C.S.J.M. UNIVERSITY, KANPUR

Syllabus for Pre-Ph.D. Course Work

MATHEMATICS

1. Each paper will carry 100 marks: 70 marks for theory paper and 30 for internal assessment. The internal assessment in Paper I will be based on Mid sem. Test, and Practical work/library work/written assignments/presentations/own paper presentation (published in any reputed journal bearing ISSN Number).

2. The internal assessment in Paper II will be based on Mid sem. Test, and seminar presentation and report writing consisting of about 5000 words on any subject of the student’s choice dealing with the field of research in the subject of Research.

3. 5 Marks in internal assessment in both Paper I and Paper II will be assigned to attendance where 75% to 80% only 1 mark, 80% to 85% only 3 marks and above 85% 5 marks.

4. During the entire Course at least one paper published in any reputed journal bearing ISSN Number by the student is desirable and it will be the part of internal assessment.

5. The candidate will have to obtain at least 50% marks in theory as well as internal assessment in order to qualify the course.

6. 75% attendance will be compulsory in theory/practical classes.

7. The marks distribution of internal assessment (30 marks) will be: 5 marks for attendance, 15 marks for mid sem. Test and 5 marks each for two written assignments (Research-1, Computer Application-1)
Detailed Syllabus

Paper I: Research Methodology (Objectives, Hypothesis, Report writing, and Thesis writing), Quantitative methods, Computer Applications, Research ethics and reviewing of published research in the relevant field and other techniques/methods, specific for the broad subject/area:

1. Foundation of Research
   What is Research? Objectives of Research, Scientific Research, Research and Theory, Conceptual and Theoretical Models, Importance of research methodology in scientific research

2. Types and Methods of Research
   Classification of Research, Pure and applied Research, Exploring or Formulative Research, Descriptive Research, Diagnostic Research/Study, Evaluation of Research/Studies, Action Research, Experimental Research.

3. Literature Survey and Problem Definition
   Need for Reviewing Literature, what to review and for what purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking, Libraries and Documentation.

4. Planning of Research
   Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis formation, Measurements, Research Design/Plan.

5. Sampling
   Sampling Methods, Choice of sampling methods, Sample size, Sampling and Non-Sampling errors, Estimation of Population Proportion and Population Mean, Estimation of Standard Error and Confidence Interval.

6. Methods of Data Collection
   Meaning and Importance of Data, Design of Experiments, Experimentation, Sources of Data, Methods of Collecting Primary Data, Observation Methods, Experimentation, Design of Experiments, Simulation.

7. Processing of Data
   Editing, Classification and Coding, Transcription, Tabulation, and Graphical Representation, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Introduction to Statistical Software: MINITAB.

8. Statistical Analysis of Data
   Statistical Analysis, Measures of Central Tendency, Measures of Dispersion, Measures of Association/Relationship, Probability distributions: Binomial, Poisson, Uniform, Normal and Exponential, Hypothesis Testing, Confidence Interval, Test of Significance, Comparison of Two Proportions, Comparison of Means (z test, t test, two sample t test, paired-t test), ANOVA, Non-parametric Methods.

9. Report Writing

10. Fundamentals of Computer

11. Word Processing
    Introduction to word processing, MS-Word, creation of files in folders, Save Documents as files, Print, Formatting, Insert Page Layout, Reference (citation and bibliography), Review (comments, tracking compare), Converting to PDF, Writing Scientific Documents with latex, Graphics and visualization, Gnu plot, Introduction to other useful software tools e.g. Mathematics and Mat lab etc.
12. Spreadsheet Tools
Introduction to spreadsheet application, Features and functions, Data storing, features for statistical mathematical data analysis, generating chart/graphs and other features, Tools used may be Microsoft Excel, Open Office or Similar tool, Mathematical Computing.

13. Presentation Tool
Introduction to presentation tool, Features and function, creating presentation, Customizing presentation, showing presentation, Tools used may be Microsoft Power Point, Open Office or Similar tools.

14. Web Search
Introduction to internet, Use of internet and search engine like Google, Yahoo etc., Use of internet in Research activities, Submission of paper in Archive Electronic Mail System, Cyber law, working knowledge of Math SciNet, JSTOR, Sodhganga, EBSCOhost and other online journals.

Books/References:

List of Experiments & Assignments:
1. To write a short note on evaluation of Windows Operating system.
2. To prepare a list of different system and application software with their uses.
3. To prepare a word document of the Ph.D. synopsis with proper formatting.
4. To prepare a word document of 20 references related to your Research work in a standard format.
5. To prepare a worksheet to calculate the salary of employees of your department using MS-Excel.
6. To prepare a chart of any organization to present the production with respect to time using MS-Excel (based on assumed data)
7. To prepare a Power Point presentation of Ph.D. synopsis having Animation, Graphics, Sound etc.
8. To write a short note on the importance of e-journals in research work using internet.
9. To prepare a list of 10 popular websites imparting education with their uses.
Paper II: Advance level theory and Research Methods

Unit 1
1. Real Analysis.
Cardinal numbers and their arithmetic, Schroeder-Bernstein theorem, Cantor's theorem and the continuum hypothesis, Poset, Axiom of choice, Zorn's lemma, well ordering theorem.

2. Complex Analysis.
Riemann mapping theorem, Univalent functions, Area theorem, Bieberbach theorem, Koebe's 1/4-theorem, Distortion theorems, Convex and starlike functions, Coefficient estimates.

Unit 2

Unit 3
1. Algebra.
Canonical forms, triangular form, Nilpotent transformations, Jordan canonical form, Rational canonical form, Unitary and normal operators, Forms on inner product spaces, Positive form.
2. Special Functions.
Generalised hypergeometric functions and their convergence, Elliptic and theta functions.

Unit 4
Choose any two of the following four topics
3. Operations Research. Linear programming, Inventory control and related models, Queing theory, Network analysis, CPM and PERT models.

Reference Books:
Unit-1: (1) H.L. Royden : Real Analysis
(2) R.R. Gold Berg : Methods of real Analysis, new age international.
Unit-2: (1) K.D. Joshi : Introduction to General Topology, Wiley Eastern Ltd.
(3) E.W. Cheney, Jain Iyenger Jain : Introduction to Numerical Analysis.
(4) S.S. Shastri : Numerical Analysis.
Unit-3: (1) Vivek Sehai & Vikas Bisht : Linear Analysis, Narota
(2) I.N. Harstein : Topics in Algebra.
(3) Hoffman & Kunge : Linear Algebra.
(5) M.A. Pathan, V.B.L. Chaurasia, P.K. Bannerji & M.C. Goyal : Special Functions and calculus of variations, Ramesh Book Depot, New Delhi.

(5) Jacob Bear : Dynamics of Fluids in Porous media, Springer.
(8) Uday Singh Rajput : Advance Discrete Mathematics, P.H.I.
(9) Kenneth H. Rosen : Discrete Mathematics & Its Applications,