MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SYLLABUS FOR Pre-Ph.D. COURSEWORK
Doctor of Philosophy (Ph.D.) - COMPUTER SCIENCE

Scheme of examination

w.e.f. 2011-12

S.No.	Course Code	Course Title	Internal Marks	Marks (Theory)	Total Marks	Course Requirements (Hrs)
1	PhD-CS 1001*	RESEARCH METHODOLOGY & ITS RELEVANCE IN COMPUTER SCIENCE	20	80	100	4
2	PhD-CS 1002	ELECTIVE-I	20	80	100	4
3.	PhD-CS 1003	ELECTIVE-II	20	80	100	4
	Total		60	240	300	12

ELECTIVE-I & ELECTIVE -2 PAPERS ARE TO BE SELECTED BY THE CANDIDATE FROM THE LIST OF ELECTIVE PAPERS GIVEN BELOW:

LIST OF ELECTIVES

I	SOFTWARE DESIGN AND ENGINEERING
II	DATA WAREHOUSING AND MINING
III	MOBILE COMPUTING
IV	ADHOC AND SENSOR NETWORKS
V	SOFTWARE TESTING AND QUALITY ASSURANCE
VI	JAVA & WEB TECHNOLOGIES
VII	ADVANCED COMPILER DESIGN
VIII	ADVANCED COMPUTER NETWORKS
IX	ADVANCED DATA BASES
X	EMBEDDED SYSTEMS
XI	DIGITAL IMAGE PROCESSING
XII	INFORMATION SECURITY
XIII	INFORMATION RETRIEVAL SYSTEMS

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More Elective Papers may be added from time to time depending upon the availability of the Expertise in the Department and its suitability for the prospective researchers.

PhD-CS-1001: RESEARCH METHODOLOGY & ITS RELEVANCE IN COMPUTER SCIENCE

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT-1

Research:

Types, Research process and steps in it, Hypothesis, Research proposals and aspects. Research Design: Need, Problem Definition, variables, research design concepts, Literature survey and review, Research design process, Errors in research

Research Modeling: Types of Models, Model building and stages, Data consideration and testing, Heuristic and Simulation modeling. Report Writing: Pre writing considerations, Thesis writing, Formats of report writing, formats of publications in Research journals.

UNIT-2

Design of Experiments:

Objectives, strategies, Factorial experimental design, Designing engineering experiments, basic principles-replication, randomization, blocking, Guidelines for design of experiments; Single Factor Experiment: Hypothesis testing, Analysis of Variance (ANOVA) components for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effects model, Estimation of variance components, Model adequacy checking, Chi-Square Test.

Two factor Factorial Design, Basic definitions and principles, main effect and interaction, response surface and contour plots, General arrangement for a two-factor factorial design; Models-Effects, means and regression, Hypothesis testing.

UNIT-3

Measurement and Scaling Techniques:

Measurement: concept, Levels and components of Measurement, Techniques of Developing Measurement Tools, sources of Error in measurement, Tests of Sound Measurement.

Scaling: Meaning of Scaling, Bases of Scales- classification, important scaling techniques-Rating and Ranking. Approaches of the scale construction, different types of scales-Arbitrary Scales, Differential Scales, Summated Scales, Cumulative Scales, factor Scales.

Sampling:

Sampling Theory, Sandler's A-test, Concept of standard errors, Estimating Population mean (μ), Sample size and its Determination.

UNIT-4

Qualitative Research:

Themes of qualitative Research, Research Strategies; Data collection Techniques, combining qualitative and quantitative research.

Data Analysis and Interpretation of Data:

Data Analysis: Paramedic and Nonparametric data, Descriptive and Inferential Analysis. Interpretation of Data: Forms of Interpretation, Prerequisites for Interpretation, Precautions in Interpretation, conclusions and Generalizations, sources of Errors in Interpretations, Mathematical and statistical analysis using software tools like MAT Lab, SPSS or free wares tools. The computer: Its role in research.

Suggested Books:

1. Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, (Wiley India)
2. Montgomery, Douglas C. & Runger, George C. (2007), 3/e, Applied Statistics & Probability for Engineers (Wiley India)
3. Kothari C.K. (2004), 2/e, Research Methodology- Methods and Techniques (New Age International, New Delhi)
4. Krishnaswamy, K.N., Sivakumar, Appa Iyer and Mathiranjan M. (2006), Management Resarch Methodology; Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)
5. The complete reference Office Xp – Stephan L. Nelson, Gujulia Kelly (TMH)
6. Basic Computer Science and Communication Engineering – R. Rajaram (SCITECH)
7. Book for Open Office.

PhD-CS 1002: SOFTWARE DESIGN AND ENGINEERING

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT -1
Introduction to Software Engineering:

The evolving role of software, Changing Nature of Software, legacy software, Software myths. A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

Process models: The waterfall model, Incremental process models, Evolutionary process models, specialized process models, The Unified process. Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

UNIT- 2

Role of Software Design:

The nature of the design process; transferring design knowledge; constraints upon the design process and product, recording design decisions, designing with others, context for design, economic factors, assessing design qualities, quality attributes of the design product, assessing the design process.

Transferring Design Knowledge-Representing abstract ideas; design viewpoints, the architecture concept, design methods, design patterns, Design representations, and rationale for design methods. Design Processes and Strategies: The role of strategy in design methods, describing the design process –The D – Matrix, design by top-down decomposition, design by composition and organizational influences upon design.

UNIT -3

Designing with objects and components:

Designing with objects: design practices for object-oriented paradigm, Object- oriented frame works, Hierarchal object oriented design process and heuristics, the fusion method, the unified process.

Component – based design: The component concept, designing with components, designing components, COTS, Performing User interface design-The Golden rules, Interface analysis and design models, user and task analysis, analysis of display content and work environment, applying interface design steps, user interface design issues, design evaluation.

UNIT -4

Project Management and Metrics:

Project Management: The management spectrum: people, product, process and project, W5HH principle, critical practices. Metrics for Process and Projects: Process metrics, project metrics, size-oriented metrics, function oriented metrics, Object-oriented and use-case metrics, metrics for software quality, integrating metrics within the software process.

Project Scheduling and Risk Management:

Project Scheduling: Basic concepts, project scheduling, defining a task set and task network, timeline Charts, tracking the schedule, tracking the progress for an OO project, Earned value analysis. Risk Management: reactive vs. Proactive risk strategies, software risks, risk identification, risk Projection, risk refinement, risk mitigation and monitoring, the RMMM plan.

Suggested Books:

1. Software design, David Budgen, second edition, Pearson education, 2003.
2. Software Engineering: A practitioner's Approach, Roger S Pressman, seventh edition Mc-Graw Hill International Edition, 2009.
3. Software Engineering, Ian Sommerville, seventh edition, Pearson education,2004.
4 Software Project Management, Bob Hughes & Mike Cotterell, fourth edition,Tata Mc-Graw Hill,2006
5. The art of Project management, Scott Berkun, O'Reilly, 2005.

6. Software Engineering Project Management, Richard H. Thayer & Edward Yourdon, second edition,
   Wiley India 2004.
7. Software Engineering Foundations, Yingxu Wang, Auerbach Publications, 2008
8. Applied Software Project Management, Andrew Stellman & Jennifer Greene,O'Reilly, 2006.
9. Software Design,Eric Braude,John Wiley&Sons.

PhD-CS 1003: DATA WAREHOUSING AND MINING

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Introduction:

Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

Data Preprocessing:

 Need for Preprocessing; the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

UNIT II

Data Warehouse and OLAP Technology for Data Mining:

 Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

UNIT III

Mining Frequent Patterns, Associations and Correlations:

Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining .

Classification and Prediction:

Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods

UNIT IV

Cluster Analysis Introduction:

Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis - Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multirelational Data Mining:

Mining Object, Spatial, Multimedia, Text and Web Data:

Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Data Mining, Multimedia Data Mining, Text Mining, Mining the World Wide Web.

Applications and Trends in Data Mining:

Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining and Social Impacts of Data Mining.

Suggested Books:

1. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, 2nd Edition, 2006.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.
3. Data Warehousing in the Real World – Sam Aanhory & Dennis Murray Pearson Edn Asia.
4. Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley student Edition
5 The Data Warehouse Life cycle Tool kit – Ralph Kimball Wiley student edition
6. Building the Data Warehouse By William H Inmon, John Wiley & Sons Inc, 2005.
7 Data Mining Introductory and advanced topics –Margaret H Dunham, Pearson education
8. Data Mining Techniques – Arun K Pujari, University Press.

PhD-CS 1004: MOBILE COMPUTING

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Introduction to Network Technologies and Cellular Communications:

HIPERLAN: Protocol architecture, physical layer, Channel access control sub-layer, MAC sub-layer, Information bases and networking .WLAN**:** Infrared vs. radio transmission, Infrastructure and ad hoc networks, IEEE 802.11. Bluetooth**:** User scenarios, Physical layer, MAC layer, Networking, Security, Link management GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services. Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture

UNIT II

Wireless) Medium Access Control:

Motivation for a specialized MAC (Hidden and exposed terminals, near and far terminals); SDMA, FDMA, TDMA, CDMA;

Mobile Network Layer:

Mobile IP: Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations, Dynamic Host Configuration Protocol (DHCP).

UNIT III

Mobile Transport Layer:

Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Database Issues:

Hoarding techniques, caching invalidation mechanisms; client server computing with adaptation; power-aware and context-aware computing; transactional models, query processing, recovery, and quality of service issues.

UNIT IV

Data Dissemination:

Communications asymmetry: classification of new data delivery mechanisms, push based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

Mobile Ad hoc Networks (MANETs):

Overview, Properties of a MANET, spectrum of MANET applications, unicast and multicast routing algorithms, DSR, AODV, OLSR, CEDAR, ODMRP Protocols and Tools: security in MANETs, Wireless Application Protocol-WAP: Introduction, protocol architecture, and treatment of protocols of all layers. Bluetooth: User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME

Suggested Books:
1. Jochen Schiller, "Mobile Communications", *Pearson Education*., second edition, 2004
2. "Raj kamal, "Mobile Computing", OXFORD University Press
3. Asoke Talukder, Roopa Yavagal "Mobile Computing", ISBN: 0070588074, tata McGraw Hill
4. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2004,
5. C.Siva Ram murthy, B.S. Manoj "Adhoc wireless networks, architectures and protocols" peason education
6. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002

PhD-CS 1005: ADHOC AND SENSOR NETWORKS

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Introduction to Ad Hoc Networks:

Characteristics of MANETs, Applications of MANETs and challenges of MANETs - Routing in MANETs: Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms, Position based routing algorithms, Other routing algorithms.

UNIT II

Data Transmission:

Broadcast storm problem, Broadcasting, Multicasting and Geocasting. TCP over Ad Hoc: TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT III

Basics of Wireless, Sensors and Applications:
Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.

UNIT IV
Data Retrieval in Sensor Networks:

Routing layer, Transport layer, High-level application layer support; Adapting to the inherent; dynamic nature of WSNs; Sensor Networks and mobile robots. Security: Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.

Sensor Network Platforms and Tools:

Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms - Operating System: TinyOS – Imperative Language**:** nesC, Dataflow style language: TinyGALS, Node-Level Simulators, ns-2 and its sensor network extension, TOSSIM

Suggested Books:

1. Ad Hoc and Sensor Networks – Theory and Applications, *Carlos Corderio Dharma P.Aggarwal,* World Scientific Publications, March 2006, ISBN – 981-256-681-3

2.Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman

PHD-CS 1006: SOFTWARE TESTING AND QUALITY ASSURANCE

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT-I

A perspective on Testing, STLC, Functional testing: Boundary value testing, Equivalence –class testing, Decision Table Testing etc., Retrospective on Functional Testing; Structural testing: path testing, data flow testing, mutation testing, etc. Retrospective testing, Levels of testing: Integration testing, system testing, acceptance testing, stress testing, Regression testing-β testing.

UNIT-II

Object-oriented Testing, Interaction testing, Testing of Web Applications, Testing metrics, Testing Paradigms: Scripted testing, Exploratory testing, Test planning, Supporting Technologies: Defect taxonomies, Testing tools and standards, Case studies.

UNIT-III

Introduction to Software Quality, Quality Models: McCall's Model , Hierarchical model FCMM , Measuring Software Quality, Quality Metrics: Process, Product, Quality Control Tools, Quality assurance concept, importance, Requirements for SQA works,

UNIT-IV

Pareto Principle to SQA, Costs of Software Quality, SQA metrics, Audit Review, Walk through, Inspection techniques, SQA plan., Quality standards: SEI-CMM, ISO 9000 series, comparison between SEI CMM and ISO 9000.

Suggested Books:

1) A Practitioner's Guide to Test Case Design by LEE Copland, Artech House Publishers, Boston - London.
2) Software Testing – A Craft's man Approach, Paul C. Jorgensen, A CRC Press LLC.
3) Software Quality Theory and Management by Alan C. Gillies, Chapman & Hall.
4) Software Quality by Galrry S. Marliss , Thomson.
5) Metrics and Models in Software Quality Engineering by Stephen H. Kan , Pearson Education.
6) Handbook of Software Quality Assurance by G. Gordon Sculmeyer, Artech House Publishers, Boston –London

PhD-CS 1007: JAVA & WEB TECHNOLOGIES

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

Unit -1

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets; Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script, CSS XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX, Review of Applets, Class, Event Handling, AWT Programming. Introduction to Swing: JApplet, Handling Swing Controls like Icons – Labels – Buttons – Text Boxes – Combo – Boxes– Tabbed Pains – Scroll Pains – Trees – Tables Differences between AWT Controls & Swing Controls Developing a Home page using Applet & Swing.

Unit -2

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes and Java Beans API. Web servers: Tomcat Server installation & Testing. Introduction to Servelets: Lifecycle of a Serverlet, JSDK the Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters.

Unit -3

More on Servlets: The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues. Introduction to JSP: The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC architecture. AJAX.

Unit -4

JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute,Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages,Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data –Memory Usage Considerations. Database Access Database Programming using JDBC Studying Javax.sql.* package Accessing a Database from a JSP Page Application – Specific Database Actions Deploying JAVA Beans in a JSP Page

Suggested Books:

1. Programming world wide web-Sebesta,Pearson
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES, Marty Hall and Larry Brown Pearson
3. Internet and World Wide Web – How to program, Dietel and Nieto PHI/Pearson.
4. Jakarta Struts Cookbook, Bill Siggelkow, S P D O'Reilly for chap 8.
5. Murach's beginning JAVA JDK 5, Murach, SPD
6. An Introduction to web Design and Programming –Wang-Thomson
7. Professional Java Server Programming,S.Allamaraju and othersApress(dreamtech).
8. Java Server Programming, Ivan Bayross and others,The X Team,SPD
9. Web Warrior Guide to Web Programmming-Bai/Ekedaw-Thomas
10. Beginning Web Programming-Jon Duckett WROX.
11. Java Server Pages, Pekowsky, Pearson.
12. Java Script,D.Flanagan,O'Reilly,SPD

PhD-CS 1008: ADVANCED COMPILER DESIGN

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Overview of Compilation:

Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

Parsing:

Context free grammars, Top down parsing – Backtracking, LL (1), recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing.

Bottom up parsing:

Shift Reduce parsing, LR and LALR parsing, Error recovery in parsing, handling ambiguous grammar, YACC – automatic parser generator.

UNIT 2

Semantic analysis:

Intermediate forms of source Programs – abstract syntax tree, Attributed grammars, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker.

Symbol Tables:

Symbol table format, organization for block structured languages, hashing, and tree structures representation of scope information. Block structures and non block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays, strings and records.

UNIT 3

Code Generation:

Processing the intermediate Code- Interpretation, Code generation, Simple code generation, code generation for basic blocks, BURS Code generation and dynamic programming, Register allocation by graph coloring, Evaluation of code generation techniques Preprocessing the intermediate code, post processing the target code, machine code generation.

Code optimization:

Consideration for Optimization, Machine dependent and machine independent code; optimization, Scope of Optimization; local optimization, loop optimization, frequency reduction, folding, DAG representation.

Unit-4

Data flow analysis:

Dataflow Analysis, Intermediate representation for flow analysis, various dataflow analyses, Transformations using dataflow analysis speeding up dataflow analysis, Alias analysis.

Loop Optimizations:

Dominators, Loop-invariant computations, Induction variables, Array bounds checks, Loop unrolling

Suggested Books:
1. Principles of compiler design -A.V. Aho . J.D.Ullman; Pearson Education
2. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.
3. Advanced Compiler Design Implementation,S.S.Muchnick,Elsevier.
4. Compilers principles, techniques and tools A.V.Aho,Ravi Sethi& J.D. Ullman; Pearson ed.,
5. lex &yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly
6. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.
7. Engineering a Compiler-Cooper & Linda, Elsevier.
8. Compiler Construction, Louden, Thomson.

PhD-CS 1009: ADVANCED COMPUTER NETWORKS

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT- I

Computer Networks and the Internet:

What is the Internet, The Network edge, The Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched

Networks, History of Computer Networking and the Internet? Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing, Equal-Sized Packets Model:

ATM - Networking Devices: Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure.

UNIT- 2

The Link Layer and Local Area Networks:

Link Layer: Introduction and Services, Error-Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Virtualization. Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intradomain Routing Protocols, Interdomain Routing Protocols, Congestion Control at Network Layer

UNIT- 3

Logical Addressing:

IPv4 Addresses, IPv6 Addresses. Internet Protocol: Internetworking, IPv4, IPv6,Transition from IPv4 to IPv6 – Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intradomain Multicast Protocols, Interdomain Multicast Protocols, Node-Level Multicast algorithms - Transport and End-to-End Protocols: Transport Layer, Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control –Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP,Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server

UNIT- 4

Wireless Networks and Mobile IP:

Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs). Optical Networks and WDM Systems: Overview of Optical Networks, Basic Optical Networking Devices, Large-Scale Optical Switches, Optical Routers, Wavelength Allocation in Networks, Case Study: An All-Optical Switch VPNs, Tunneling and Overlay Networks:

Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS), Overlay Networks – VoIP and Multimedia Networking: Overview of IP Telephony,VoIP Signaling Protocols, Real-Time Media Transport Protocols, Distributed Multimedia Networking, Stream Control Transmission Protocol - Mobile A-Hoc Networks: Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks – Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols

Suggested Books:
1. Computer Networking: A Top-Down Approach Featuring the Internet, *James F. Kurose, Keith*
2. *W.Ross*, Third Edition, Pearson Education, 2007
3. Computer and Communication Networks, *Nader F. Mir,* Pearson Education, 2007
4. Data Communications and Networking, *Behrouz A. Forouzan*, Fourth Edition, Tata McGraw Hill, 2007
5. Guide to Networking Essentials, *Greg Tomsho,Ed Tittel, David Johnson,*Fifth Edition, Thomson.
6. An Engineering Approach to Computer Networking, *S.Keshav,* Pearson Education.
7. Campus Network Design Fundamentals, *Diane Teare, Catherine Paquet,* Pearson
8. Education (CISCO Press)
9. Computer Networks, *Andrew S. Tanenbaum*, Fourth Edition, Prentice Hall.
10. The Internet and Its Protocols, A. Farrel, Elsevier.

PhD-CS 1010: ADVANCED DATA BASES

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Introduction:

Distributed Data Processing, Distributed Database System. Distributed DBMS Architecture; Architectural Models for Distributed DBMS, DDMBS Architecture. Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.Query Optimization: Global query, operator tree, canonical expressions, and qualified relations

UNIT II

Transaction Management:

Definition, properties of transaction, types of transactions. Distributed concurrency control: Serializability, concurrency control Mechanisms & Algorithms; Time stamped & Optimistic concurrency control Algorithms, Deadlock Management.

UNIT III

Object Oriented Data Model:

Inheritance, Object identity, persistent programming languages, persistence of objects, comparing OODBMS and ORDBMS Data Warehousing & OLAP: Data warehouse, Multidimensional data model, OLAP operations, OLAP engine Association analysis: Apriori, partition, Pincer search,

FP-tree growth, Dynamic item set counting algorithms, rapid association rule mining, incremental, border algorithms, generalized association rule, item constraints.

UNIT IV

Cluster analysis:

Paradigms, Partitioning algorithms, k-Mediod, CLARA, CLARANS, Hierarchical algorithms, DBSCAN, BIRCH, CURE, Categorical clustering algorithms, STIRR, ROCK, CACTUS; Rough Set Theory: Definition, Reduct, Propositional reasoning, Types of reducts, Rule extraction, Decision tree, Fuzzy sets, Granular computing. Web & Text Mining: Web mining- content, structure, usage, Text mining, unstructured text, Episode rule discovery, Hierarchy of categories, text clustering. Temporal & Spatial Mining: Temporal association rules, Sequence mining, GSP algorithm, SPADE,SPIRIT, WUM, Episode discovery, Event Prediction Problem, Time series analysis, Spatial Mining tasks, trends, clustering.

Suggested Books:

1. M.Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Willipse Pelagatti: Distributed Databases, McGraw Hill.
3. Jiawei Han & Micheline Kamber "Data Mining – Concepts and Techniques" 2E - Harcourt India.
4. Arun.K.Pujari, " Data mining techniques" 2E,University press2009
5. Data Warehousing in the Real World – SAM ANAHORY & DENNIS MURRAY. Pearson,Edn Asia.
6. Data Warehousing Fundamentals – PAULRAJ PONNAIAH WILEY STUDENT EDITION

7. The Data Warehouse Life cycle Tool kit – RALPH KIMBALL WILEY STUDENT EDITION
8. Data Mining Introductory and advanced topics –MARGARET H DUNHAM, PEARSON EDUCATION

PhD-CS 1011: EMBEDDED SYSTEMS

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Introduction to Embedded Systems:

Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software, Complex System Design, and Design Process in Embedded System, Formalization of System Design, and Classification of Embedded Systems

UNIT II

8051 and Advanced Processor Architecture:

8051 Architecture, 8051 Micro controller Hardware, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, Interrupts, Introduction to Advanced Architectures, Real World Interfacing, Processor and Memory organization

Devices and Communication Buses for Devices Network:

Serial and parallel Devices & ports, Wireless Devices, Timer and Counting Devices, Watchdog Timer, Real Time Clock, Networked Embedded Systems, Internet Enabled Systems, Wireless and Mobile System protocols

UNIT III

Embedded Programming Concepts:

Software programming in Assembly language and High Level Language, Data types, Structures, Modifiers, Loops and Pointers, Macros and Functions, object oriented Programming, Embedded Programming in C++ & JAVA

UNIT IV

Real – Time Operating Systems:

OS Services, Process and Memory Management, Real – Time Operating Systems, Basic Design Using an RTOS, Task Scheduling Models, Interrupt Latency, Response of Task as Performance Metrics. RTOS Programming: Basic functions and Types of RTOSES, Windows CE

Embedded Software Development Process and Tools:

Introduction to Embedded Software Development Process and Tools, Host and Target Machines, Linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware-Software Design and Co-Design Testing, Simulation and Debugging Techniques and Tools: Testing on Host Machine, Simulators, Laboratory Tools

Suggested Books:

1. Embedded Systems, Raj Kamal, Second Edition TMH.
2. Embedded/Real-Time Systems, Dr.K.V.K.K.Prasad, dreamTech press
3. The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Pearson.
4. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.
5. An Embedded Software Primer, David E. Simon, Pearson Education.
6. Micro Controllers, Ajay V Deshmukhi, TMH.
7. Microcontrollers, Raj kamal, Pearson Education.
8. Introduction to Embedded Systems,Shibu K.V,TMH.

PhD-CS 1012: DIGITAL IMAGE PROCESSING

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Fundamental steps of image processing, components of an image processing of system, the image model and image acquisition, sampling and quantization, station ship between pixels, distance functions, scanner.

UNIT II

Statistical and spatial operations, Grey level transformations, histogram equalization, smoothing & sharpening-spatial filters, frequency domain filters, homomorphic filtering, image filtering & restoration. Inverse and weiner filtering FIR weiner filter. Filtering using image transforms, smoothing splines and interpolation.

UNIT III

Morphological and other area operations, basic morphological operations, opening and closing operations, dilation erosion, Hit or Miss transform, morphological algorithms, extension to grey scale images.

Segmentation and Edge detection region operations, basic edge detection, second order detection, crackedge detection, gradient operators, compass and laplace operators, edge linking and boundary detection, thresholding, region based segmentation, segmentation by morphological watersheds.

UNIT IV

Types and requirements, statistical compression, spatial compression, contour coding, quantizing compression, image data compression-predictive technique, pixel coding, transfer coding theory, lossy and lossless predictive type coding. Basics of color image processing, pseudocolor image processing, color transformation, color smoothing and sharpening, color segmentation, color image compression, compression standards.

Image Transforms - Fourier, DFT, DCT, DST, Haar, Hotelling, Karhunen -Loeve, Walsh, Hadamard, Slant. Representation and Description, Chain codes, Polygonal approximation, Signatures Boundary Segments, Skeltons, Boundary Descriptors, Regional Descriptors, Relational Descriptors, PCA.

Suggested Books:

1. Digital Image Processing – by Rafael.C.Gonzalez & Richard E.Woods, 3rd edition, Pearson Education,
2. 2008
3. Fundamentals of Digital Image Processing – by A.K. Jain, PHI
4. Digital Image Processing – William K, Part I - John Wiley edition.
5. Digital Image Processing using MATLAB – by Rafael.C.Gonzalez, Richard E.Woods, & Steven
6. L.Eddins, Pearson Education, 2006
7. Digital Image Processing, Kenneth R. Castleman, Pearson Education, 2007

PhD-CS 1013: INFORMATION SECURITY

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Security Goals, Security Attacks Interruption, Interception, Modification and Fabrication Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internet work security, Internet Standards and RFCs

UNIT II

Conventional Encryption Principles & Algorithms(DES, AES, RC4), Block Cipher Modes of Operation, Location of Encryption Devices, Key Distribution, Public key cryptography principles, public key cryptography algorithms(RSA, RABIN, ELGAMAL,Diffie-Hellman, ECC), Key Distribution.

UNIT III

Approaches of Message Authentication, Secure Hash Functions (SHA-512, WHIRLPOOL) and HMAC Digital Signatures: Comparison, Process- Need for Keys, Signing the Digest, Services, Attacks on Digital Signatures, Kerberos, X.509 Directory Authentication Service.

UNIT IV

Email Security: Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3, Intruders, Viruses and related threats, Virus Countermeasures Firewall Design principles, Trusted Systems, Intrusion Detection Systems

Suggested Books:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education,
2. 2008.
3. 2.Cryptography & Network Security by Behrouz A. Forouzan, TMH 2007.
4. Information Security by Mark Stamp, Wiley – India, 2006.
5. Information Systems Security,Godbole,Wiley Student Edition.
6. Cryptography and Network Security by William Stallings, Fourth Edition,Pearson Education 2007.
7. Fundamentals of Computer Security , Springer.
8. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
9. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY
10. 2006.
11. Modern Cryptography by Wenbo Mao, Pearson Education 2007.
12. Principles of Information Security, Whitman, Thomson.

PhD-CS 1014: INFORMATION RETRIEVAL SYSTEMS

Max. Marks: 80
Times: 3 Hrs.

Note: The Examiner is required to set eight questions in all with two questions from each Unit and the candidate shall be required to attempt five questions in all by selecting at least one question from each Unit.

UNIT I

Introduction:

Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses, Information Retrieval System Capabilities - Search, Browse, Miscellaneous.

UNIT II

Cataloging and Indexing:

Objectives, Indexing Process, Automatic Indexing, Information Extraction, Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure - Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages

UNIT III

Document and Term Clustering:

Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters - User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Weighted searches of Boolean systems, Searching the Internet and hypertext - Information Visualization: Introduction, Cognition and perception, Information visualization technologies.

UNIT IV

Text Search Algorithms:

Introduction, Software text search algorithms, Hardware text search systems; Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.

Multimedia Information Retrieval:

Models and Languages: Data Modeling, Query Languages, Indexing and Searching Libraries and Bibliographical Systems – Online IR Systems, OPACs, Digital Libraries.

Suggested Books:
1. Information Storage and Retrieval Systems: Theory and Implementation by Kowalski, Gerald,
2. Mark T Maybury Kluwer Academic Press, 2000.
3. Modern Information Retrival By Ricardo Baeza-Yates, Pearson Education, 2007.
4. Information Retrieval: Algorithms and Heuristics By David A Grossman and Ophir Frieder, 2nd
5. Edition, Springer International Edition, 2004.
6. Information Retrieval Data Structures and Algorithms By William B Frakes, Ricardo Baeza-Yates,
7. Pearson Education, 1992.
8. Information Storage & Retieval By Robert Korfhage – John Wiley & Sons.
9. Introduction to Information Retrieval By Christopher D. Manning and Prabhakar Raghavan,
10. Cambridge University Press, 2008.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK

SYLLABUS FOR Pre-Ph.D. COURSEWORK
Doctor of Philosophy (Ph.D.) - COMPUTER SCIENCE

Scheme of examination

w.e.f. 2011-12

S.No.	Course Code	Course Title	Internal Marks	Marks (Theory)	Total Marks	Course Requirements (Hrs)
1	PhD-CS 1001*	RESEARCH METHODOLOGY & ITS RELEVANCE IN COMPUTER SCIENCE	20	80	100	4
2	PhD-CS 1002	ELECTIVE-I	20	80	100	4
3.	PhD-CS 1003	ELECTIVE-II	20	80	100	4
	Total		60	240	300	12

ELECTIVE-I & ELECTIVE -2 PAPERS ARE TO BE SELECTED BY THE   CANDIDATE FROM THE LIST OF ELECTIVE PAPERS GIVEN BELOW:

LIST OF ELECTIVES

I	SOFTWARE DESIGN AND ENGINEERING
II	DATA WAREHOUSING AND MINING
III	MOBILE COMPUTING
IV	ADHOC AND SENSOR NETWORKS
V	SOFTWARE TESTING AND QUALITY ASSURANCE
VI	JAVA & WEB TECHNOLOGIES
VII	ADVANCED COMPILER DESIGN
VIII	ADVANCED COMPUTER NETWORKS

IX	ADVANCED DATA BASES	
X	EMBEDDED SYSTEMS	
XI	DIGITAL IMAGE PROCESSING	
XII	INFORMATION SECURITY	
XIII	INFORMATION RETRIEVAL SYSTEMS	