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

Ph. D. COURSE WORK STRUCTURE

Mathematics

2018-19

AWADHESH PRATAP SINGH UNIVERSITY, REWA

STRUCTURE OF SYLLABUS FOR Ph.D. COURSE WORK (MATHEMATICS) 2018-19 ONWARDS
(AS PER ORDINANCE NO. 11 DOCTOR OF PHILOSOPHY)

	Paper Code	Name of Theory Papers	Credits	Maximum Marks (Theory+ Internal Assessment)	Minimum Passing Marks
Ph.D.	Ph.D. 101	RESEARCH METHODOLOGY	4	100 (80+20)	55
	Ph.D. 102	REVIEW OF PUBLISHED RESEARCH IN THE RELEVANT FIELD	3	100	55
	Ph.D. 103	COMPUTER APPLICATIONS	3	100 (80+20)	55
	Ph.D. 104	SPECIALIZATION SUBJECTS (ANY ONE OF THE FOLLOWING): MP 104 (I) : RIEMANNIAN GEOMETRY AND COSMOLOGY MP 104 (II): GENERATING FUNCTIONS	3	100 (80+20)	55
	Ph.D. 105	COMPREHENSIVE VIVA-VOCE	3	100	55
		TOTAL CREDITS	**16**		

MATHEMATICS
Ph. D. 101 : RESEARCH METHODOLOGY

Time: 03 Hours   **Theory Paper : Max. Marks-80**
Internal Assessment   : Max. Marks-20
Minimum Pass Marks-55

The paper setter is required to set in all **Eight questions**, out of which only **four** questions are to be attempted by the students. All questions will be of equal marks. Two questions are to be set from each unit. The students are required to attempt at least one question from each unit.

Unit-I: Introduction to research methodology: Meaning, Objectives and Types of research, Motivation in research, Research approaches, Research methods verses methodology, Significance of research, Criteria of good research, Research design.

Unit-II: Tensors and their transformation laws. Symmetric and skew-symmetric tensors. Contraction, Metric tensor. Definition and examples of differentiable manifolds.

Vector fields, Lie bracket, Connections, Covariant derivative, Curvature tensor, Bianchi's identities.

Unit-III: Definition and examples of fixed point and common fixed point, Contraction mapping, Contractive mapping, Non-Expansive mapping, Lipschitz mapping, Relation between these mappings and continuous mapping, Banach contraction principle and its generalizations, Fixed point theorem of Brouwer and Schaunder, Fixed point theorem for multi-functions.

Unit-IV: Hypergeometric Function: Function F(a, b; c; z), Evaluation of F(a, b; c; 1), Contigous function relations, Elementary Series Manipulations, Generalized hypergeometric functions, Definition and elementary properties of the H-function of one and two variables.

Text Books:

1. C.R. Kothari, Research Methodology, New Age International publishers (2004).
2. Catherine Dawson, Practice Research Methods, UBS Publishers Distributors, New Delhi (2002).
3. Ranjit Kumar, Research Methodology – A step by step Guide for Beginners (2nd Ed.), Singapore Pearson Education (2005).
4. B.B.Sinha, An Introduction to Differential Geometry, Kalyani Publishers, New Delhi, 1982.
5. R.S. Mishra, A Course in Tensors with Applications to Riemannian Geometry, Pothishala Pvt. Ltd., Allahabad India, 1985.
6. U.C. De and A.A.Shaikh, Differential Geometry of Manifolds, Narosa Publishing House Pvt. Ltd., 2007.
7. E.D.Rainville, Special Functions, Chelsea Publ. Co., Bronx, New York (1971).
8. H.M.Shrivastava, K.C.Gupta and S.P.Goyal, The H-function of One and Two Variables with Applications, South Asian Publishers, New Delhi.
9. Sankatha Singh, Bruce Watson and Pramila Shrivastava, Fixed point theory and best approximation, The KKM-Map Principle, Kluwer Academic Publishers, Londan.

<u>**Ph.D. MATHEMATICS**</u>
Ph.D. 103 : COMPUTER APPLICATIONS

Time: 03 Hours   **Theory Paper : Max. Marks-80**
Internal Assessment   : Max. Marks-20
Minimum Pass Marks-55

The paper setter is required to set in all **Eight questions**, out of which only **four** questions are to be attempted by the students. All questions will be of equal marks. Two questions are to be set from each unit. The students are required to attempt at least one question from each unit.

Unit-I: Typesetting Mathematical Text with LATEX: Sample Document, Type style, Environments, Lists, Centering, Tables, Verbatim, Vertical and Horizontal Spacing, Equation Environments, Fonts, Hats and Underlining, Braces, Arrays and Matrices, Customized Commands, Theorem–like Environments, Math Styles.

Unit-II: Document classes and the overall structure, Titles for Documents, Sectioning Commands, Packages, Inputting Files, Inputting Pictures, Making a Bibliography, Making an Index, Slides.

Unit-III: MATLAB: Basics of MATLAB, MATLAB Window, Input-Output, File types, Working with arrays of numbers, Creating and Printing Simple Plots, Creating, Saving and Executing a Script file, Creating and Executing a function file, Matrices and Vectors: Input, Indexing, Matrix manipulation, Creating Vectors, Matrix and Array operations, Saving and Loading Data, Plotting Simple Graphs.

Unit- IV: Introduction to Internet- Internet evaluation and concept, Internet vs Intranet, Internet service provider (ISP) and its functions, Connectivity- Dialup, Leased line, VSAT, URLs, Portals, Internet Services, Applications. Email- Basics of sending and receiving, Internet chatting- Voice chat, Text chat, World Wide Web (www)- Web browsers and its functions, Searching the web, HTTP, URLs, Web services, Web Protocols, Network layers and TCP/IP protocols. Advantages and disadvantages of Internet and world wide web.

Text Books:

1. David F. Griffiths, Desmond J. Higham, Learning LATEX. Society for Industrial and Applied Mathematics, Philadelphia (1997).
2. Laslie Lamtort, LATEX, Addison Wesley publication company (1994).
3. Amos Gilat, MATLAB-An Introduction with Applications, John Wiley & Sons, Inc. 2010.
4. Rudra Pratap, Getting Started with MATLAB, Oxford University Press, 2002.
5. V.K.Jain, Internet and Web Page Designing, B.P.B. Publications.

Ph.D. MATHEMATICS
Ph. D. 104 (I) : RIEMANNIAN GEOMETRY AND COSMOLOGY

Time: 03 Hours　　　　　　　　　　　　　　　　　**Theory Paper : Max. Marks-80**
Internal Assessment　: Max. Marks-20
Minimum Pass Marks-55

The paper setter is required to set in all **Eight questions**, out of which only **four** questions are to be attempted by the students. All questions will be of equal marks. Two questions are to be set from each unit. The students are required to attempt at least one question from each unit.

Unit-I　　　Lie Derivative in Riemannian Space: Motion, Killing Vector Field, Properties of Killing Vector Field, Lie Derivative of Christoffel Symbols, Affine Motion, Lie Derivative of Scalar, Covariant Vector and Contravariant Vector, Commutation Formula, Conformal Motion, Collineation, Conformal Collineation.

Unit-II　　　Almost complex manifolds, Nijenhuis tensor, Contravariant and covariant almost analytic vectors, Almost Hermite manifold, Almost analytic vector fields, Curvature tensor, Kahler manifolds, Holomorphic sectional curvature.

Unit-III　　　Principle of equivalence and Principle of general covariance, Energy- momentum tensor, Energy-momentum tensor for perfect fluid, Newtonian approximation of equations motion, Derivation of Einstein's field equations, Poisson equation as approximation of field equations.

Unit-IV　　　Static cosmological models, Einstein Universe, deSetter universe, Their physical and geometrical properties.

Books Recommended:

[1] B.B.Sinha, An Introduction to Differential Geometry, Kalyani Publishers, New Delhi, 1982.

[2] R.S. Mishra, A Course in Tensors with Applications to Riemannian Geometry, Pothishala Pvt. Ltd., Allahabad India, 1985.

[3] U.C. De and A.A.Shaikh, Differential Geometry of Manifolds, Narosa Publishing House Pvt. Ltd., 2007.

[4] S.R. Roy and Raj Bali, Theory of Relativity, Jaipurindia Publishing House.

[5] J.V. Narlikar, Lectures on General Relativity and Cosmology, Mac Millan Co.India.

Ph.D. MATHEMATICS
Ph. D. 104 (II): GENERATING FUNCTIONS

Time: 03 Hours

Theory Paper : Max. Marks-80
Internal Assessment   : Max. Marks-20
Minimum Pass Marks-55

The paper setter is required to set in all **Eight questions**, out of which only **four** questions are to be attempted by the students. All questions will be of equal marks. Two questions are to be set from each unit. The students are required to attempt at least one question from each unit.

UNIT-I

Series Rearrangement Technique:

Some useful Lemmas, Description of the series rearrangement technique, Applications to Jacobi Polynomials (Linear Generating Functions, Extended linear generating functions).

UNIT-II

Decomposition Technique:

Bilinear Generating functions, Trilinear Generating functions, Bilateral Generating functions, Generating functions for Gegenbauer (or Ultraspherical) polynomials, Generating functions for Jacobi Polynomials, Generating functions for Laguerre Polynomials.

UNIT-III

Operational Techniques:

Preliminaries on the Laplace and Inverse Laplace Transforms, Linear, Bilinear and Bilateral Generating functions, Use of Differential operators.

UNIT-IV

Fractional Derivative Technique:

Brief Historical Survey, Application to Hypergeometric functions, Linear Generating functions, Bilinear Generating Functions.

Book Recommended:

1. **A Treatise on Generating Functions**, H. M. Srivastava and H. L. Manocha, Ellis Horwood Ltd. Publishers, 1984.