results, an existence result for wave equations.	CO4

Course Code : **MTL MD 909**
Course Title : **Entire Functions**
L-T-P/S=Credits : **3-1-0 =4**
Course Category : **Major**
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Meromorphic functions, Rational and Transcendental meromorphic function, Entire function, Maximum modulus, Minimum modulus theorem, Cauchy's inequality, Liouville theorem, Maximum modulus of polynomials Sin z, Cos z, e^z, Zeros of entire functions, Hadamard's three circle theorem, Order of an entire function, Picard like theorems	16
2	Infinite product representation of an entire functions, Weierstrass's Factorization theorem, Order of sum and product of two entire functions, Type of an entire function, Canonical product, Genus of canonical product, Hadamard Factorization theorem.	16
3	Order of an entire function, Laguerre's theorem, Luccas theorem, G.polya theorem, Borel's theorem, Exceptional value, Landou's theorem, Poisson integral formula, Poisson Jensen formula, First fundamental theorem of Nevanlinna, H.Cartan theorem, Order of an meromorphic function. Spaces of entire functions and their elementary properties.	16

Suggested Books:

Sr.	Name of Book, Author, Publisher	Year of Publication / Reprint
1	S.B. Holland, Introduction to the theory of Entire functions, Academic Press, 2nd edition	
2	S. Ponnuswamy. Foundations of complex Analysis, Narosa, 2nd edition.	
3	L. Alfors, Complex Analysis, McGraw-Hill, New York, 2nd edition	
4	J.B Conway, Functions of one Complex variables, 2nd edition, Springer-Verlag.	
5	E.C Titchmarsh, Theory of Functions, 2nd edition, Oxford University Press.	
6	R.P Boas, Entire functions, Academic Press, 2nd edition.	

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the meaning of Rational and Transcendental meromorphic function.	CO1
2	Analyze the concept of entire functions and order of an entire function.	CO2
3	Apply the different types of entire function to study Luccas, G.polya, Borel's theorem	CO3
4	Create and solve the problems by using Entire functions and their properties.	CO4

Course Code : **MTL MD 910**
Course Title : **Skew Polynomial rings and their applications**
L-T-P/S=Credits : **3-1-0 =4**
Course Category : **Major**
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Derivations, Skew-Polynomial Rings (general type, endomorphism type and derivation type) Skew Laurent RingRings, Polynomial Rings, Fields, Finite Fields, Euclidean rings, Endomorphisms and s, Basic results of these Rings	16
2	Codes, Coding techniques, Encoding and Decoding, Error detecting and correcting codes, Polynomial codes, Generating polynomial, Shift register and its use in polynomial multiplication.	16
3	Coding with Skew Polynomial Rings , where is automorphism of , Skew codes defined as ideals, Self-Dual Skew codes, Euclidean Self-Dual codes over Bose-Chaudhuri-Hocquenghem (BCH)-code, Ideal , Module , BCH Modules , Dual for the Euclidean Scalar Products, Parity Check Matrices, , Hermition Scalar Product and its dual, distance for self-dual and minimum distance properties.	16

Suggested Books:

Sr.	Name of Book, Author, Publisher	Year of Publication / Reprint
1	Berrick, A., Keating, M., An introduction to rings and modules, Cambridge Studies in Advanced Mathematics 65, Cambridge University Press (2000).	2000

2	Birkhoff, G ., Bartee, T., Modern Applied Algebra, Mcgraw Hill, New York (Cheap Edition CBS Publishers, New Delhi) (1999).	1999
3	Goodearl, K. R., Warfield, R.B., Jr., An Introduction to noncommutative Noetherian rings, Cambridge University Press (2004)	2004
4	Lint, J. V., Introduction to Coding Theory, Springer-Verlag (1998).	1998

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the non-commutative Noetherian rings.	CO1
2	Analyze the Skew-Polynomial rings of various types (Endomorphism type, derivation type, Full Ore-extension).	CO2
3	Apply the different Skew-Polynomial rings in Coding	CO3

Course Code : MTL MD 911
Course Title : Sample Surveys
L-T-P/S=Credits : 3-1-0 =4
Course Category : Major
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Estimation of sample size, Stratified random sampling, different methods of allocation, relative precision of stratified random sampling with S.R.S, formation and construction of strata, Post Stratification and Deep Stratification.	16
2	Systematic sampling, estimation of mean and sampling variance, comparison of systematic sampling with stratified and S.R.S, interpenetrating systematic sampling, Varying probability sampling methods of selecting sample with p.p.s sampling W.R., efficiency of p.p.s sampling PPSWOR, H.T. estimator, Des Raj Sampling Strategy, Murphy estimator, Sen-Midzuno method.	16
3	Ratio estimator, bias and mean square error, estimation of variance, comparison with SRS, ratio estimator in stratified sampling, unbiased type ratio estimators. Difference estimator, Cluster sampling with equal and unequal cluster sizes, relative efficiency with SRS and optimum cluster size. Two stage sampling with equal and unequal s.s.u's estimation of mean and sampling variance, successive sampling, sampling on two occasions, Randomized response Technique.	16

Suggested Books:

Sr.	Name of Book, Author, Publisher	Year of Publication / Reprint
1	Theory and Methods of Survey Sampling by Parimal Mukhopadhyay.	NA
2	Theory and Analysis of Sample Survey Designs by D. Singh and F. S. Choudhary	NA
3	Sampling Theory by Des Raj.Theory and Methods of Survey Sampling by P. Mukhopadhyay	NA

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the Stratified sampling, Post stratified and Deep Stratified	CO1
2	Analyze the Systematic sampling and its comparison with Stratified sampling	CO2
3	Apply the Ratio estimator, bias and mean square error, estimation of variance and its comparison with SRS	CO3
4	Create and solve the Difference estimator, Cluster Sampling with equal and unequal cluster size.	CO4

Course Code : MTL 912
Course Title : Geometry of manifolds
L-T-P/S=Credits : 3-1-0 =4
Course Category : Major
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Manifold, Differentiable manifold, Differential function, tangent space, Jacobian map, immersion and imbedding, distributions, connection, affine connection, covariant derivative, torsion tensor	16
2	Lie Bracket, lie derivative, Exterior derivative, Gradient Curl and Divergence, lie group and lie algebras, lie transformation groups, fibre bundle, vector bundle, tangent bundle, induced bundle, associated bundle, linear frame bundle, bundle, homomorphisms.	16
3	Riemannian manifolds, Riemannian connection, curvature tensor, Einstein manifold, geodesic in a Riemannian manifold, Projective curvature tensor, conformal curvature tensor, concircular and conharmonic curvature tensor, flat manifold, recurrent manifold.	16

Suggested Books:

Sr.	Name of Book, Author, Publisher	Year of Publication / Reprint
1	Will More, T.J., Introduction to differential Geometry.	NA
2	U.C.DE., A.A. Shaikh, Complex manifolds and contact manifolds.	NA
3	Quddus Khan, Differential geometry of manifolds, PHI learning, 2012.	2012
4	Bishop, Crittenden, Geometry of manifolds.	NA

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the fundamentals based on differential Manifolds.	CO1
2	Analyze the fundamentals based on Riemanian Manifolds.	CO2
3	Apply the concepts of differentiable and Riemanian Manifolds to develop theorems.	CO3
4	Apply above tools to solve geometric problems.	CO4

Course Code : MTL MD 913
Course Title : Sequences spaces
L-T-P/S=Credits : 3-1-0 =4
Course Category : Major
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Introduction of Sequence Spaces, Basic Definitions and Results, Duals, Topology on Sequence Spaces, K-spaces related to α-, β- and γ-duals, Spaces of the form λ_A, μ_A and V_A, Perfect Spaces, Simple Sequence Spaces and Symmetric Sequence Spaces.	16
2	Modular Sequence Spaces, Conjugate modular Spaces, F-Modular Spaces, Bimodular Spaces, Modular Convergence and Modular Bases, Lorentz Sequence Spaces and their properties.	16
3	Orlicz Sequence Spaces, Generalized Orlicz Spaces, Embeddings of generalized Orlicz classes and Orlicz Spaces, Compactness of Orlicz	16

	Spaces, Generalized Orlicz-Sobolev Spaces and Spaces of functions of finite generalized variations.	

Suggested Books:

Sr.	Name of Book, Author, Publisher	Year of Publication / Reprint
1	P.K. Kamthan and Manjul Gupta, Sequence Spaces and Series, Marcel Dekker, Inc., New York and Basel, 1981.	1981
2	J. Musielak, Orlicz Spaces and Modular Spaces, Springer-Verlag Berlin, Heidelberg, New York, Tokyo, 1983.	1983
3	M. M. Rao and Z. D. Ren, Theory of Orlicz Spaces, Marcel Dekker, New York, 1991	1991

Course Outcome

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the concept to find α-, β- and γ-duals of sequence spaces	CO1
2	Analyze the different sequence spaces by using modulus function and Orlicz function.	CO2
3	Apply the concept of Orlicz function to study generalized Orlicz spaces and their classes.	CO3
4	Create new types of generalized sequence spaces by using above concept.	CO4

Annexure-III

Course Code : **MTL BS 104**
Course Title : **Probability and Statistics**
L-T-P/S=Credits : **3-1-0 =4**
Course Category : **BSC**
Pre-requisite Courses (if any) :
Equal Course Code (if any) :
Equivalent Course Code (if any) :

Detailed Syllabus

Sr	Contents	Approx. Contact Hours
1	Measures of Central tendency, Dispersion, Skewness and Kurtosis. Review of probability. Bayes' rule. Distribution function, Marginal and joint probability distribution. Mathematical expectation of sum and product of random variables, Probability distributions: Binomial, Poisson and Normal- evaluation of statistical parameters for these distributions.	16
2	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.	16
3	Test of significance for single mean, difference of means, correlation coefficient, single proportion, difference of proportions and variance. Chi-square test for goodness of fit and independence of attributes.	16

Suggested Books:

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

Sr	After successful completion of this course, students will be able to;	CO
1	Understand the measures of central tendency, Dispersion, Skewness and Kurtosis with applications	CO1
2	Analyze the probability distributions with evaluation of their parameters	CO2
3	Apply the different measures of Correlation and Regression lines	CO3
4	Create and solve the different tests of inferential statistics.	CO4