VEER KUNWAR SINGH UNIVERSITY ARA

Draft Regulations and Syllabus

For

Ph.D. Course Work

In

Mathematics (Faculty of Science)

(2019-2020)

Approved by Academic Council, VKS University, Ara (Bihar)-802301.

Duration of Course Work: One Semester (6 Months).

Total Marks: 200 (Two papers 100 marks each).

Paper I: Compulsory Units: 100 Marks

Research Methodology and basics of statistical analysis **Group-A**, which consists (5X16 =80 marks) related to research methodology and is further, subdivided into five units. Each unit two questions will be asked and students have to answer only one question from each unit. **Group-B** consist Computer Basics of (10X2 = 20 marks). Four questions will be asked in this section and student will have to answer only two questions.

Paper II: 100 marks

Paper II is divided into two groups namely **Group-A**, which consists (4X15= 60 marks) related to deep area of mathematics subjects and is further subdivided into four units. Each unit two questions will be asked and students have to answer only one question from each unit. **Group-B** based on department observation, which also consist 40 marks and is further subdivided into three groups.

1. Group -(i)-20 marks: The candidate will have to write one research paper or assignment in about 2000 to 3000 words concerning to his subject or area of interest.

2. Group-(ii)-10 marks: The candidate will have to give a power point presentation at the department related to his topic or subject.

3. Group-(iii)-10 marks: The candidate will have to appear in the viva-voce examination at the department.

Examination will be held at the end of the Semester.

The candidate will have to clear all the paper with appropriate passing marks (55 percent or equivalent grade), then they will be eligible for the submission of their research proposal or synopsis in the meeting of the PGRC (Post Graduate Research Council).

Syllabus of Paper-I (RESEARCH METHODOLOGY)

Group-A   (16x5=80 marks)

Unit 1:

Introduction: Definition of Research, Qualities of Researcher, Components of Research Problem, Research methods and research methodology, Various Steps in Scientific Research: Hypotheses, Research Purposes, Research Design, Literature searching.

Unit 2:

Design and planning of mathematical problems formulation, Choice of methods, Aims and Objectives, Expected outcome, Methodology to be adapted, planning of experiments for achieving the aims and objectives, Importance of reproducibility of research work.

Unit 3:

Programming language(s) - C, C++ (some basic idea of any one among these two programming languages. Use of mathematical software such as matlab, mathematica and math type etc for research in mathematics and related areas.

Unit 4:

Paper and Report writing: Basic concept of paper/ thesis writing and report generation, writing research abstract, introduction, review of published research papers, Result & Discussion, conclusion, concepts of Bibliography and References, significance of report writing, steps of report writing, types of research reports, skill of scientific presentations. Research Ethics.

Unit 5:

Statistical Methods: Sources of Data: Primary Data, Secondary Data. Methods of data collection: Experimental data, field data, data from other sources. Statistical average, standard derivation and variance, Binomial, Poisson , Gaussian Distributions, Data acquisition system, error propagation, curve fitting, Least square method, Correlation and Regression Analysis.

Group-B (1 unit)   (10x2= 20marks)

Introduction to operating systems, windows, MS office, power point, word, excel, virus and protection. Acquaintance with www, IP, email, application programs, Tips on PC maintenance, basic setup of printer, scanner and other peripherals. Video conferencing tools.

How can computational ability be useful in research (using a programming language) data representation and conversion between various number systems.

References:

1. Balaguruswamy, E.: Object oriented programming with C++, Tata McGraw Hill publication.

2. Chochran, W. G. (2012): Sampling techniques, third edition, wiley publication.

3. Das, N. G. (2009): Statistical methods, Vol I & II, Tata McGraw Hill publication.

4. Gupta, S. C. and Kapoor, V. K. (2002): Fundamentals of mathematical statistics, Sultan chand & sons publication.

5. Kanetkar, Y. (2016): Let us C, fifteen edition, BPB publication.

6. Kothari, C. R. (2004): Research methodology methods& techniques, New age international publication.

7. Mishra, S. B and Alok, S. (2011): Handbook of research methodology, Educreation publication.

8. Rajaraman, V. (2005): Computer programming in C, Prentice –Hall publication.

9. Ravichandran, J. (2010): Probability and statistics for engineers, Wiley publicatio

Syllabus of Paper –II Group: A   (4x15=60 marks)

Unit 1: Topology

Definition and examples of topological spaces, closed sets, dense subsets, neighbourhood, interior, boundary and accumulation points. Derived sets, Bases and subbases. Subspace and relative topology.

Continuous functions and homomorphism, characterization of continuity in terms of open sets, closed sets and closure, first and countable topological spaces, Lindelof's theorem, separable spaces, second countability and separabilty.

Separation axioms T_0, T_1 and T_2 spaces and their basic properties, compactness, continuous function and compact sets, basic properties of compactness and intersection properties.

Connectedness, continuous function and connected sets characterization of connectedness in terms of a discrete two point space, connectedness on real line.

Regular and Normal spaces T_3 and T_4 spaces, characterization and basic properties, urysohn's lemma and Tietze extension theorems.

Unit 2: Numerical analysis

Definition and sources of errors, Propagation of errors, Numerical Solution of algebraic equations, Method of Iteration and Newton – Raphson method, Rate of Convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss Seidel Methods. Finite differences, Lagrange, Hermite and Spline Interpolation. Numerical differentiation and Integration, Numerical Solution of ODEs using Picard, Euler, modified Euler and Runge – Kutta methods. Solution of tridiagonal system, Complex root of non-linear equation, solution of simultaneous non-linear equations, Numerical evaluation of double and triple integrals with constant and variable limits and its application, Solution of integral equations, Solution of initial-value problem by single and multistep methods, Solution of linear and non-linear boundary-value problems, Solution of Characteristics value problems, Solution of Laplace and Poisson equations in two

variables by five point formula, Solution of Laplace equation in two variables by ADI method, Solution of mixed boundary value problem.

Unit 3: Operations research

Simplex methods for unrestricted variables, Two-Phase method, Dual simplex method, parametric Linear Programming, upper Bound technique, Interior point algorithm, Linear Goal Programming.

Integer programming, Branch and bound technique, Gomory's algorithm.

One and multi-variable unconstrained optimization, Kuhn-Tucker condition for constrained optimization, Wolfe's and Beal's methods.

Game theory, Two-person zero sum games with mixed strategies, Graphical solution by expressing as a linear programming problem.

Inventory theory, Different costs of inventory model, Deterministic Economic lot size model, EOQ with uniform demand and several productions of unequal length/production runs of equal length EOQ models-Shortages not allowed, Shortages allowed.

Unit 4: Abstract Algebra

Introduction to Group, Elementary properties of Group, Finite Group and subgroup. Cyclic Group, Permutation Group, Properties of Permutations, Rings, Integral Domain, Characteristic of Rings.

Homomorphism: Group actions, Sylow theorems, Normal and subnormal series, composition series of a group, Jordon-Holder theorem, Solvable groups, commutator subgroup of a group, Nilpotent groups.

Ring homomorphism, Isomorphism, Quotient rings, Ideals, Kernel of ring homomorphism, principal ideal ring and domain, Prime and maximal ideal, Euclidean domain.

Extension fields, algebraic and transcendental extension, splitting field of Polynomial, Separable and inseparable extension, normal extension, constructible real numbers.

6

Cyclic Module, simple Modules, semi-simple Modules, Schur's Leema, Free Modules.

Solutions of equations by radicals, insolvability of equations of degree 5 by radicals.

References:

1. Artin, M. : Algebra.

2. Datta, N. and Jana, R. (2014): Introductory numerical analysis, seventh edition, Shreedhar prakashani.

3. Futton: Algebraic topology first course.

4. Gallian, J. A. (2019): Contemporary abstract algebra, Cengage learning India private limited.

5. Grewal, B. S. and Grewal, J. S. (2010): Numerical methods in engineering and science with programs, nineth edition, Khanna publishers.

6. Gupta, P. K. and Hira, D. S. (2009): Problems in operations research, S. chand and company publication.

7. Herstein, I. N. : Topics in Algebra.

8. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. (2012): Numerical methods for scientific and engineering computation, sixth edition, New age international publications.

9. Jha, K. K. : Functional analysis, advanced general topology.

10. Kalavathy, S. (2013): Operations research, fourth edition, Vikas publishing house private limited.

11. Simmons, G. F.: Introduction to topology and modern analysis.

12. Swarup, K., Gupta, P. K. and Mohan, M. (2010): operations research, fifteen edition, sultan chand & sons publication.