Syllabi & Scheme of Examination

Under Choice Based Credit System

DOCTORATE OF PHILOSHPHY

Department of Computer Science and Applications

Chaudhary Devi Lal University, Sirsa (Haryana)

Department of Computer Science & Applications
Chaudhary Devi Lai University, Sirsa

Scheme of Examination for Ph.D. (Computer Science)

Paper Code	Nomenclature of Paper	Credit	Int Marks	Ext Marks	Total Marks
PH-CS-01	Research Methodology	04	30	70	100
PH-CS-02	Advancements in Computing	04	30	70	100
PH-CS-03	Elective Paper	04	30	70	100
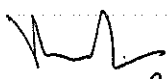
List of Elective Subjects:

PH-CS-03(E-i)	Simulation and Modeling
PH-CS-03(E-ii)	Advanced Computer Architecture
PH-CS-03(E-iii)	Advanced Programming Languages
PH-CS-03(E-iv)	Data Mining & Data Warehousing
PH-CS-03(E-v)	Advanced Operating Systems
PH-CS-03(E-vi)	Advanced Database Systems
PH-CS-03(E-vii)	Data Communication and Networking
PH-CS-03(E-viii)	Advanced Software Engineering

Note: During the Ph.D Course Work the Research Scholars shall have to earn a total of Two (02) credits from Open Elective Courses offered by various Teaching Departments of the University.

PH-CS-01   Research Methodology

L/T	P	Credit		Int	Ext
4	-	4		30	70

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of Five short (each 2 marks) questions covering entire syllabus uniformly. In addition Eight more questions will be set unit wise comprising two questions from each unit of the given syllabus carrying 15 marks each. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Unit-1

Research an Introduction: Meaning, Characteristics, Classification, Importance. Research Methods and Techniques: Classification of Research Methods, Advantages and Limitations: Steps Involved. Role of Library, Internet and Simulation. Review of Literature: Meaning, Importance, Research Review.

Unit-II

Formulation of Research Problem: Formulation of Research Problem, Delimiting problems. Sources of Research Problem. Criteria of a good Research Problem, Formulation and Stating the Problem. Common Errors.

Hypothesis: Meaning, Importance, Types, Sources, Characteristics, Testing.

Research Design: Meaning, Characteristics of a Good Research Design, Components of a Research Design, Types of Research Design.

Unit-III

Census and Sample Investigation: Meaning of Census and Sampling Investigation, Objective of Sampling. Advantages of Sampling and Census Method, Types of Sampling Techniques, Sampling Errors.
Data Collection: Primary and Secondary Data, Methods of Primary Data Collection, Sources of Secondary Data, Precautions in the use of Secondary Data. Processing of Data: Editing, Coding, Classification.

Unit-IV

Analysis and Statistical Techniques: Meaning of Analysis, Primary Data Analysis, Secondary Data Analysis, Characteristics of Data Analysis, Statistical Methods in Analysis. Interpretation of Data: Meaning and Need. Pre-requisites of Interpretation, Sources of Errors, Conclusion and Generalization,
Report Writing: Research Report, Types of Reports, Steps in Report Writing, Format of Research Report, Style and Typing of Research Report, Problems in Preparing Research Report.

References:
1. Research Methodology & Statistical Techniques, Santosh Gupta
2. Research Methodology, CRKothari
3. Research Methods by Ranjit Kumar
4. Research Methods by Lokesh Koul

PII-CS-02   Advancements in Computing

L/T	P	Credit	Int	Ext
4	-	4	30	70

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of Five short (each 2 marks) questions covering entire syllabus uniformly. In addition Eight more questions will be set unit wise comprising two questions from each unit of the given syllabus carrying 15 marks each. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Unit-I

Data Base System concepts and Architecture: Data Models, Schemas and Instances, DBMS architecture and Data Independence Data Base languages & Interfaces, DBMS functions and component modules.

Relational Data Model: Relational Model concepts, Integrity constraints over Relations. Relational Algebra - Basic operations Relational Data Base Design: Functional Dependencies. Decomposition, Desirable properties of decomposition, normal forms based on primary keys (I NF, 2 NF 3 NF and BCNF).

Unit-II

CPU organization: Processor organization, Machine Instructions, Instruction Cycle, Instruction Format and addressing mode. Microprogramming Concepts and micro program sequencer. I/O Organization: I/O interface, interrupt structure, transfer of information between CPU/Memory and I/O devices, and IOPs. Memory Organization,
Parallel Architectures: Concepts; Classification, Parallel Techniques. Code Scheduling. Interconnection networks, VLIW Superscalar.
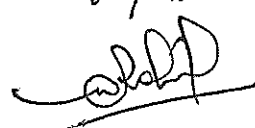
Unit-III

Issues, opportunities and constraints in applications of modern information and communication technologies in following domains of public life: commerce (e-commerce), banking (e-banking), teaching-learning (e-learning), Public governance (e-governance) and tourism.
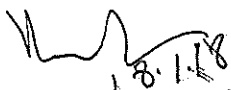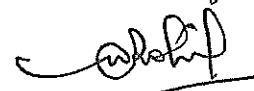
Unit-IV

Software Quality, Software Quality Factors, Software Quality Metrics, Relationship between quality factors and quality metrics. Software standards. Software Reviews, Formal Technical Reviews, Software Quality Assurance, Clean Room Software Engineering., SEI-CMM. Standards of Software Quality, Quality Assurance Standard, Quality Review

References:
- Elmasri & Navathe : Fundamentals of Database System, 3rd Edition, Addison Wesley, New Delhi.
- Korth & Silberschatz: Database System Concept, 4th Edition, McGraw Hill International Edition.
- Mano M. Morris Digital Logic and Computer Design, Prentice hall of India Pvt. Ltd., 2000.
- Carpinelli. Computer Systems Organization & Architecture, Pearson Education.
- Hayes. J.P., Computer Architecture and organisation, McGraw Hill, 1998, Third Ed.

PII-CS-DE-03(E-i) Simulation and Modeling

L/T	P	Credit	Int	Ext
4	-	4	30	70

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of Five short (each 2 marks) questions covering entire syllabus uniformly. In addition Eight more questions will be set unit wise comprising two questions from each unit of the given syllabus carrying 15 marks each. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Unit -1

Concept of simulation, steps in simulation experiment Benefits of simulation and its pitfalls. system modeling, principal used in modeling, Generation of random numbers, Generation of non-uniformly distributed random numbers. Illustrative examples: Inventory problem. Chemical Reactor. Servo System, Water Reservoir System, Hypothetical Computer.

Unit-II

Simulation of discrete system: Fixed time-step vs. Event-to-Event Model, Monte Carlo computation.
Continuous system simulation: Continuous System models, Differential Equations. Analog Computers, Hybrid Computers, Digital-Analog Simulators.

Queuing Systems: Congestion in systems, Arrival Patterns, Poisson Arrival Patterns, Exponential Distribution, Coefficient of Variation, Erlang Distribution. Service Times, Normal Distribution. Basic concept of queuing theory. Simulation of single server, two servers.

Unit-III

Simulation of A PERT Network: Network model of a project, Analysis of an Activity Network. Critical Path Computation, Uncertainties in Activity Durations, Simulation of an Activity Network. Computer Program for Simulation, Resource allocation and Cost Consideration.

Simulation of Inventory Control And Forecasting: Elements of inventor)' theory, inventory models. Forecasting and aggression analysis.
Design And Evaluation of Simulation Experiments: Length of Simulation Runs. Variance Reduction Techniques and validation.

Unit-IV

Simulation Languages: Continuous and discrete simulation languages. Block Structured continuous simulation languages. Expression based languages, Discrete system simulation languages, GPSS SIMCRIPT SIMULA. Factors in selection of discrete system simulation languages.

References:

1. Narsing Deo, System Simulation with Digital Computers, PHI New Delhi.
2. Avrill M. Law & Kelton, Simulation Modeling and Analysis, McGraw Hill.
3. Jerry Banks et. al., Discrete Event System Simulation, Prentice Hall of India
4. Gordon Geoferry: "System Simulation, Prentice-Hall of India Pvt Ltd New Delhi-1993

PH-CS-03(E-ii)   Advanced Computer Architecture

L/T	P	Credit		Int	Ext
4	-	4		30	70

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of Five short (each 2 marks) questions covering entire syllabus uniformly. In addition Eight more questions will be set unit wise comprising two questions from each unit of the given syllabus carrying 15 marks each. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Unit-I

Fundamentals: Computational model. Evolution of computer architecture. process, program thread. concurrent and parallel execution. types and levels of parallelism, classifications of parallel architectures. Relationships between languages and parallel architectures.

Unit-II

Instruction-Level-Parallel Processors: Evolution and overview, Dependencies between instructions, Instruction Scheduling, Preserving Sequential Consistency, Speed-up Potential of ILP Processing.
Pipelined Processors: Basic concepts. Principles of Pipelined instruction processing. synchronous & asynchronous pipelining. Linear Pipeline-clocking and timing control. speedup efficiency & throughput. Non linear pipeline- reservation table, latency analysis: collision free scheduling, internal data forwarding.

Unit-III

Superscalar pipeline Design- Structure data dependencies pipeline stalling. In order issue. Out of order issue VLIW architecture. Branch handling delayed handling. branch processing multiway branching. guarded execution. code scheduling basis, block scheduling, loop scheduling, global scheduling.
Memory Hierarchy Technology: Inclusion, coherence and locality, virtual memory models. TLB, paging and segmentation, memory replacement policies, cache addressing models, cache performance issues, interleaved memory organization.

Unit-IV

MIMD Architectures: Architectural concepts. Problems of scalable computers, Main design issues of scalable MIMD computers.
Distributed Memory MIMD Architectures: Introduction, Direct Connection networks. Shared Memory MIMD Architectures: Dynamic interconnection networks-shared path, switching networks- crossbar & multistage networks. Cache coherence problem, Hardware based cache coherence protocol-Snoopy cache protocol directory scheme, scalable coherent interface. and hierarchical cache coherence protocol. UMA, NUMA, CC-NUMA and COMA multiprocessors.

Reference:
- Sima. Dietal., Advanced Computer Architecture, Addison Wesley. 2000.
- Wang, Kai, Advanced Computer Architecture, McGraw Hill, International Ed.
- Wang Kai, Brings Faye A., Computer Architecture and Parallel Processing. McGraw Hill, International Ed.
- Main. Richard Ya, Advanced Computer Architecture PHI 1999

PH-CS-03(E-iii) Advanced Programming Languages

L/T	P	Credit		Int	Ext
4	-	4		30	70

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of Five short (each 2 marks) questions covering entire syllabus uniformly. In addition Eight more questions will be set unit wise comprising two questions from each unit of the given syllabus carrying 15 marks each. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Unit-I

Introduction: Brief history of Programming Language, Characteristics of programming language. Programming Language Processors: The structure and operation of a computer, Hardware and firmware computers, Translator and simulator computers. Syntax, semantics and virtual computers, hierarchies of computers, binding and binding time

Elementary Data Types: Data object, variable and constants, data types, specification of elementary data types, declarations, type checking and type conversion, assignment and initialization, numeric data types, enumerations, Boolean, characters

Unit-II

Structured Data Types: Structured data object and data types, specification of data structure types, implementation of data structure types, declarations and type checking for data structures, vector and arrays, record, character strings, variable sized data structures, pointers and programmer-constructed data objects, sets, file and input/output

Subprogram And Programmer-Defined Data Types: Evolution of the data type concept. Abstraction, encapsulation, and information hiding, subprogram, type definitions, abstract data types

Unit-III

Sequence Control: Implicit and explicit sequence control, sequence control within expression, sequence control between statements, subprogram sequence control, recursive subprogram, exceptions and exception handlers, Co-routines, scheduled subprograms, tasks and concurrent execution, data structures and sequence control.

Data Control: names and referencing environments, static and dynamic scope, block structure, local data and local referencing environments, shared data, task and shared data.

Unit-IV

Storage Management: Major Runtime elements requiring storage, programmer and system controlled storage management, storage management phases, static storage management, stack based storage management, heap storage management

Syntax And Translation: General syntactic criteria, syntactic elements of language, stages in translation, formal definition of syntax.

Operating and Programming Environment: Batch processing environment, interactive environments, embedded system environments, programming environments Theoretical Models: Problem in syntax and translation, problem in semantics.

References:

Programming Languages, design and implementation second edition by Terrence W. Pratt Prentice Hall of India pvt.ltd. New Delhi

PH-CS-03(E-iv) Data Mining & Data Warehousing

L/T	P	Credit		Int	Ext
4	-	4		30	70

Note:-Total 09 Questions are to be set by the examiner. First question will be compulsory consisting of Five short (each 2 marks) questions covering entire syllabus uniformly. In addition Eight more questions will be set unit wise comprising two questions from each unit of the given syllabus carrying 15 marks each. A candidate is required to attempt five questions in all selecting one question from each unit including the compulsory question.

Unit-I

Introduction: The Evolution of Data Warehousing (The Historical Context), The Data Warehouse- a Brief History. Today's Development Environment.
Principles of Data Warehousing (Architecture and Design Techniques): Types of Data and their uses, conceptual Data Architecture, Design Techniques, introduction to the Logical Architecture. Creating the Data Asset: Business Data Warehouse Design, Populating the Data Warehouse.

Unit-II

Unlocking the Data Asset for end users (The use of Business Information): Designing, Business Information Warehouses, Populating Business Information Warehouses, User Access to Information, Information Data in Context.

Implementing The Warehouse (Managing the Project and Environment): Obstacles to Implementation, Planning your implementation, justifying the warehouse, Organizational Implications o Data Warehousing, The Data Warehouse in your Organization, Data Warehouse Management, Locking to the Future.
Data Mining: Motivation, Importance, data mining, kind of data, Functionalities, interesting patterns, classification of data mining system, Major issues.

Unit-III

Data warehouse and OLAP Technology for data mining: data warehouse, operational data base systems and data warehouse, Architecture, Implementation, development of data cube technology, data warehousing to data mining, Data warehouse usage.
Data Preparation: Preprocess, Data cleaning, Data Integration and transformation, Data reduction, Discritization and concept hierarchy generation.
Data Mining Primitives, Languages, and system Architectures, graphical user interfaces.

Unit-IV

Concept Description: Characterization and Comparison, Data Generalization and summarization-based characterization, Analytical characterization, analysis of attribute relevance, mining class comparisons, Mining descriptive statistical measures in large databases.
Mining Association Rules in Large Database, Mining single-dimensional Boolean association rules from transactional databases, mining multilevel association rules from transaction databases, Mining multidimensional association rules from relational databases and data warehouses, From association mining to correlation analysis, constraint-based association. Classification and prediction, issues, classification by decision induction, Dayesian classification, classification by back propagation, classification based on concepts from association rule mining other classification methods.

Reference:
- Data Mining, Ale Berson, Stephen Smith, Korth Theorling, TMH.
- Data Mining, Admaans, Addison-wesley Longman.
- Data Warehousing in the Real World Anahory, Addison-wesley Longman
- Data Mining and warehousing, Chanchal Singh, Wiley.
- Data Mining, John E, Herbert P.

PH-CS-03(E-v)   Advanced Operating Systems

L/T	P	Credit	Int	Ext
4	-	4	30	70

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Unit-I

Graphical User Interface and the Operating System: Windowing Technology, Graphical User Interface, relationship between Operating System and the Windows, Components of GUI, requirement of a Windows based GUI

Security and Protection: Security Threats, Attacks on Security, Security Violation through Parameters, Computer Worms, Computer Viruses, Security Design Principles, Authentication, Protection Mechanism, Encryption, Security in Distributed Environment.

Unit-II

Processes: Process Model, Implementation of Processes, Threads, Inter-process Communication, Race Condition, Critical Section, Mutual Exclusion with Busy waiting, Sleep and Wakeup, Semaphores, Monitors, Message Passing, Classical IPC Problems, Process Scheduling, Round Robin, Priority, Multiple Queues, Shortest Job First, Guaranteed, Lottery, Real Time and Two-Level Scheduling.

Disk Performance Optimization: Moving Head Disk Storage, Disk Scheduling, Seek Optimization, Rotational Optimization, Disk Caching.
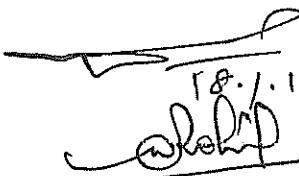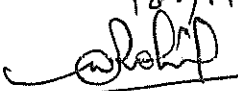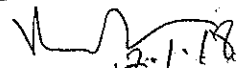
Unit-III

Distributed and Parallel Processing: Parallel Processing, Distributed Processing, Difference between Distributed and Parallel Processing, Advantages of Parallel Processing, Writing Programs for Parallel Processing, Machine Architecture supporting Parallel Processing, Operating System for Parallel Processors, Issues in Operating System in Parallel Processing.
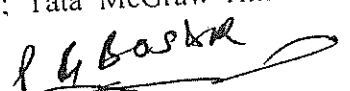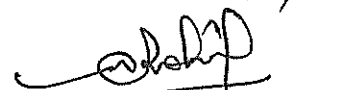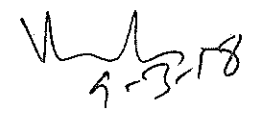
Unit-IV

Distributed Operating Systems: Architecture of Distributed Systems, Networking, Interprocess Communication Protocols, Distributed Computation Paradigm, Network Operating System, Design issues in Distributed Operating System, Theoretical issues in Distributed Systems, Distributed Control Algorithms, Distributed Mutual Exclusion, Distributed Deadlock Handling, Distributed Scheduling Algorithms, Recovery and Fault Tolerance, Distributed File System, Distributed system Security.

References:

1. Operating Systems: Achyut S Godbole: Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Operating Systems; A Concept based Approach; D. M. Dhamdhere; Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Operating Systems-2nd Edition; H. M. Deitel; Pearson Education.

L/T	P	Credit	Int	Ext
4	-	4	30	70

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Unit-I

Extended E-R Model: Subclasses, super classes and Inheritance, Specialization and Generalization, Constraints and Characteristics of Specialization and generalization.

Object-oriented Data Model : Object Identity, Object Structure, and Type constructors. Encapsulation of Operations, Methods and Persistence, Type Hierarchies and Inheritance. Complex Objects, Polymorphism, Multiple Inheritance, Versions and Configurations.

Object Relational Databases: Basic Concepts of Object-Relational systems, Object-Relational features of Oracle. An overview of SQL3, Object-Relational support in SOL3, Relational Data Model.

Unit-II

Further Normalization: Higher Normal Forms, Multivalued Dependencies and 4th normal Form. Join Dependencies and 5th Normal Forms, Domain-key Normal Form.

Database System Architectures: Centralized systems, Client-Server Systems, Server System Architecture, Parallel Systems, and Distributed Systems.

Unit-III

Distributed Database and Client-Server Architecture: Distributed Database concepts. Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Type of Distributed Database System, Overview of Concurrency Control and recovery in Distributed Databases. An Overview of Client-Server Architectures, Distributed Databases in Oracle.
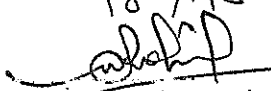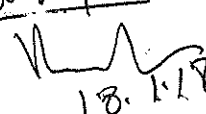
Unit-IV

Data warehousing Concepts: Architecture, Data flows, Tools & Technologies, Data Marts, Data Mining & Online Analytical Processing
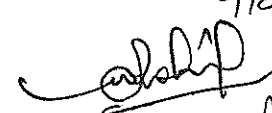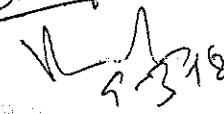
Web Interfaces to Databases: Web Fundamentals, Databases and the Web, Web Servers and Sessions, Providing access to Database on WWW, The Oracle Web server, Performance Tuning, Performance Benchmarks.
Enhance Data models for Advanced Applications: An Overview of active Databases, Spatial Databases, Deductive Databases and Multimedia Databases.Mobile Computing & Mobile Databases

Reference:
1. Elmasri & Navathe: Fundamentals of Database systems, 3rd Edition; Addison Wesley New Delhi.
2. Korth & Siiberschatz: Database System Concepts, McGraw Hill International Edition. Raghu Ramakrishnan & Johannes Gehrke: Database Management Systems, 2* edition. McGraw Hill International Edition.
3. Bipin C. Desai: An Introduction to Database System Galgotia Publication, New Delhi.

PH-CS-03(E-vii)   Data Communication and Networking

L/T	P	Credit	Int	Ext
4	-	4	30	70

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Unit-I

Basic concepts of analog and digital signals. data transmission concepts, Analog and digital data, transmission. Analog to digital conversion. Digital to Analog conversion. transmission media. Shannon Capacity. Network Topologies. Switching, Multiplexing, Protocols and Standards. OSI (model, Transmission Media, Modems.

Unit-II

Data Link Layer: Data Link Layer Design issues, Error - detection and correction, Data Link Protocols. Sliding Windows Protocols. Protocols specification and Verification, Example Data Link Protocols, Medium Access Sublayer (Channel Allocation Problem, Multiple Access Protocols).
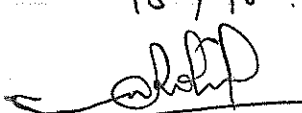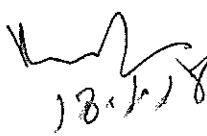
Unit-III

Network Layer: Network Layer Design Issues, Routing Algorithms. Congestion Control Algorithms. Network Layer in ATM Networks. Transport Layer - Transport Service. Elements of Transport Protocols. Performance Issues.
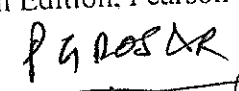
Unit-IV

Application Layer: Network Security. Domain Name System. SNMP. Electronic Mail. Multimedia. Mobile Databases
Satellite Systems: History, Applications, Basics, Routing, Localization, Handover Broadcast Systems: Overview. Cyclic repetition of Data, Digital audio broadcasting, Digital video broadcasting. convergence of broadcasting and mobile communication.

References:

- Jochen Schiler. Mobile Communication.
- Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.
- Andrew S. Tanenbaum, "Computer Networks", PHI, Fourth Edition, 2003.
- William Stallings. "Data and Computer Communication", Sixth Edition, Pearson Education, 2000

PH-CS-03(E-viii) Advanced Software Engineering

L/T	P	Credit	Int	Ext
4	-	4	30	70

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Unit-I

Introduction: Life cycle models, Requirement Analysis and specification, Formal requirements specification. Fundamental issues in software design, goodness of design, cohesions, coupling. Function- oriented design.

Unit-II

Structured analysis and design, overview of object -oriented concepts. Unified Modeling Language, unified design process.

Unit-III

User interface design, coding standards and guidelines, code walkthrough and reviews. Unit testing, black box and white box testing, integration and system testing. Software quality assurance and reliability modeling.

Unit-IV

SEI CMM, ISO 9001 and Six Sigma, clean room testing technique. Software maintenance issues and techniques. Software reuse. Client-Server software development.Personnel Software process. Soft Computing

Reference:
1. Ian Sommerville, Software Engineering, Addison Wesley.
2. Pressman Roger, Software Engineering -A Practitioner's Approach.
3. Richard Fairley, Software Engineeering Concepts,Tata Mcgraw Hill.
4. Pankaj Jalote, An Integrated Approach to Software engineering, Narosa Publication.