FACULTY OF SCIENCES

SYLLABUS

FOR

Pre Ph.D. Course in MATHEMATICS

(Credit Based Evaluation & Grading System)

Examinations: 2019-20

GURU NANAK DEV UNIVERSITY
AMRITSAR

PRE PH.D COURSE IN MATHEMATICS (CBE & GS)

Scheme

Course No.	**Course No.**	**L**	**T**	**P**	**Total Credits**
MTL 901	Research Methodology	**2**	**0**	**1**	**3**
MTL 902	Topics in Analysis	**3**	**0**	**0**	**3**
MTL 903	MATLAB Programming and Simulations	**2**	**0**	**1**	**3**
MTL 904	Methods in Operations Research	**3**	**0**	**0**	**3**
MTL 905	Seminar	**0**	**0**	**1**	**1**
	Interdisciplinary Courses				**4**

PRE PH.D COURSE IN MATHEMATICS (CBE & GS)

MTL 901 : Research Methodology

L-T-P
2-0-1

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section - A

Review of Literature: An elementary or a fundamental book along with some research papers of the concerned research field will be provided to each student by his/her Ph.D. supervisor. The same may be treated as course contents.

Section - B

Mathematica Software: Getting started with Mathematica, Numerical capabilities, Symbolic capabilities, Plotting functions, Visualizing Data, Data manipulation and analysis,

Section - C

Writing your own programs, Rule based programming, Functional programming, Procedural programming, Writing interactive programs.

Section - D

Practical: Based on the Mathematica software.

Text Book:

1. Blachman, N. and Williams, C.P. “Mathematica: A Practical Approach, 2nd Edition”, 1999, Printice Hall. (Chapters 1 to 5 and 17.)

Reference Books:

1. Bahder, T.B. “Mathematica for Scientists and Engineers”, 1995, Addison Wesley Publishing Company.
2. Wolfram, S. “The Mathematica, 3rd Edition”, 1996, Cambridge University Press.
3. Abell, M.L., Braselton, J.P., and Rafter, J.A. “Statistics with Mathematica”, 1999, Academic Press.
4. Glynn, J. and Gray, T. “The Beginner’s Guide to Mathematica”, 2000, Cambridge University Press.
5. Wagon, S. “Mathematica in Action, 2ND Edition”, 1999, Springer Telos.

PRE PH.D COURSE IN MATHEMATICS (CBE & GS)

MTL 902 :Topics in Analysis

L-T-P
3-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section - A

Real valued convex function on normed spaces, Bilinear forms, Lax Milligram Lemma, Riesz Representation theorem, Differentiation and Integration in normed spaces, Gateaux derivative, Frechet derivative, sub differential, Integration.

Section - B

Fixed Point Theorems: Brouwer's and Schauder's fixed point theorems (Statements only). Application of Banach Contraction Principle to matrix equation, Differential equation and Integral equation.

Section - C

Fourier Series: Trigonometric series and system, Fourier co-efficients, Fejer's theorem (without proof), orthogonality, Generalized Fourier series, Bessel's inequality, Completeness.

Section - D

Fourier Transform: Definition and properties, convolution, Fourier inversion, Plancherel's formula, Dilation, Translation and Modulation.

Books Recommended:

1. A.H. Siddiqi: Functional Analysis with Application, Tata Mcgraw Hill, 5th Reprint 1994 relevant portion of Chap: 1,2,5,7.
2. D.F. Walnut: An Introduction to Wavelet Analysis, Birkhauser 2001. Chap. 2 (2.1, 2.3),
3. Chap.3 (3.1-3.6, 3.8)
4. Water Rudin: Real and Complex Analysis, 2nd Edition, Tata Mcgraw-Hill.
5. Chap. 9 (9.1-9.14)

PRE PH.D COURSE IN MATHEMATICS (CBE & GS)

MTL 903 : MATLAB Programming and Simulations

L-T-P
2-0-1
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section - A

MATLAB Programming: Basic constructs of MATLAB Programming, Built-in functions, User defined functions, Working with scripts and functions.

Section - B

Graphics-interface, Movies of graphs, Applications, Simulation and the Monte-Carlo method, Uniform pseudo-random number generation and random variate generation.

Section - C

Generating random variate from standard statistical distributions (discrete and continuous distributions), Monte-Carlo integration and variance reduction techniques.

Section - D

Practicals: Practical use of MATLAB programming for simulations

References

1. B.R. Hunt, R.L. Lipsman, and J.M. Rosenberg “A guide to MATLAB”, Cambridge University Press, 2001.
2. J.H. Mathews and K.D. Fink “Numerical Methods using MATLAB”, Prentice Hall, N.J. 1999.
3. R.Y. Rubinstein, “Simulation and the Monte Carlo Method”, John Wiley, 1981.
4. J.R. Thompson, “Simulation: A Modeler’s Approach”, John Wiley, 2000.

PRE PH.D COURSE IN MATHEMATICS (CBE & GS)

MTL 904 : Methods in Operations Research

L-T-P
3-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section - A

Introduction to Stochastic process, specification of stochastic process, Bernoulli process, Renewal Process. Markov process with discrete state space, Poisson process and its extension and generalization, birth-death process.

Section - A

Markov process with continuous state space, Description of communication system, Axioms for uncertainty measures, Measure of Information, Properties of uncertainty function,

Section - C

Entropy in two dimensional scheme, joint and conditional uncertainties, Interpretation of uncertainty function.

Section - D

The problem of unique decipherability, conditions for instantaneous and uniquely decipherable codes, noiseless coding theorem, channel capacity, efficiency and redundancy, Shannon-Fano encoding procedure.

Books Recommended:

1. Medhi, J.: Stochastic Process
2. Gross, D. and Harris, C.M.: Fundamentals of Queuing Theory
3. Trivedi, K. S.: Probability and Statistics with Reliability, Queuing and Computer Science Applications.
4. Ash, R.: Information Theory, Inderscience Publishers, NY, 1965.
5. Reza, F.M.: An Introduction to Information Theory, Mc Graw Hill Book Co. Inc, 1961.
6. Aczal, J. and Daroczy, Z. On Measures of Information and their Characterizations, Academic Press NY, 1975.