UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY
MAHARSHI DAYANAND UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATIONS

Doctor of Philosophy (Ph.D.) – COMPUTER SCIENCE & ENGINEERING
Scheme w.e.f. 2012-13

Pre-Ph-D Course

i) The duration of the Pre-Ph.D. course will be of one semester.
ii) The Department concerned shall design the Pre-Ph.D. course as per latest guide lines of UGC which are:
"The Pre-Ph.D. course must include a course on research methodology which may include quantitative methods and computer applications. It may also involve review of published research in relevant area".
iii) The scheme for Pre-Ph.D. course work is as under:
a) Common course:
      PhD-FET-101: Research Methodology (Quantitative Techniques and Computer
                              Applications in Research)
b) Departmental course:
      PhD-FET-102: Review of Literature and Seminar (in Relevant Research Area)
      PhD-FET-103: Elective Subject (Departmental Elective Subject)

iv) The qualifying marks in each paper of the course work shall be 50%.
vi) It is only on satisfactory completion of Pre-Ph.D Programme, which shall be an essential part and parcel of the Ph.D. programme that a candidate shall be eligible to apply for registration in Ph.D. Programme.

Sr. No.	Course No.	Course Title	Marks** of Internal	Examination Marks		Total Marks	Duration of Exam
				Theory	Practical		
1	PhD-FET-101	Research Methodology (Quantitative Techniques and Computer Applications in Research)	20	80	-	100	3
2	PhD-FET-102	Review of Literature and Seminar (in Relevant Research Area)	20	-	80	100	3
3	PhD-FET-103	Elective Subject (Departmental Elective Subject)	20	80	-	100	3
	Total		60	160	80	300	

**** Based on two assignments of 10 marks each

SYLLABUS (Pre PhD CSE)

List of Departmental Elective Subjects:

1	PhD-CSE-101	Advanced Information Security Systems
2	PhD-CSE-102	Digital Image Processing
3	PhD-CSE-103	Neural Networks
4	PhD-CSE-104	Advanced Topics in Database Systems
5	PhD-CSE-105	Performance Modeling
6	PhD-CSE-106	Data Warehousing and Mining
7	PhD-CSE-107	Software Testing and Quality Assurance
8	PhD-CSE-108	Embedded Systems
9	PhD-CSE-109	Advanced Wireless Networks
10	PhD-CSE-110	Genetic Algorithms
11	PhD-CSE-111	Grid Computing
12	PhD-CSE-112	Mobile Computing
13	PhD-CSE-113	Advanced Multimedia Technology
14	PhD-CSE-114	Parallel Computing
15	PhD-CSE-115	Web Engineering
16	PhD-CSE-116	Fuzzy Logic
17	PhD-CSE-117	Advanced Networking and Protocols
18	PhD-CSE-118	Intelligent Systems
19	PhD-CSE-119	Information Processing and E-commerce
20	PhD-CSE-120	Information Hiding Techniques
21	PhD-CSE-121	Data Modeling and Design
22	PhD-CSE-122	Structured Systems Analysis, Design and Testing
23	PhD-CSE-123	Information Theory and Coding
24	PhD-CSE-124	Fault Tolerant System

Note: The departmental elective subjects will be offered as per availability of expertise and the required infrastructure in the department.

PhD-FET- 101: RESEARCH METHODOLOGY
(Quantitative Techniques and Computer Applications in Research)

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions taking at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	**T**	**P/D**		
			Marks of Internal:	**20**
3	**-**	**-**	**Examination:**	**80**
Duration of Exam:		**3 Hrs**	**Total Marks:**	**100**

UNIT I: Element of Research
Scientific process meaning and definition, a brief history of scientific process. Introduction to research methodology- Meaning of research, objective of research, types of research, significance of research, problem encountered by researchers in india, Research problem- Definition, necessity and techniques of defining research problem, formulation of research problem, objective of research problem, research design- Meaning, need and features of good research design, types of research designs, basic principles of Experimental design. Sampling design, census and sample surveys, different types of sample designs, characteristics of good sample design, Techniques of selecting a random sample. Data collection-primary and secondary data, methods of selecting primary and secondary data,

UNIT II: Hypothesis & Statistical Analysis
Hypothesis- definition, testing of hypothesis, procedures of hypothesis testing, flow diagram for hypothesis testing, parametric and non-parametric tests for testing of hypothesis, limitations of tests of hypothesis. Hypothesis tests- One sample test-two sample tests/ chi square tests, association of attributes. T-tests, statistical analysis, correlation and regression analysis- analysis of variance, completely randomized design, randomized complete block design, Latin square design-partial and multiple correlations – discriminent analysis - cluster analysis – principle component and factor analysis, repeated measure analysis. Probability and probability distributions; Binomial, Poisson, distribution, Basic ideas of testing of hypotheses; Tests of significance based on normal distributions.

UNIT III: Paper Writing and Report Generation
Basic concepts of paper writing and report generation, review of literature, concepts of bibliography and references, significance of report writing, steps of report writing, types of research reports, methods of presentation of report.

UNIT IV: Computer Applications in Research
Computer Applications: Fundamentals of computers-Definition, types of computers, RAM, ROM, CPU, I/O devices, Number systems-Binary, octal and hexadecimal, base conversion, logic gates- AND, OR, NOT, Operating system-definition, types of operating system, Database system – definition & applications, Networks – definition & applications, Internet & its applications, Web Searching, Email, Uses of software's MS-Office-Power Point, Word, Excel and Access.

Text Books:
1. C. R. Kothari – Research Methodology Methods and Techniques – Wishwa Prakashan Publishers – Second Edition.

PhD- FET-102: REVIEW OF LITERATURE AND SEMINAR
(in Relevant Research Area)

1. The research student is required to prepare a concept paper/working, paper/review paper by reviewing at least 50 research papers / references books / unpublished doctoral dissertations / other reports etc.

2. To qualify the paper the research student is required either to present the prepared paper in an International Conference/ Seminar/ Workshop or publish the same in a research journal. Acceptance for publication or presentation will be considered as published/ presented.

3. A duly constituted committee of three teachers of the department by the Director/Head shall evaluate the completion of the paper.

PhD-CSE-101: ADVANCED INFORMATION SECURITY SYSTEMS

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions taking at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:	3 Hrs			Total Marks:	100

UNIT 1: CRYPTOGRAPHY

Basic Concepts, Cryptosystems, Crypto-Analysis, Ciphers & Cipher Modes, DES, AES, RSA algorithm, Key Management Protocols, Diffie Hellmann Algorithm, Digital Signatures, Message Digest, Secure Hash Algorithms, Public Key Infrastructure.

UNIT II: INFORMATION THEORY

Basic of Probability & Statistics, Shannon Characteristics, Perfect Secrecy, Confusion and Diffusion, Information Theoretic Tests, Unicity Distance, Entropy, Floating Frequency, Histogram, Autocorrelation, Periodicity, Random Analysis Tests, Zero Knowledge Technique.

UNIT III: MATHEMATICAL SECURITY

Basic Number Theory, Congruence, Chinese Remainder Theorem. Finite Fields, Discrete Logarithm, Bit Commitment, Random Number Generation, Inverses, Primes, Greatest Common Divisor, Euclidean Algorithm, Modular Arithmetic, Properties of Modular Arithmetic, Computing the inverse, Fermat's Theorem, Algorithm for Computing Inverses, NP-Complete Problems, Characteristics of NP-Complete Problems, Meaning of NP-Completeness, NP-Completeness and Cryptography.

UNIT IV: NETWORK SECURITY

Network Threats, Authentication & Access Control Mechanism, Secured Communication Mechanisms, Biometric, Secured Design for LAN, Firewall, Intrusion Detection System, Virtual Private Network, Email and Web Security. WEP, Access Controls, Secure Socket Layer, IPSEC, WAP Security, Security Issues, Challenges & Defense Mechanisms for Bluetooth, GSM, CDMA, GPRS, Wi-Fi, Wi-Max & IEEE Standards.

References:

- Security in Computing, Charles P. Pfleeger, Prentice- Hall International, Inc.,
- Applied Cryptography Protocols, Algorithms, and Source Code in C, Bruce Schneier, John Wiley & Sons, Inc., 1995.
- Digital Certificates Applied Internet Security", Jalal Feghhi, Jalli Feghhi and Peter Williams, Addison Wesley Longman.
- Introduction to Cryptography with Coding Theory, Wade Trppe, Lawrence C., Washington, Pearson Education.
- Network Security, Compete Reference, Tata Mc-Graw Hill.
- Fundamental of Computer Security, Piepryzyk, Hardjono, Seberry, Universities Press (India) Pvt. Ltd.

PhD-CSE-102: DIGITAL IMAGE PROCESSING

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:		3 Hrs		Total Marks:	100

UNIT I :   Introduction and Fundamentals
The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Components of an Image Processing Systems, Image Acquisition, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

UNIT 1I: Image Enhancement in Spatial Domain & Frequency Domian
Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters,
Introduction to Fourier Transform and the frequency Domain, Properties of 2-D Fourier Transform, Smoothing and Sharpening Frequency Domain Filters,

UNIT II1:   Image Restoration & Compression
A model of The Image Degradation / Restoration Process, Noise Models, Mean Filters, Order-Statistics Filters, Adaptive Filters, Bandreject Filters, Bandpass Filters, Notch Filters, Minimum Mean Square Error (Wiener) Filtering, geometric mean Filter, Inverse Filtering,
Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free compression, Lossy compression, Image compression standards.

UNIT 1V: Image Segmentation & Object Recognition
Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation.
Patterns and Pattern Classes, Minimum Distance Classifier, matching by Correlation, bayes Classifier

Text/Reference Books:
1.   Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 2nd edition, Pearson Education, 2004
2.   A.K. Jain, "Fundamental of Digital Image Processing", PHI, 2003
3.   Rosefield Kak, "Digital Picture Processing", 1999

PhD-CSE-103: NEURAL NETWORKS

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:		3 Hrs		Total Marks:	100

UNIT 1: Neuron Model and Network Architectures

Objective, History, Applications, biological inspiration, Neuron Model, Transfer Functions, Network Architectures.

UNIT 1I: Learning Rules

Perception Learning: Learning Rules, Perceptron Architecture, Perceptron Learning Rule, Training Multiple Neuron Perceptrons. Unsupervised Learning. Supervised Hebbian Learning: The Hebb Rule, Performance Analysis, Application, Variations of Hebbian Learning.

UNIT 1II: Transformations & Optimization

Linear Vector Spaces, Spanning a Space, Inner Product, Norm, Orthogonality, Vector Expansions, Linear Transformations, Matrix Representations, Change of Basis, Eigenvalue and Eigenvectors.

Performance surfaces and Optimization: Taylor Series, Directional Derivatives, Necessary Condition for Optimality, Quadratic Functions, Optimization Techniques; Steepest Descent, Newton's method, Conjugate Gradient Method.

UNIT 1V: Back propagation & Competitive Networks

The Backpropagation Algorithm; Performance Index, Chain Rule, Example, Drawbacks of Backpropagation, Heuristic Modifications; Momentum, Conjugate Gradient, Levenberg-Marquardt Algorithm.

Associative Learning and Competitive Networks: Simple Associative Network, Unsupervised Hebb Rule, Kohonen Rule, Competitive Learning Rule, Self Organizing Feature Maps.

Text/Reference Books:

1. M.T.Hagan, H.B.Demuth and M.Beale, "Neural Network Design" Thomson Learning, 2002

2. Simon Haykin, "Neural Networks – A Comprehensive Foundation," 2nd Edition, Pearson Education, 1999.

PhD-CSE-104: ADVANCE TOPICS IN DATABASE SYSTEMS

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	**T**	**P/D**		**Marks of Internal:**	**20**
3	**-**	**-**		**Examination:**	**80**
Duration of Exam:		**3 Hrs**		**Total Marks:**	**100**

UNIT 1: Indexing
Types of Single-Level Ordered Indexes, Multilevel Indexes, Dynamic Multilevel Indexes Using B-trees and B+-trees

UNIT 1I: Concurrency control
Locking Techniques for Concurrency Control, Concurrency Control Techniques Based on Timestamp Ordering

UNIT 1II: Transactions Processing
Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Schedules and Recoverability, Serializability of Schedules.

UNIT 1V: Parallel & Distributed databases
Introduction, I/O parallelism, inter-query parallelism, intra-query parallelism, interoperation parallelism, Design of parallel systems.
Distributed data storage, Network transparency, Distributed query processing, Distributed transaction model, commit protocols, coordinator selection, concurrency control, deadlock handling.

TEXT BOOKS
- Database System Concepts by A. Silberschatz, H.F.Korth and S.Sudarshan, 3rd edition, 1997, McGraw-Hill and International Edition.
- Fundamentals of Database Systems by R.Elmasri and S.B.Navathe, 3rd edition.
- An Introduction to Database Systems by C.J.Date, 7th edition, Addison-Wesley, Low Priced Edition, 2000
- Database Management and Design by G.W Hansen, 2nd edition, 1999, Prentice-Hall of India, Eastern Economy Edition.
- Database Management Systems by A,.K.Majumdar and P.Bhattacharyya.5th edition, 1999, Tata McGraw-Hill Publishing.
- Data Management & file Structure by Loomis, 1989, PHI

PhD-CSE-105: PERFORMANCE MODELING

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	**T**	**P/D**		**Marks of Internal:**	**20**
3	**-**	**-**		**Examination:**	**80**
Duration of Exam:		**3 Hrs**		**Total Marks:**	**100**

UNIT 1:   Probability
Review of Probability, Random variables and Distributions; Generating functions and transforms; Poisson, Markov and semi-Markov processes.

UNIT I1:   Queuing Systems
Characteristics of queueing systems; Little's formula; Markovian and non-Markovian queueing systems; embedded Markov chain applications to M/G/1, G/M/1, and related queueing systems.

UNIT 1II: Networks Simulations
Networks of queues; open and closed queueing networks, algorithms to compute the performance metrics. Simulation techniques for queues and queueing networks.

UNIT 1V: Advanced Topics
Advanced topics like queues with vacations, priority queues, queues with modulated arrival process, and discrete time queues; introduction to matrix-geometric methods; applications of the theory to the performance modelling of computer and communication networks.

Texts and References:
- D. Gross and C. Harris, *Fundamentals of Queueing Theory, 3rd Edition,* Wiley, 1998.
- R.B. Cooper, *Introduction to Queueing Theory, 2nd Edition,* North-Holland, 1981.
- L. Kleinrock, *Queueing Systems, Vol. 1: Theory,* Wiley, 1975; *Vol. 2: Computer Applications,* Wiley, 1976.
- R. Nelson, *Probability, Stochastic Processes, and Queueing Theory: The Mathematics of Computer Performance Modelling,* Springer, 1995.
- E. Gelenbe and G. Pujolle, *Introduction to Queueing Networks, 2nd Edition,* Wiley, 1998.
- T.G. Robertazzi, *Computer Networks and Systems: Queueing Theory and Performance Evaluation, 3rd Edition,* Springer, 2000.

PhD-CSE-106: DATA WAREHOUSING AND DATA MINING

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	**T**	**P/D**		**Marks of Internal:**	**20**
3	**-**	**-**		**Examination:**	**80**
Duration of Exam:		**3 Hrs**		**Total Marks:**	**100**

UNIT-I: Data Warehousing Architecture

Introduction to Data Warehousing: Evolution of Data Warehousing, Data Warehousing concepts, Benefits of Data Warehousing, Comparison of OLTP and Data Warehousing, Problems of Data Warehousing. Architecture: Operational Data and Datastore, Load Manager, Warehouse Manager, Query Manager, Detailed Data, Lightly and Highly summarised Data, Archive/Backup Data, Meta-Data, architecture model, 2-tier, 3-tier and 4-tier data warehouse, end user Access tools.

UNIT-II: Data Warehousing Tools and Technology

Tools and Technologies: Extraction, cleaning and Transformation tools, Data Warehouse DBMS, Data Warehouse Meta-Data, Administration and management tools, operational vs. information systems.OLAP & DSS support in data warehouse.

UNIT-III: Distributed Data Warehouse & Knowledge discovery

Types of Distributed Data Warehouses, Nature of development Efforts, Distributed Data Warehouse Development, Building the Warehouse on multiple levels.
 Knowledge discovery through statistical techniques, Knowledge discovery through neural networks, Fuzzy technology & genetic algorithms.

UNIT-IV: Types of Data Warehouses & Data Warehouse Design

Host based, single stage, LAN based, Multistage, stationary distributed & virtual data-warehouses. Data warehousing Design: Designing Data warehouse Database, Database Design Methodology for Data Warehouses, Data Warehousing design Using Oracle, OLAP and data mining: Online Analytical processing, Data mining.

Text Books:
1. Building the Data Warehouse, W.H.Inmon, 3rd Edition, John Wiley & Sons.
2. Developing the Data Warehouse, W.H.Inmon, C.Kelly, John Wiley & Sons.
3. Thomas Connoly, Carolyn Begg-"Database Systems-A practical approach to. Design, Implementation and management" 3rd Edition Pearson Education
4. W.H.Inmon, C.L.Gassey, "Managing the Data Warehouse", John Wiley & Sons.
5. Fayyad, Usama M. et. al., "Advances in knowledge discovery & Data Mining", MIT Press.

PhD-CSE-107: SOFTWARE TESTING AND QUALITY ASSURANCE

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:		3 Hrs		Total Marks:	100

UNIT-I: Introduction

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,

UNIT-II: Tools & Technologies

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: Quality Models

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: Standards

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.

References:
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-CSE-108: EMBEDDED SYSTEM

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		
3	-	-		

Marks of Internal: 20
Examination: 80

Duration of Exam: 3 Hrs   **Total Marks:** 100

UNIT-I: Introduction

The concepts of embedded system design, embedded microcontroller cores, embedded memories, examples of embedded systems. Technological aspects of embedded system: interfacing between analog and digital blocks, signal conditioning, Digital signal processing, subsystem interfacing, interfacing with external systems, user interfacing, Design tradeoffs due to process compatibility, Thermal consideration etc. Software aspects of embedded systems: real time programming languages and operating systems.

UNIT-II: Arctitecture

Introduction, CPU architecture, registers, instruction sets addressing modes Loop timing, timers, Interrupts; Interrupt timing, I/o Expansion, I2C Bus Operation Serial EEPROM, Analog to digital converter, UART Baud Rate-Data Handling-Initialization, Special Features - serial Programming-Parallel Slave Port.

UNIT-III: Processors

Motorola MC68H11 Family Architecture Registers, Addressing modes Programs. Interfacing methods parallel I/o interface, Parallel Port interfaces, Memory Interfacing, High Speed I/o Interfacing, Interrupts-interrupt service routine-features of interrupts-Interrupt vector and Priority, timing generation and measurements, Input capture, Output compare, Frequency Measurement, Serial I/o devices RS.232, RS.485. Analog Interfacing, Applications. ARM processors.

UNIT-IV: System Development

Embedded system development, Embedded system evolution trends. Round - Robin, robin with Interrupts, function-One-Scheduling Architecture, Algorithms. Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

Text Books:
1. David E Simon, " An embedded software primer ", Pearson education Asia, 2001.
2. John B Peat man " Design with Microcontroller ", Pearson education Asia, 1998.
3. Jonartthan W. Valvano Brooks/cole " Embedded Micro computer Systems. Real time Interfacing ", Thomson learning 2001.

References:
1. Burns, Alan and Wellings, Andy, " Real-Time Systems and Programming Languages", Second Edition. Harlow: Addison-Wesley-Longman, 1997.
2. Raymond J.A. Bhur and Donald L.Bialey, " An Introduction to real time systems: Design to networking with C/C++ ", Prentice Hall Inc. New Jersey, 1999.
3. Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.
4. Heath, Steve, " Embedded Systems Design ", Newnes 1997

PhD-CSE-109: ADVANCED WIRELESS NETWORKS

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:		3 Hrs		Total Marks:	100

UNIT-I :   Transmission & Spread Spectrum Techniques

Analog and Digital Data; Transmission fundamentals, Channel Capacity. Transmission Media. Multiplexing. LANs, MANs, and WANs. Switching Techniques; Circuit-Switching. Packet Switching. Asynchronous Transfer Mode- ATM. The Concept of Spread Spectrum. Frequency Hopping Spread Spectrum. Direct Sequence Spread Spectrum. Code-Division Multiple Access. Generation of Spreading Sequences.

UNIT-II: Cellular & CDMA Technology

Cellular Network Concept, First Generation (1G) Analog, Second Generation (2G) Digital TDMA. GSM and mobility management in GSM, Third Generation Systems (3G) CDMA and 4 G Technology overview. Principles of Wideband CDMA (WCDMA), CDMAOne and CDMA2000, Universal Mobile Telecommunications System (UMTS), Evolution of Mobile Communication Networks, Call Controls and Mobility Management in CDMA.Quality of Service (QoS) in 3G Systems, CDMA network planning, design and applications

UNIT-III :   Blue Tooth & IEEE 802.11 Wireless Networks

Radio Specifications. Base band Specification. Link Manager Specification. Logical Link Control and Adaptation Protocol. IEEE 802 Protocol Architecture. IEEE 802.11 Architecture and Services. IEEE 802.11 Medium Access Control. IEEE 802.11x Standards.

UNIT-IV: Wireless Application Protocol (WAP)

The Wireless Application Protocol application environment, wireless application protocol client software, wireless application protocol gateways, implementing enterprise wireless application protocol strategy and Security Issues in Wireless LAN. Wireless network management, GPRS, and VOIP services.

Text/Reference:
1.   William Stalling, Wireless Communications and Networks. Prentice Hall 2002
2.   Yi-Bing Lin, Imrich Chlamtac, Wireless and Mobile Network Architecture, John Wiley-2001.
3.   M. R. Karim, Mohsen Sarraf, W-CDMA and cdma2000 for 3G Mobile Networks, McGraw-Hill Professional, 2002

PhD-CSE-110: GENETIC ALGORITHMS

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	**T**	**P/D**		
3	**-**	**-**	**Marks of Internal:**	**20**
			Examination:	**80**
Duration of Exam:	**3 Hrs**		**Total Marks:**	**100**

UNIT-I: Genetic Algorithms in Scientific models

A brief history of evolutionary computation, Elements of Genetic Algorithms, A simple genetic algorithm, Applications of genetic algorithms, Evolving computer programs, data analysis & prediction, evolving neural networks, Modeling interaction between learning & evolution, modeling sexual selection, measuring evolutionary activity.

UNIT-II: Theoretical & Implementation of GA

Schemas & Two-Armed and k-armed problem, royal roads, exact mathematical models of simple genetic algorithms, Statistical- Mechanics Approaches. Data structures, Reproduction, crossover & mutation, mapping objective functions to fitness form, fitness scaling, coding, a multiparameter, mapped, fixed point coding, discretization and constraints.

UNIT-III: Applications of genetic algorithms

The risk of genetic algorithms, De Jong & function optimization, Improvement in basic techniques, current application of genetic algorithms

UNIT-IV: Advanced operators & techniques in genetic search

Dominance, duplicity, & abeyance, inversion & other reordering operators. Other micro operators, Niche & speciation, multiobjective optimization, knowledge based techniques, genetic algorithms & parallel processors.

Text Books:
1.   David E. Goldberg, "Genetic algorithms insearch, optimization & Machine Learning" Addison Wesley, 1989

References:
1.   Melanle Mitchell, "An introduction to genetic algorithms" MIT press, 2000.
2.   Masatoshi Sakawa, "Genetic Algorithms & Fuzzy Multiobjective Optimization", Kluwer Academic Publisher, 2001
3.   D. Quagliarella, J Periaux, C Poloni & G Winter, "Genetic Algorithms in Engineering & Computer science", John Wiley & Sons, First edition, 1997

PhD-CSE-111: GRID COMPUTING

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:		3 Hrs		Total Marks:	100

UNIT-I: Introduction

Grid Computing & Key Issues – Applications – Other Approaches – Grid Computing

Standards – Pragmatic Course of Investigation.

UNIT-II: Benefits & Status of Technology

Motivations – History of Computing, Communications an Grid Computing – Grid Prime

Time – Suppliers and Vendors – Economic Value- Challenges.

UNIT-III: Architectures

Components of Grid Computing Systems and Architectures: Basic Constituent Elements

– A Functional View – A Physical View – Service View.

UNIT-IV: Standards
Grid Computing Standards – OGSI: Standardization – Architectural Constructs –

Practical View – OGSA/OGSI Service Elements and Layered Model – More Detailed

view.

Text Books:
A Network Approach to Grid Computing, Daniel Minoli, Wiley Publication.

References:

1. Grid Computing – A Practical Guide to Technology and Applications, Ahmar

    Abbas, Charles Media Publication.

PhD-CSE-112: MOBILE COMPUTING

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:		3 Hrs		Total Marks:	100

UNIT-I: Overview

Mobile Computing and Applications, Overview 1G,2G,3G,4G technologies, Mobile IP and IPv6,VoIP.
CDPD- Architecture, air interface, radio resource allocation, roaming management.
Mobile Adhoc networks: Characteristics of MANETs, spectrum of MANET applications, Security consideration in MANETs, AODV, DSR routing protocols

UNIT-II: Mobility Management

Location Management, InterBS Handoff, Intersystem Handoff, Detection and assignment for handoff management, Strategies for handoff detection-Mobile controlled handoff, Network controlled handoff, mobile assisted handoff, handoff failure, hard handoff-MCHO link transfer, MAHO/NAHO link transfer, Soft handoff-adding and dropping new BS.

UNIT-III: Mobile Services

3G mobile services: Paradigm shift in 3G systems, WCDMA, CDMA2000, Improvements on core network, quality of service in 3G, Wireless operating systems for 3G handsets, DoCoMo W-CDMA field trial. GSM: Architecture, location tracking and call setup, security, data services-HSCSD, GPRS, GSM location updates, mobility databases, failure restoration, International GSM call setup, reducing international call delivery cost,

UNIT-IV: WAP & Markup Scripts

Wireless application protocol: WAP model, WAP gateway, WAP protocols-wireless datagram protocol, wireless transport layer security, wireless transaction protocol, wireless session protocol, wireless application environment, wireless local loop architecture and deployment issues, wireless local loop technologies-satellite based systems, cellular based systems, fixed wireless access systems.
Wireless markup language and wireless markup script: Fundamentals of WML, Writing and formatting text, Navigating between cards and decks, Displaying images, Tables, Using variables, Acquiring User input, Introduction to WML Script, Wml Script control Structures.

Text Books:
1. Yi Bing Li "Wireless and Mobile Network Architecture", John Wiley
2. Wrox "The beginning WML and WML script",Wrox Publication
3. John Schiller

PhD-CSE-113: ADVANCED MULTIMEDIA TECHNOLOGY

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D			
			Marks of Internal:	20
3	-	-	Examination:	80
Duration of Exam:	3 Hrs		Total Marks:	100

UNIT-I: Introduction

Concept of Multimedia, Media & data stream, main properties of multimedia system, Data stream characteristics &for continuous media Multimedia Applications, Hardware Software requirements, Storage Technologies: RAID, Optical Media.

UNIT-II: Compressions & File formats

Text, Basic sound concepts , MIDI , Speech ,Basic concept of Images, Graphics format ,Basic concepts of Video & animation, Conventional system, Computer based animation, Authoring Tools, Categories of Authoring Tools.
Compression Techniques: Lossless and Lossy compression, Run length coding, Statistical Coding, Transform Coding, JPEG, MPEG, Text compression using static Huffmann technique, Dynamic Huffman Technique, Arithmetic Technique.

UNIT-III: Animations

Introduction, Basic Terminology techniques, tweaning & morphing, Motion Graphics 2D & 3D animation.
Animation: Key frame animation, reactive animation, path animation, Skelton animation etc., deformers..

UNIT-IV: Advanced Topics

Dynamics: soft bodies, Rigid bodies and its usages in the scene etc.,
Rendering: soft, Hard rendering. IPR rendering, Line and box rendering etc.,
Special Effects: Shading & Texturing Surfaces, Lighting, Special effects.
Working with MEL: Basics & Programming

Text Book:
1.David Hillman, "Multimedia Technology & Applications", Galgotia Publications, 2000
Reference Books:
1.Nigel Chapman & Jenny Chapman, "Digital Multimedia", Wiley Publications, 2000
2.D.P. Mukherjee, "Fundamentals of Computer Graphics and Multimedia", PHI, 2001
3.Maya manuals.

PhD-CSE-114: PARALLEL COMPUTING

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:		3 Hrs		Total Marks:	100

UNIT-I: Parallel and Network Models

The state of computing, multiprocessors and multicomputers, multivector and SIMD computers, architectural development tracks.

Program and Network Properties: Conditions of parallelism, program partitioning and scheduling, program flow mechanisms. System Interconnect Architectures. Network properties and routing, static interconnection networks and dynamic interconnection networks, MPI and PVM architecture.

UNIT-II: Processors and Memory Hierarchy

Advanced processor technology- CISC, RISC, Superscalar, Vector, VLIW and symbolic processors, Memory hierarchy technology, Virtual memory technology (Virtual memory models, TLB, paging and segmentation). Cache memory organization, shared memory organization, sequential and weak consistency models

UNIT-III: Pipelining and Super scalar techniques

Linear Pipeline Processors, Nonlinear Pipeline processors, Instruction Pipeline Design, Arithmetic Pipeline Design.

UNIT-IV: Parallel and Scalable Architecture

Multiprocessors System Interconnects, Cache Coherence and Synchronization Mechanisms, Vector Processing Principles, Multivector Multiprocessors and Data Flow Architecture.

Text:
1.   Kai Hwang "Advanced Computer Architecture", McGraw Hill.

References:
1.   J.P.Hayes "Computer Architecture and Organization", McGraw Hill.
2.   Harvey G. Cragon, "Memory Systems and Pipelined Processors", Narosa Publication.
3.   V. Rajaranam & C.S.R. Murthy, "Parallel Computers", PHI.
4.   R. K. Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications.
5.   Kai Hwang and Zu, "Scalable Parallel Computers Architecture", McGraw Hill.
6.   Stalling W., "Computer Organization & Architecture", PHI.

<h1 align="center">PhD-CSE-115: WEB ENGINEERING</h1>

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:	3 Hrs			Total Marks:	100

UNIT-I: Information Architecture

The role of the Information Architect, Collaboration and Communication, Organizing Information, Organizational Challenges, Organizing Web sites and Intranets, Creating Cohesive Organization Systems Designing Navigation Systems, Types of Navigation systems, Integrated Navigation Elements, Remote Navigation Elements, Designing Elegant Navigation Systems, Searching Systems, Searching your Web Site, Designing the Search Interface, Indexing the Right Stuff, To search or Not To Search, Grouping Content, Conceptual Design, High-Level Architecture Blueprints, Architectural Page Mockups, Design Sketches.

UNIT-II: Dynamic HTML and Web Designing

HTML Basic Concepts, Good Web Design, Process of Web Publishing, Phases of Web Site development, Structure of HTML documents, HTML Elements-Core attributes, Language attributes, Core Events, Block Level Events, Text Level Events, Linking Basics, Linking in HTML, Images and Anchors, Anchor Attributes, Image maps, Semantic Linking Meta Information, Image Preliminaries, Image Download Issues, Image as Buttons, Introduction to Layout: Backgrounds, Colors and Text, Fonts, Layout with Tables. Advanced Layout: Frames and Layers, HTML and other media types. Audio Support in Browsers, Video Support, Other binary Formats. Style Sheets, Positioning with Style sheets. Basic Interactivity and HTML: FORMS, Form Control, New and emerging Form elements.

UNIT-III: Java Server Pages and Active Server Pages

Basics, Integrating Script, JSP/ASP Objects and Components, configuring and troubleshooting,: Request and response objects, Retrieving the contents of a an HTML form, Retrieving a Query String, Cookies, Creating and Reading Cookies. Using application Objects and Events.

UNIT-IV: Overview of advance features of XML

Basics, Integrating Script, Objects and Components, Configuring and troubleshooting, advanced features & their creation and applications, embedding XML with other tools.

Text Books:
- HTML The complete Reference, TMH
- CGI Programming with Perl 2/e, Scott Guelich, Shishir Gundavaram, Gunther Birzniek; O'Reilly
- Doug Tidwell, James Snell, Pavel Kulchenko; Programming Web Services with SOAP, O' Reilly
- Pardi, XML in Action, Web Technology, PHI

PhD-CSE-116: FUZZY LOGIC

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	**T**	**P/D**		**Marks of Internal:**	**20**
3	**-**	**-**		**Examination:**	**80**
Duration of Exam:		**3 Hrs**		**Total Marks:**	**100**

UNIT-I: Fuzzy Logic

Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

Operations on Fuzzy Sets: Complement, Intersection, Union, Combinations of Operations, Aggregation Operations.

UNIT-II: Fuzzy Arithmetic

Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges.

UNIT-III : Uncertainty based Information

Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets, Bayesian Theory & other uncertainty theories.

UNIT-IV: Applications & Genetic Algorithms

Application of Fuzzy Logic: Medicine, Economics etc.

Genetic Algorithm: An Overview, GA in problem solving, Implementation of GA

Introduction of Neuro-Fuzzy Systems: Architecture of Neuro Fuzzy Networks.

Text Books:

1.   "An Introduction to Neural Networks", Anderson J.A., PHI, 1999.
2.   "Introduction to the Theory of Neural Computation", Hertz J. Krogh, R.G. Palmer, Addison-Wesley, California, 1991.
3.   "Fuzzy Sets & Fuzzy Logic", G.J. Klir & B. Yuan, PHI, 1995.
4.   "An Introduction to Genetic Algorithm", Melanie Mitchell, PHI, 1998.

Reference books:

1.   "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
2.   "Neural Networks: Algorithms, Applications and Programming Techniques", Freeman J.A. & D.M. Skapura, Addison Wesley, Reading, Mass, (1992).

PhD-CSE-117: ADVANCED NETWORKING AND PROTOCOLS

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D			
3	-	-	**Marks of Internal:**	20	
			Examination:	80	

Duration of Exam: 3 Hrs   **Total Marks: 100**

UNIT-I: Review of Basic Concepts

Network Architecture- Protocol Hierarchies, Layered model, Services, Interface, Reference Models,Underlying Technologies, LAN's (Ethernet, Token Ring, Wireless), Point-to-Point WAN's, Switched WAN's (X.25, Frame Relay, ATM)

UNIT-II: Internet Layer Protocols

IP- Datagram, fragmentation and reassembly, ICP, ICMP
Interior and Exterior Routing-RIP, OSPF, BGP, Multicast Routing- Unicast, Multicast and Broadcast, Multicasting

UNIT-III: The Transport Layer

The transport service-Services provided, Service primitives, Sockets, Elements of transport protocols-addressing, connection establishment, connection release, flow control and buffering, multiplexing, crash recovery, UDP-Introduction, Remote Procedure Call, TCP- Service model, Protocol, frame format, connection establishment release, connection management

UNIT-IV: The Application Layer

DNS, Telnet and Rlogin, FTP,TFTP,SNMP, SMTP, World Wide Web(Client and Server Side, cookies, wireless web), Java and the Internet, Multimedia (streaming audio, Internet Radio, voice over IP-RTP, video standards) Real time traffic over the internet

References:

1.   Behrouz Forouzan, TCP/IP Protocol Suite, Second Edition, Tata McGraw Hill

2.   Andrew S Tanenbaum, Computer Networks, Fourth Ecition, Pretice Hall

3.   Douglas E. Comer, Internetworking with TCP/IP,Vol. 1, Principles, Protocols and Architecture Fifth Edition, Prentice Hall, 2000, ISBN o-13-018380-6.

4.   William Stallings, Data and Computer Communications, Seventh Edition, Pearson Education

PhD-CSE-118: INTELLIGENT SYSTEMS

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D			
			Marks of Internal:		20
3	-	-	**Examination:**		80
Duration of Exam:		3 Hrs	**Total Marks:**		100

UNIT-I: Introduction

Intelligent Agents – Agents and environments – Good behavior – The nature of environments – structure of agents – Problem Solving – problem solving agents – example problems – searching for solutions – uniformed search strategies –avoiding repeated states – searching with partial information.

UNIT-II: Searching Techniques

Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments – Constraint satisfaction problems (CSP) –Backtracking search and Local search – Structure of problems – Adversarial Search

UNIT-III: Knowledge Representation

First order logic - syntax and semantics – Using first order logic – Knowledge engineering – Inference – propositional versus first order logic – unification and lifting – forward chaining – backward chaining – Resolution – Knowledge representation

UNIT-IV: Learning

Learning from observations – forms of learning – Inductive learning – Learning decision trees – Ensemble learning – Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods – Learning with complete data – Learning with hidden variable – EM algorithm – Instance based learning.

Text Books:
1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education / Prentice Hall of India, 2004.
References:
1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Second Edition, Tata McGraw Hill, 2003.
3. George F. Luger, "Artificial Intelligence-Structures And Strategies For Complex Problem Solving", Pearson Education / PHI, 2002.

PhD-CSE-119: INFORMATION PROCESSING AND E-COMMERCE

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D			
			Marks of Internal:	20
3	-	-	**Examination:**	80
Duration of Exam:		3 Hrs	**Total Marks:**	100

UNIT-I: Compression
Compression & Decompression Techniques – Loosy & Loose less Techniques, Different formats of multimedia files such as images, videos and audios will be studied

UNIT-II: Algorithms and Analysis
Elementary data Structures and their operations, Basic search and traversal techniques, Divide-Conquer techniques, Greedy method, Branch bound.

UNIT-III: Searching & Computing
Cloud Computing: Introduction, Iaas, Paas, Saas, Baas, Internetworking between Clouds. Search Engine Strategies: Functioning, Making information accessible on net, Getting better rating and preference in search engines

UNIT-IV: E-Commerce
Overview of E-Commerce, Benefits of E-Commerce, Impact of E-Commerce, Applications of E-Commerce, Business Models of E-Commerce. Electronic Payment System: Introduction to Payment System, Online Payment System, Pre-paid and Post-paid Payment System. Security in E-Commerce: Transaction Security, Cryptology, Authentication Protocol, Digital Signature.

References:

1. "Security Technologies for World Wide Web", Rolf Oppliger, Artech House: Inc.

2. "Introduction to Cryptography with Coding Theory", Wade Trappe, Lawrence C. Washington, Pearson Education.

3. "Network Security: Complete Reference", TMH

4. "Compilers: principles, Techniques and Tools" ,Aho, Lam, Ullman, Pearson Education.

5. P.T. Joseph: E-Commerce - A Managerial Perspective, PHI Publication.

6. Jeffery: Introduction to E-Commerce, TMH.

7. Fundamentals of computer algorithms by Horowitz, Ellis; Sahni, Sartaj & Rajasekaran, university Press.

8. Cloud Computing: Web-Based Applications that change the way you work and collaborate By Michael miller.

PhD-CSE-120: INFORMATION HIDING TECHNIQUES

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:	3 Hrs			Total Marks:	100

UNIT- I: Introduction

Introduction to Information Hiding: Types of Information Hiding, Applications, Importance & Significances. Differences between cryptography and steganography, Wisdom from Cryptography, types of steganography their application and significances. Past present and future of steganography

UNIT- II: Principles of Steganography

Framework for Secret Communication, Security of Steganography System, Information Hiding in Noisy Data, Adaptive versus non-Adaptive Algorithms, Active and Malicious Attackers, Information hiding in Written Text, Steganographic system, Study of Different methods of insertion and retrieval of message using image steganography, Study of histrogram analysis using MATLAB of original image and stego image

UNIT- III: Watermarking and Copyright Protection

Basics of watermarking, Watermarking process, Watermarking applications, Requirements and Algorithmic Design Issues, Evaluation and Benchmarking of Watermarking, Bit plane of an Image, study of noises in stego images and their comparisons, Robustness of watermarking schemes on different attacks like blurring, cropping , compression of the image. PSNR calculation of the images.

UNIT IV: Biometrics & Frame proof codes

Use of image steganography in biometric sciences, Study of security enhancement of biometric template using steganographic

Frame proof codes:-Definition, Introduction of frame proof codes, Methods to obtain 2-frame proof codes using mutually orthogonal latin squares. Use of frame proof codes in ownership and software piracy.

PhD-CSE-121: DATA MODELING AND DESIGN

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:	3 Hrs			Total Marks:	100

UNIT-I: Conceptual Modeling
Conceptualization and 100% principles, ER, SHM, SHM+
Conversion of conceptual schemas to relational models
High and Low CASE tools

UNIT-II: Object oriented modeling
Functional modeling, dynamic modeling, and object modeling, Representation of these in UML
Principles of class design: Open closed principle, Liskov's substitution principle, dependency inversion principle
Principles of package design: package cohesion principle, common-reuse principle, common-closure principle, package coupling, stable dependencies principle.

UNIT-III: Multidimensional modeling
Facts, dimension, aggregate, star schema, snowflake schema, constellation.
Conversion of ER to star schema, Star schema to relational schema, using multi-dimensional data structures

UNIT-IV: Structured systems analysis
Statement of purpose, context diagram, developing process hierarchy. Use cases
XML, XML schema, XML query

PhD-CSE-122: STRUCTURED SYSTEMS ANALYSIS, DESIGN AND TESTING

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:		3 Hrs		Total Marks:	100

UNIT-I: Structured systems design & Principles
Structuring definition, application to real world phenomena,
Data Flow Diagrams, principles of module design, cohesion, coupling

UNIT-II: Structured programming languages
Data structuring: need, definition, evolution of data structuring in Fortran, COBOL, Pascal, C Control structuring: need, definition, control structuring in Fortran, COBOL, Pascal, C program structuring: need, side effects, calling conventions and their applications in program structuring.

UNIT-III: Testing Structured Systems
Testing life cycle, Notion of a test case,
White box testing: statement testing, branch testing, condition testing, basis path, cyclomatic complexity, loop testing, testing recursive programs
Integration testing: top down and bottom up testing, stubs and drivers
Black box testing: domain testing, equivalence class testing, boundary value testing and its different forms, Cause-effect graphs.

UNIT-IV: Structured systems analysis
Statement of purpose, context diagram, developing process hierarchy. Use cases.

PhD-CSE-123: INFORMATION THEORY AND CODING

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D			
			Marks of Internal:	20
3	-	-	Examination:	80
Duration of Exam:	3 Hrs		Total Marks:	100

Unit 1: Information Theory
Marginal, joint and conditional entropy, information rate, mutual information, channel capacity of various channels, cascaded channels, repetition of signals

Unit 1: Shannon's theorem
Shannon Hartley theorem, bandwidth- S/N ratio tradeoff, continuous channel, negative entropy

Unit 1: Coding
Irreducibility, separatibility, coding efficiency, source encoding, Shannon Fano code, Huffman code, and data compression

Unit 1: Channel Encoding
Minimum distance, error detection and correction, FEC and ARQ, block code, convolution codes, and cyclic codes, signal error correction, multiple error correction, burst error correction, Cryptography, Encryption and decryption

References:
1. Information Theory; F.M Reza; McGraw Hills
2. Digital and Analog Communication Systems; K Sam Shanmugam; John Wiley
3. Communication Systems: Analog and digital; Singh and Sapre; TMH 1995
4. Digital Communication; B. Sklar; Pearson Education Asia

PhD-CSE-124: FAULT TOLERENT SYSTEM

Note: Total 9 questions are to be set by the examiner/teacher covering the entire syllabus uniformly. A candidate is required to attempt any five questions at least one question from each unit. Question no. 1 is Compulsory. All questions shall carry equal marks.

L	T	P/D		Marks of Internal:	20
3	-	-		Examination:	80
Duration of Exam:	3 Hrs			Total Marks:	100

Unit 1:   Introduction

Top challenges facing the practice of fault-tolerances. Definitions, Dependability, Maintainability, Fault-Error-Failure. Redundancy, Error Detection, Damage Confinement, Error Recovery, Fault Treatment, Passive HW Redundancy, Voting. Fault Prevention -Fault tolerance – anticipated and unanticipated Faults- Test generation for digital systems-Combinational logic.

Unit 1I: Error models

General coding scheme – Parity checking code- arithmetic code – code for computer memories –checking errors in logical operation – communication coding. Error detection techniques: Watchdog processors, Heartbeats, consistency and capability checking, Data audits, Assertions, Control-flow checking, Error control coding. Application: DHCP Fault tolerance: Coding technique-fault tolerant self checking and fail safe circuits-fault tolerance in combinatorial and sequential circuits- synchronous and asynchronous fail safe circuits. Software fault tolerance: Process pairs, Robust data structures, N version programming, Recovery blocks, Replica consistency & reintegration, Multithreaded programs Application: VAX

Unit II1:   Experimental Evaluation

Network fault tolerance: Reliable communication protocols, Agreement protocols, Database commit protocols -Application: Distributed SQL server

Check pointing & Recovery - Application: Micro check pointing, IRIX Checkpoints Experimental Evaluation: Modeling and simulation based, Fault injection based - Application: NFTAPE fault injector

Modeling for performance, dependability and performability: dependability-specific methods (fault trees, reliability block diagrams), queues, stochastic Petri nets and stochastic activity networks - Application: UltraSAN

Unit 1V: Practical Systems for Fault Tolerance

Application: Ad-hoc wireless network- Application: NASA Remote Exploration & Experimentation System, Architecture: Fault tolerant computers - general purpose commercial systems-fault tolerant multiprocessor and VLSI based communication architecture. Fault tolerant software: Design-N-version programming recovery block - acceptance tests-fault trees- validation of fault tolerant systems.

REFERENCES
K.K.Pradhan, "Fault Tolerant computing theory and techniques" volume III. P Hall, 1989.
Anderson and Lee, "Fault Tolerant principles and practice" ,PHI 1989.
Parag K. Lala, "Fault Tolerant and Fault Testable, Hardware design" PHI 1985.
LALA, " Digital systems design using PLD's ",PHI 1990.
N. N. Biswas, "Logic Design theory", PHI 1990.
Shem , toy Levei , Ashok K.Agarwala , "Fault Tolerant System design", Tata MG Hill, 1994
V. Nelson, "Fault-Tolerant Computing: Fundamental Concepts".