XXV Approved by Academic Council in Its 8th Meeting held on 14 Nov, 2017, has approved vide resolution No. -16 Annexure-XXV

Chaudhary Ranbir Singh University, Jind
Department of Computer Science and Applications

Scheme and Course Structure of Course Work for Ph.D. (Computer Science) 2017-18

Compulsory Paper

Sr. No.	Paper Code	Title of Paper	External Marks	Minimum Passing Marks	Internal Marks	Minimum Passing Marks	Total Marks	Minimum Passing Marks
1	Ph.D-1	Research Methodology	80	44	20	11	100	55

Elective Papers (Attempt any two)

Sr. No.	Paper Code	Title of Paper	External Marks	Minimum Passing Marks	Internal Marks	Minimum Passing Marks	Total Marks	Minimum Passing Marks
1	Ph.D-2	Advances in Database	80	44	20	11	100	55
2	Ph.D-3	Data Analytics	80	44	20	11	100	55
3	Ph.D-4	Cloud Computing	80	44	20	11	100	55

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Research Methodology

Paper Code: Ph.D- I **External : 80, Internal : 20**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Objectives: The objective of this course is to provide insights about various research methodologies and their terminologies along with some research tools in computer science. It focuses on learning about various tool and approaches to carry out the research and presentation of research also.

Learning Outcomes: At the end of this course students should be able to:

- Start a carrier in research.
- Can decide about various tools which will help them in research for analysis, ethics, presentation and writing of research.

Unit-I

Research: Meaning, scope, limitation, nature (fundamental, applied and action).Scientific Inquiry: Concept, assumptions and their role. Paradigm: Meaning, positivist and non-positivist paradigms. Problem Identification & Formulation: Research question, hypothesis. Types of Research Design: Exploratory, Descriptive, Experimental; Qualitative and Quantitative Research, Independent & Dependent variables. Measurement: Causality, generalization, replication. Sources of Research data: Primary and secondary sources.

Unit-II

Population & Sampling techniques: Concept, types (random, purposive, probability and non-probability). Technical Writing: Layout of a Research Paper, Impact factor of Journals, Plagiarism and Self-Plagiarism. Formatting: Citations, bibliography, references. Writing research paper: Evaluating and reviewing research reports and papers. Thesis Writing: Introduction, review of literature, results, abstract, summary and synopsis, Reference citing and listing. Tools and techniques of data collection for qualitative and quantitative research - observation, interview, questionnaire, rating scale, inventory, check list, content analysis.

Unit-III

Probability : Probability Rules, Probability Under Conditions of Statistical Independence and Statistical Dependence, Baye's Theorem, Random Variables, Types of Random Variables, Expected Value, Moment Generating Functions, Markov's Inequality, Chebyshev's Inequality, Strong Law of Large Numbers, Central Limit Theorem.

Unit-IV

Introduction to Sampling, Random Sampling, Non Random Sampling, Design of Experiments, Sampling Distributions, Relationship between Sample Size and Standard Error, Hypothesis, Types of Errors, Variance, Means. Chi Square as a Test of Independence, Chi Square as a Test of Goodness of Fit, Analysis of Variance. Inferences about population variance.

ADVANCES IN DATABASES

Paper Code: Ph.D- 2 **External: 80 Internal: 20**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Objectives:

The objective of this course is to provide the fundamental concepts of advanced technologies in database. It also focuses on parallel & distributed database technology, web database, graph and no-sql databases.

Learning Outcomes:

At the end of this course students should be able to:

- Design distributed database for application development.
- Apply query optimization principles for optimizing query performance in centralized and distributed database systems
- Design distributed database schema using principles of fragmentation and allocation.
- Apply distributed transaction principles for handling transactions in distributed database applications.
- Apply distributed database administration principles for managing distributed database.
- Identify computing frameworks for Big Data analytics.

UNIT – I

Object Model: Overview of Object-Oriented concepts, Object identity, Object structure, Type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Complex objects. Query Processing and Optimization: Using Heuristics in QueryOptimization, Semantic Query Optimization, Database Tuning in Relational Systems.

UNIT – II

Databases for Advance Applications: Architecture for parallel database; Distributed database concepts, Data fragmentation, Replication, and allocation techniques, Overview of Client-Server Architecture, Active Database Concept and Triggers, Temporal Databases Concepts, Spatial and Multimedia Databases, Deductive Databases, XML Schema, Documents and Databases.

UNIT – III

Principles of Big Data: Classifications, Ontologies, Classes with Multiple Parents, Choosing a Class Model. Data Integration and Software Interoperability, Versioning and Compliance Issues, Stepwise Approach to Big Data Analysis, Failures & Legalities.

UNIT – IV

NoSQL Databases: Concepts, Schema, Schema Free, Two Phase Commit, Share Nothing Architecture, Types of NoSQL Databases, CAP & BASE Theorems, Elastic Scalability, High Availability & Fault Tolerance, Tuneable Consistency, Writing and Reading Data,

Text Books:

1. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Ed., Pearson Education.
2. Jules J. Berman, "Principles of Big Data", 1st Ed., Elsevier India.

Reference Books:

1. Date C.J., "An Introduction to Database Systems", 8th Ed., Pearson Education.
2. Hector G.M., Ullman J.D., Widom J., "Database Systems: The Complete Book", 2nd Ed., Pearson Education.
3. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", 5th Ed., Tata McGraw Hill.

DATA ANALYTICS

Paper Code: Ph.D- 3 **External: 80 Internal: 20**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Objectives: The objective of this course is to provide insights about various data analytics and interpretations. It focuses on learning different analytic tools and their insights in computer science.

Learning Outcomes: At the end of this course students should be able to:

- Learn about data analytics terminologies and their use.
- Use these techniques to perform various data analysis and interpret the results.

UNIT – I

Introduction: Need of Big Data, Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

Data Science & Analytics: Introduction, Business value, Typical problems solved with data science, Analytics Modeling, Analytic Processes and Tools - Analysis and Reporting - Modern Data Analytic Tools.

UNIT – II

DATA ANALYSIS : Analytic terminologies, Evolution of analytic methods, analysis versus reporting, Core and advanced analytics, Statistical significance and business importance, making inferences, Analytic team, analytic innovations, key principles of data analytics.

UNIT – III

FRAMEWORKS AND VISUALIZATION :MapReduce – Hadoop, Hadoop Distributed File Systems. Algorithms using MapReduce, Extensions to MapReduce, mapper and reducer configurations, number of mappers and reducers. Handling of large datasets.Visual Data Analysis Techniques.

UNIT – IV

MongoDB: Documents, Collections, MongoDB Shell, CRUD operations: Inserting and Saving Documents, Removing Documents; Updating Documents; Querying: find, query criteria, type-specific criteria, cursors; Indexing, Application design, replication configuration, Sharding configuration, MongoDB Server administration.

Text Books:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley India Pvt. Ltd.
2. Glenn J. Myatt, "Making Sense of Data", Wiley India Pvt. Ltd.

REFERENCE BOOKS:

3. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
4. Kristina Chodorow, "MongoDB: The Definitive Guide", 2nd Ed., O'Reilly Media.
5. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
6. Akerker, "Big Data Computing", CRC Press.
7. Statistics by S. C. Gupta.

CLOUD COMPUTING

Paper Code: Ph.D- 4 **External: 80 Internal: 20**

Note: Examiner will be required to set NINE questions in all. Question Number 1 will consist of objective type/short-answer type questions covering the entire syllabus. In addition to question no. 1, the examiner is required to set eight more questions selecting two from each unit. Student will be required to attempt FIVE questions in all. Question Number 1 will be compulsory. In addition to compulsory question, student will have to attempt four more questions selecting one question from each Unit. All questions will carry equal marks.

Course Objectives: The objective of this course is to provide comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications by introducing and researching state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations. Another objective is to expose the students to frontier areas of Cloud Computing while providing sufficient foundations to enable further study and research.

Learning Outcomes: Completing this course students should be able to

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- Explain federated and multimedia cloud computing architectures.
- Explain the core issues of security, privacy, and interoperability in cloud computing.
- Analyze and design applications for clouds using Python language.

UNIT – I

Cloud Computing: Definition, roots of clouds, characteristics, Cloud Architecture – public, private, hybrid, community, advantages & disadvantages of Cloud Computing.

Migrating into a Cloud: broad approaches, seven-step model to migrate

Virtualization: benefits & drawbacks of virtualization, virtualization types – operating system virtualization, platform virtualization, storage virtualization, network virtualization, application virtualization, virtualization technologies.

UNIT – II

Cloud Services & Platforms: Compute services, Storage services Database services, Application Services, Queuing services, E-mail services, Notification services, Media services, Content delivery services, Analytics services, Deployment & management services, Identity & access management services. Case studies of these services.

Federated & Multimedia Cloud Computing: architecture, features of federation types, federation scenarios, layers enhancement of federation: Multimedia Cloud.

UNIT – III

SLA Management in Cloud Computing: traditional approaches to SLA management, types of SLA, life cycle of SLA, SLA management in cloud, automated policy-based management.

Cloud Security: challenges, CSA cloud security architecture, authentication, authorization, identity & access management, data security, auditing.

Legal Issues in Cloud Computing: data privacy and security issues, cloud contracting models.

UNIT – IV

Developing for Cloud: Design considerations for cloud applications, reference architectures for cloud applications, cloud application design methodologies, data storage approaches

Python for Cloud: Python characteristics, data types & data structures, control flows, functions, modules, packages, file handling, date/time operations, classes, Python web application framework – Django.

Text Books

1. ArshdeepBahga, Vijay Madisetti, Cloud Computing – A Hands-on Approach, University Press, 2014
2. Saurabh Kumar, Cloud Computing, 2nd Edition, Wiley India Pvt Ltd.
3. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing – Principles and Paradigms, Wiley India Pvt. Ltd.

Reference Books

1. Barrie Sosinsky, Cloud Computing Bible, Wiley India Pvt. Ltd.
2. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing.