List of Revised Courses

Department : *Mathematics*

Program Name : *M.Sc., Ph.D. Course Work*

Academic Year : 2021-22

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.		INFORMATION THEORY AND ITS APPLICATIONS
02.		SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT
03.		FINSLER GEOMETRY
04.		MATHEMATICAL MEASURE OF INFORMATION AND THEIR CHARACTERIZATIONS
05.		FINANCIAL MATHEMATICS AND ITS APPLICATIONS
06.	MaPhD06	GEOMETRY OF FINSLER SPACE
07.	MaPhD07	STRUCTURES ON MANIFOLDS

Department of Mathematics

Guru Ghsidas Vishwavidyalaya, Bilaspur (CG)

Minutes of BOS Meeting held on March 12, 2021

The Following Members were Present:

1.	**Dr. P. P. Murthy,** Head	Chairman
2.	**Professor Ravi Prakash Dubey**	Subject Expert
3.	**Professor A. S. Ranadive**	Member
4.	**Dr. Sandeep Singh**	Member
5.	**Dr. J. P. Jaiswal**	Special invitee
6.	**Dr. Dhananjay Gopal**	Special invitee
7.	**Dr. M. K. Gupta**	Special invitee
8.	**Dr.K. N. V. V. Vara Prasad**	Special invitee
9.	**Dr. Uma Devi Patel**	Special invitee
10.	**Dr. Santosh Verma**	Special invitee
11.	**Dr. Brijendra Paswan**	Special invitee

Chairman of BOS welcome all the honourable members of **Board of Studies** and special invitees in this meeting. In the meeting, the following agenda approved unanimously. Most of the papers offered at Pre-Ph.D. Course level revised thoroughly and introduced new papers.

Pre-Ph.D. COURSE WORK in Mathematics

Examination Scheme

- There shall be a Course Work Examination for all provisionally admitted students after atleast six months from the commencement of classes of Pre-Ph.D. Course Work.
- For Pre-Ph.D. Course Work Examination, there shall be three papers of 100 marks each or such papers as mentioned in Ph.D. regulations/ Ordinances as amended from time to time.
- The duration of examination for each question paper shall be of three hours and there shall be two sections in each question paper in the following manner:

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a. There shall be 10 (3 marks each) objective type or short-answer questions in first section/ part of the question paper for 30 marks.

b. There shall be 05 (14 marks each) descriptive / essay / interpretable type answer questions in second section/ part of the question paper for 70 marks.

- Examinee of Pre-Ph.D. Course Work has to score minimum 40 marks in each paper and overall, 55% marks in aggregate in examination in order to be eligible to continue in the program leading to the completion of Ph.D. thesis.
- Examinee of Pre-Ph.D. Course Work has to present a Seminar in the department. No marks shall be awarded for this Seminar presented by examinee; it can be assessed as Successful / Unsuccessful only. This qualifying seminar shall be evaluated by the concerned department only.

COURSE STRUCTURE

There should be **one compulsory paper, two optional papers** and **Seminar evaluations**. Students are required to choose any two (02) optional papers from the given list of Eleven (11) papers approved by BOS.

COMPULSORY PAPER

MaPhD01: RESEARCH METHODOLOGY

OPTIONAL PAPERS (ANY TWO):

MaPhD02: INTRODUCTORY FUZZY GROUP THEORY

MaPhD03: APPLIED FUNCTIONAL ANALYSIS

MaPhD04: CRYPTOGRAPHY

MaPhD05: DYNAMICAL SYSTEM

MaPhD06: GEOMETRY OF FINSLER SPACE

MaPhD07: STRUCTURES ON MANIFOLDS

MaPhD08: FIXED POINT THEORY AND APPLICATIONS

MaPhD09: MECHANICS OF SOLIDS AND WAVE PROPAGATION

MaPhD10: ADVANCED NUMERICAL ANALYSIS

MaPhD11: ITERATIVE METHODS FOR SOLVING NONLINEAR EQUATIONS

MaPhD12: FRACTIONAL CALCULUS

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iii. *to use a range of specialised analytical techniques which are required in the study of dynamical systems*
iv. *to describe dynamical systems geometrically and represent them graphically via phase plane analysis*
v. *to understand and predict the occurrence and consequences of bifurcations*
vi. *to explain and prove special properties of finite-dimensional Hamiltonian systems, in particular conservation laws, Liouville's Theorem and Poincare's Recurrence Theorem prove simple theoretical results about abstract dynamical systems*
vii. *to understand the origin of dissipation and its effect on the orbits of dynamical systems*
viii. *to find fixed points and period orbits of discrete dynamical systems, and find their stability*
ix. *to do graphical analysis of 1D discrete dynamical systems*
x. *to understand the basic properties of a chaotic dynamical system*

MaPhD06: GEOMETRY OF FINSLER SPACE

Course Objectives:

The objective of this course is to enable the students, concepts of Finsler geometry so that they can pursue research in this area.

Basic concepts of Finsler space

Berwald and Cartan covariant differentiation

Lie differentiation of a tensor, Lie differentiation of Berwald connection coefficients, different commutation formulae, Motion, affine motion and projective motion, Conformal tansformation.

Riemannian curvature, isotropic point, Shur's theorem, Szabo's theorem.

Reference Books:

1. H. Rund, The Differential Geometry of Finsler Spaces, Springer-Verlag, Berlin, 1959.
2. M. Matsumoto, Foundations of Finsler Geometry and Special Finsler Spaces, Kaisheisha Press, Otsu, 1986.
3. P. L. Antonelli (ed.), Handbook of Finsler Geometry, Kluwer Academic Publishers, Dordrecht, the Netherlands, 2003.
4. D. Bao, S.S. Chern and Z. Shen, An Introduction to Riemannian-Finsler Geometry, GTM, Springer, 2000.
5. S.S. Chern and Z. Shen, Riemannian-Finsler Geometry, World Scientific, 2004.
6. Z. Shen, Lectures on Finsler Geometry, Lectures on Finsler Geometry, World Scientific, 2001.

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Learning Outcomes:

After the completion of the course, students will be able to learn basic concepts of Finsler geometry. They may understand better the topics covered in allied courses like Riemannian geometry, Mathematical Physics and their applications in allied areas. They will be adequately prepared for pursuing research in Finsler geometry.

MaPhD07: STRUCTURES ON MANIFOLDS

Course Objectives:

The course develops the basic concept of Differentiable manifold and also gives concepts of different complex structures on manifolds.

Manifolds and Connection: Concepts of manifolds, Tangent vectors, Vector fields, Lie Brackets, Affine connections, Torsion tensor of an affine connection, Curvature tensor of an affine connection.

Complex and almost Complex Manifolds: Definition and example, Nijenhuis tensor, Eigen Values of an almost complex structure, Existence theorem and inerrability condition, contravariant and covariant almost analytic vector fields.

Almost Hermite Manifold: Nijenhuis tensor, Almost analytic vector fields, Curvature in almost Hermite manifold, Holomorphic Sectional Curvature, Linear connection in an almost Hermite manifold.

Koehler Manifold: Definition, Holomorphic Sectional Curvature, Bochner Curvature tensor, affine connection in almost Kaehler manifold.

Nearly Kaehler Manifold: Definition, Projective correspondence between two Nearly Kaehler manifolds, Curvature identities.

ParaKaehle Manifold: Definition, Curvature Identities and conformal flatness of ParaKaehler manifold.

Reference Books:

1. K. Yano and M. Kon, Structures on Manifolds, World Scientific, 1984.

2. D. E. Blair, Riemannian Geometry of Contact and Symplectic Manifolds, Progress in Mathematics, Vol. 203, Birkhäuser Inc., Boston, MA, 2002.

3. R. S. Mishra, Structures on Differentiable Manifolds and their Applications, ChandramaPrakashan, Allahabad, 1984.

4. U. C. De and A. A. Shaikh, Complex Manifolds and Contact Manifolds, Narosa.

Learning Outcomes:

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Note: The following papers at M.Sc. level modified slightly at M.Sc. III and M.Sc. IV semester. Implementation of the course will be from the session 2021-22 onwards.

M.Sc. III Semester

INFORMATION THEORY AND ITS APPLICATIONS

Course Objectives:

The main concern of information theory is to discover mathematical laws governing the system, design to communicate or manipulate information. It sets up quantitative measure of information and capacity of various systems to transmit, store and process the information. Coding is the application of the information theory which will be taught to the students in this paper

Introduction, communications, processes, a model for a communications system, a quantitative measure of information, a binary unit of information, discrete scheme without memory, Basic concepts of probability related to information theory, Basic concept of information theory, memory less finite scheme, elements of encoding, continuum without memory.

Books Recommended.

1. F. M. Reza, An introduction to information theory, Dover Publications Inc. New York.
2. Robert B Ash, Information theory, Inter Science Publishers New York.
3. John R. Pierce, An Introduction to information theory, Dover Publications Inc. New York.
4. John Avery, Information theory and evolution, World Scientific, New Jersey.

Learning Outcomes:

After successful completion of this paper the students will be able to explain the concepts of entropy and mutual information. The students will also be able to understand the concept of information theory and its usefulness in various fields such as in defence, in portfolio selection, in general election, in computer science, in pattern recognition and in image processing.

M.Sc. III Semester

SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

Course Objectives:

The main objectives of this paper is to study about the securities analysis and portfolio optimization which can be used in the analysis of stock market related entities.

Introduction, investment, securities market, stock exchanges, risks, share valuation, band valuation, portfolio analysis, portfolio selection, capital asset pricing model (CAPM).

Books Recommended

1. John C Hall, Options, features and other derivatives, Prentice- Hall of India Private Limited.
2. Sheldon M Ross, An introduction to Mathematical Finance, Cambridge University Press.
3. S. Kevin, Security analysis and portfolio management, PHI learning Private limited.

Learning Outcomes:

After successful completion of this paper the students will be able to analyze the various kinds of securities and they can decide to take the decision about to purchase the securities for the benefit of their own in future.

M.Sc. IV Semester

FINSLER GEOMETRY

Course Objectives:

The objective of this course is to enable the students, the basic concepts of Finsler geometry which are useful for further study.

Line element, degree of homogeneity, Finsler space, Euler's theorem, metric tensor, generalized Christoffel symbols, Cartan tensor, Minkowskian space, Tangent space, dual tangent space, length of a vector, Geodesic.

δ-differentiation, partial δ-differentiation, Berwald differentiation, commutation formulae, metrical connection, Landsberg space, Affinely connected space, Ricci commutation formula, Berwald curvature and torsion tensors, Berwald deviation tensor, Bianchi identities, Recurrent Finsler space, Symmetric Finsler space.

Projective change, projective deviation tensor, projective curvature and torsion tensors.

Cartan two processes of covariant differentiation, Cartan curvature and torsion tensors.

Books Recommended:

1. H. Rund, The Differential Geometry of Finsler Spaces, Springer-Verlag, Berlin, 1959.
2. M. Matsumoto, Foundations of Finsler Geometry and Special Finsler Spaces, Kaisheisha Press, Otsu, 1986.
3. P. L. Antonelli (ed.), Handbook of Finsler Geometry, Kluwer Academic Publishers, Dordrecht, the Netherlands, 2003.

Learning Outcomes:

After the completion of the course, students will be able to learn some basic concepts of Finsler geometry. They may understand covariant differentiation better.

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M.Sc. IV Semester

MATHEMATICAL MEASURE OF INFORMATION AND THEIR CHARACTERIZATIONS

Course Objectives:

The main objective of this paper is to study how to measure the information mathematically.

Introduction, entropy of a single event, functional equations, Shannon's measure of information, some desirable properties of entropy and their correlations, the HincinFaddeev characterization of Shannon Entropy, The fundamental equation of information.

Books Recommended.

1. J. Aczel and Z. Doroczy, On measure of information and their characterizations, Academic Press, New York.
2. F. M. Reza, An introduction to information theory, Dover Publications Inc. New York.

Learning Outcomes:

After successful completion of this paper the students will be able to measure the decay of information in communication channel during the transmission of information.

M.Sc. IV Semester

FINANCIAL MATHEMATICS AND ITS APPLICATIONS

Course Objectives:

The objectives of this paper is to study various types of financial instruments and their applications in various fields.

Financial Derivatives - Introduction, types of financial derivatives, forwards and futures. Options and its types and SWATS. Technical analysis and fundamental analysis.

Pricing contracts via arbitrage. The arbitrage theorem. The block scholes formula Cox-Ross Rubinstein model.

Books Recommended

1. John C Hall, Options, features and other derivatives, Prentice- Hall of India Private Limited.
2. Sheldon M Ross, An introduction to Mathematical Finance, Cambridge University Press.

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3. Sahil N. Nettci and Hirsa, An introduction to Mathematics of financial derivatives, Academic Press Inc.
4. Robert J Elliot and P. Ekkehard Kopp, Mathematics of financial markets, Springer-Verlag New York Inc
5. S. Kevin, Security analysis and portfolio management, PHI learning Private limited.
6. Steven Roman, Introduction to the mathematics of finance, Springer.

Learning Outcomes:

After successful completion of this paper the students will be able to explain various types of financial derivatives and they will be able to apply this concept in stock market analysis.

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