Doctor of Philosophy (Ph.D.)
COURSE WORK SYLLABUS

FACULTY OF MATHEMATICAL SCEINCES (COMPUTER SCIENCE)

Implemented from June, 2017 onwards

**Roorkee-Dehradun Road, Village Karoundi
Post Bhagwanpur, Tehsil Roorkee
District Haridwar, Uttarakhand**

PAPER I- Research Methodology and Computer Applications

Section I: Research Methodology   **Max. Marks: 100**
                              ((60 hrs) 6 Credits) (70 External+30 Internal)

Objective:

- To enable to student to understand and work methods and concepts related Research.
- To enable the student to develop research proposal and to work with research problem.
- To develop broad comprehension of research area.

UNIT –I : Concept of Research   **10 hrs (20 Marks)**
Meaning, Concept, nature steps types and characteristics of research., Types and approaches , Ethics in Research and Plagiarism, Scientific Inquiry, Philosophical and Sociological foundations of research, Interdisciplinary approach and its implications in various research area.

Unit II: Types and Methods of Research   **10 hrs (20 Marks)**
Qualitative and quantitative methods of research like Descriptive, Historical, Case study, Ethnography, Ex-post facto, documentary and content analysis, survey field and laboratory experimental studies. Characteristics of methods and their implications in research area.

Unit III: Development of research proposals   **10 hrs (20 Marks)**
Research proposal and its elements, Formulation of research problem-criteria of sources and definition, Development of objectives and characteristics of objectives, Development of hypothesis and applications.
Writing a Research Paper, Choosing a Topic, Preparing a Working Bibliography, Outlining and need to write a Research Paper

Unit IV: Methods of data collection & data analysis   **10 hrs (20 Marks)**

Concept of sampling and other concepts related to sampling. Probability and non-probability samples, their characteristics and implications. Tools of data collections, their types, attributes and uses. Redesigning, research tools-like questionnaire, observation, interviews, scales and tests etc.
Analysis of qualitative data based on various tools. Analysis of quantitative data and it presentation with tables, graphs etc. Statistical tools and techniques of data analysis-measures of central tendency, dispersion. Decision making with hypothesis testing through parametric and non-parametric tests.
Validity and delimitations of research findings.

Section II: Computer Applications

Unit V: **20 hrs (20 Marks)**
Basic Knowledge of Computer, Use of Internet for Research Purpose: E-mail, WWW, Web browsing, acquiring technical skills, drawing inferences from data, Use of technology and other equipment in Research, Research publishing tool-MS Word, Adobe acrobat, Graphics tool-MS Excel, Presentation tool-MS Power, Data Analysis Software and Analysis Techniques point. Application of Internet in research : INFLIBNET, Use of Internet, sights (DOAJ), Use of E Journals, Use of E library, use of EBSCO HOST online database of Academic Libraries.

References:

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- Kaul Lokesh (1984) – Methodology of Educational Research, Vikas Publishing House Pvt. Ltd., New Delhi.
- Sukhiya, S. P. : Melhotra P.V., Elements of Educational Research, New Delhi, Allied Publishers.
- Tuckman, B.W. (1972) – Conducting Educational Research, Harcourt Brace, Javanovich.
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- Lindquist, E.F. (1960) – Elementary Statistical Methods in Psychology and Education, Oxford Book Company, New Delhi.
- Sharma, A.R. (1984) Fundamentals of Educational Research, Loyal Book Depot, Meerut.
- Sanders, D.H., Computer Today, NY: McGraw Hill, 1981
- Sinha, P.K., Computer Fundamentals, New Delhi: BPB Publications, 1992
- Cox, J. And Urban, P. "Quick Course in Microsoft Office. Galgotia Publications, New Delhi, 1990.
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- Rajaraman, V., "Fundamental of Computers", Prentice Hall of India, New Delhi, 1996.
- Saxena, S., "A First Coursein Computers", Vikas Publishing House Pvt. Ltd., New Delhi, 1998.

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COURSE WORK SYLLABUS
CORE PAPER –II

COMPUTER SCIENCE

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Total Hours 60 (6 Credits)   **Max. Marks 100**

Unit – I

Digital Logic: Number system, Information representation, Computer arithmetic on fixed & floating point numbers, Boolean algebra, Combinational circuits, sequential circuits, Memory system, Processor organization, Input-output organization, pipe-line processing, static & dynamic interconnection networks.

Programming Languages: Paradigms, Data types, operations, Expressions, Control structures, I/O statements, Parameter parsing techniques. Language constructs for object-oriented, functional, logic & concurrent programming, Chomsky hierarchy of formal languages, finite automata & pushdown automata.

Optimization & Simulation Tools: Linear Programming: LPP in the standard form, canonical forms, conversion in standard form, Simplex prevention of cyclic computations in Simplex & Tableau, Big-M method, Dual Simplex & revised simplex.

Simulation: Analog vs. Digital simulation, Continuous & discrete system simulation, Simulation of Hypothetical Computer, Inventory system & Corporate system, simulation of PERT, Generation of uniform & Non- uniform random number, Monte Carlo method, Design of experiment, simulation languages.

Unit – II

Software Engineering: Development models, Metrics, Software Project Management, Analysis, Design: System design, detailed design, function-oriented, Object-oriented analysis & design, user interface design, Coding & Testing, Software quality & reliability, Object Modeling Technique (OMT) methodology.

Computer Graphics: Components of an Interactive Graphics system, Display systems, Input/output & storage devices, 2D geometry, Graphic operations, 3D Graphics, Animation, Graphic standards, Application Concepts, Projections and Hidden surface elimination.

Computer Networks: Fundamentals, Reference Models, Data Communication, Internetworking: Components and issues; Media access controls, virtual circuits & datagrams, Routing algorithm, Congestion control, Network Security, Firewalls, Internet architecture and protocols.

Unit – III

Data Base: Basic concepts, Characteristics of Database approach, Three-schema Architecture and Data Independence, Data Models, E-R Model, Relational Data Model, SQL Programming Techniques, Relational Database Design, Functional Dependencies, Normalization, Query Processing and Optimization, Transaction Processing Concepts, Concurrency Control Techniques and Recovery Techniques

 Enhanced Data Models for Advanced Applications, Distributed Database and Client-Server Architectures. Overview of Data Warehousing and OLAP, Data Mining Concepts. Emerging Database Technologies and Applications.

Data Structure: Arrays, String, Linked Lists - Singly, doubly & Circular List; Stacks, Queues, Priority Queues: Representation & Manipulation; Trees: Binary & Threaded Trees, traversal, Binary Search Tree, Huffman & AVL Trees, B Trees; Graphs: Adjacency Matrix, Path Matrix, Linked Representation, traversal; Searching & Sorting techniques..

Unit – IV

Operating System: Functions, Multiprogramming, Multiprocessing & Multitasking, Memory Management, Virtual memory, Paging, Fragmentation. Concurrent Processing: Mutual exclusion, Critical regions, lock & unlock. Scheduling: CPU scheduling, I/O scheduling, Deadlock: avoidance & prevention; UNIX: Structure & commands of UNIX, Interfacing with UNIX, Editors & Compliers for UNIX, LEX & YACC, File system, System calls, Filters, Shell Programming.

System Programming: Assembly language fundamentals, Assemblers - 2 pass & single pass, Macros & Macro processors. Loading, Linking, relocation, program relocatability, linkage editing, Text editors, Programming Environments, Debuggers & program generation. Compilation & interpretation, Bootstrap complier, Phase of compilation - lexical & syntax analysis, storage allocation, code optimization & generation.