MAULANA AZAD NATIONAL URDU UNIVERSITY
SCHOOL OF TECHNOLOGY
DEPARTMENT OF CS&IT

Ph.D. (Computer Science)
Course Work

- Department of CS&IT offer three courses/papers in PhD Course Work. A minimum of four credits shall be assigned to the course on Research Methodology, which shall cover areas such as quantitative methods, computer applications, research ethics and review of published research in the relevant field, training, field work, etc. Other two courses shall be advanced level courses preparing the students for PhD degree.

  The following shall be the outline for course work in PhD Semester I:
  - Compulsory Research Methodology Course (4 credits/100 marks)
  - Compulsory Course on Broad Field of study (4 credits/100 marks).
  - One Optional Course (4 credits/100 marks). Optional courses shall be developed in view of the research thrust area of the Department/Centre. The Departmental Research Committee/Board of Studies of subject concerned shall decide and develop the optional courses to be offered to PhD research scholars. Each of these optional courses shall be of 4 credits (100 marks) each.

S. No.	Code	Course Name	Course Type	Credits	Mark (Internal + External)	
1	PHCS101CCT	Research Methodology	Core	4	30	70
2	PHCS102CCT	Software Engineering	Core	4	30	70
	Electives offered by the Department		To opt for one course among the following Discipline specific electives			
1	PHCS101DST	Advance Computer Architecture	Prof. Elective	4	30	70
2	PHCS102DST	Advance Network Security	Prof. Elective	4	30	70
3	PHCS103DST	Neural Network	Prof. Elective	4	30	70

4	PHCS104DST	Distributed Database	Prof. Elective	4	30	70
5	PHCS105DST	Machine Learning	Prof. Elective	4	30	70
6	PHCS106DST	Fuzzy System	Prof. Elective	4	30	70
7	PHCS107DST	Advanced Operating System	Prof. Elective	4	30	70
8	PHCS108DST	Real Time System	Prof. Elective	4	30	70
9	PHCS109DST	Software Metrics	Prof. Elective	4	30	70
10	PHCS110DST	Software Quality Engineering	Prof. Elective	4	30	70
11	PHCS111DST	Wireless Mobile Networks	Prof. Elective	4	30	70
12	PHCS112DST	Nature Language Processing	Prof. Elective	4	30	70
13	PHCS113DST	Applied Cryptography	Prof. Elective	4	30	70
14	PHCS114DST	Human Computer Interaction	Prof. Elective	4	30	70
15	PHCS115DST	Bio Informatics	Prof. Elective	4	30	70
16	PHCS116DST	Information Security and Cyber Laws	Prof. Elective	4	30	70
17	PHCS117DST	Advanced Networks	Prof. Elective	4	30	70

Course Code	Course Title	Lecture			Semester: I
PHCS101CCT	Research Methodology	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To study and understand the research issues & challenges, research goals, scientific methods
2. To study Sampling, External Validity, Levels of Measurement, Scaling and Qualitative Measures.Data Preparation, Descriptive Statistics and Correlation; and Inferential Statistics
3. Reviewing Literature and Research Papers; Writing Research Papers, Thesis, Reports and Project Proposals Plagiarism and Copyrights.

Course Outcomes:

1. The basic concepts of research and its methodologies, Identify appropriate research topics, select and define appropriate research problem and parameters
2. Prepare a project proposal (to undertake a project)
3. Oorganize and conduct research in a more appropriate manner, writing research report and thesis.

Detailed Contents:

Unit: 1	**Research Foundations:** Research, Research Goals and Quality Research, Types of Research, Variables, Hypotheses and Data; Structure, Positivism and Post-Positivism; Scientific Methods, Reasoning and Arguments; Mathematical Methods of Proof and Research Fallacies.
Unit: 2	**CS Research Context:** Nature of Computer Science, Scientific Methods in Computer science, Types of Research in CS, Research Methods in Computer Science, Research Paradigms in CS, Grand Challenges for CS Research.
Unit: 3	**Measurements:** Sampling, External Validity, Levels of Measurement, Scaling and Qualitative Measures. **Research Design:** Internal Validity, Types of Designs, Experimental Design, Probabilistic Equivalence, Hybrid Experimental Designs and Quasi-Experimental Design.
Unit: 4	**Statistical Inference:** Conclusion Validity, Threats to Conclusion Validity, Improving Conclusion Validity, and Statistical Power; Data Preparation, Descriptive Statistics and Correlation; and Inferential Statistics.
Unit: 5	**Research Skills:** Reviewing Literature and Research Papers; Writing Research Papers, Thesis, Reports and Project Proposals; Formatting, Appendices, Citation Formats and Style; General Conventions, Issues, Plagiarism and Copyrights.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Research Methodology: a step-by-step guide for beginners, Kumar, Pearson Education.
2	Practical Research Methods, Dawson, C., UBSPD Pvt. Ltd.
3	Montgomary, Douglas C. & Runger, George C. (2007) 3/e, Applied Statistics & probability for Engineers (Wiley India).

Reference Books:

1	Kothari C.K. (2004) 2/e, Research Methodoloy – Methods and Techniques (New Age International, New Delhi).
2	Krishnswamy, K.N., Shivkumar, Appa Iyer and Mathiranjan M. (2006) Management Research Methodology; Integration of Principles, Methods and Techniques (Pearson Education, New Delhi).
3	Researching Information System and Computing by Briony J Oates.

Course Code	Course Title	Lecture			Semester: I
		L	T	P	
PHCS102CCT	Software Engineering	3	1	0	
Version:	**Date of Approval:**				

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. Study the fundamentals of software systems (including analysis, design, construction, maintenance, quality assurance and project management) using the appropriate theory, principles, tools and processes.
2. Use appropriate computer science and mathematics principles in the development of software systems.
3. Develop software in at least one application domains like Healthcare, safety, Society, Legal, Environment, Communication etc.

Course Outcomes:

1. To apply software engineering theory, principles, tools and processes, as well as the theory and principles of computer science and mathematics, to the development and maintenance of complex software systems.
2. To design and validate various software prototypes and to develop quality software metrics.
3. To elicit, analyze and specify software requirements through a productive working relationship with project stakeholders.

Detailed Contents:

Unit: 1	Software Engineering Fundamentals: Definition of software product and process, Software Characteristics, Components, Applications, Layered Technologies, Processes and Product, Methods and Tools, Generic View of Software Engineering, Software Crisis, Software development paradigms, Techniques of Process Modeling, Software Process and lifecycle models: Build & Fix Model, Waterfall Model, Prototyping Model, Iterative Enhancement Model, Evolutionary Development Model and Spiral Model, Incremental, and Concurrent Development Model.
Unit: 2	Software Requirements Analysis & Specification: System specification, Software requirements specification (SRS) standards, Formal specification methods, Specification tools, Requirements validation and management. Problem Recognition, Evaluation and Synthesis, Modeling, Specifications and Review Techniques. Analysis Modeling: Difference between Data and Information, ER Diagram, Dataflow Model, Control Flow Model, Control and Process Specification, Data Dictionary.
Unit: 3	Software Design: Software architecture, Modular Design-cohesion and coupling, Process-oriented design, Process and Optimization, Data-oriented design, User-interface design, Real-time software design, Architectural Designing, Interface Design, Procedural Design, Object Oriented Design. CASE Tools: Computer-aided software engineering, Introduction to CASE, Building Blocks of CASE, Relevance of CASE tools, High-end and low-end CASE tools, automated support for data dictionaries, DFD, ER diagrams, Integrated Case Environment, CASE workbenches.
Unit: 4	Coding and Testing: Choice of Programming languages, Coding standards, Introduction to Testing Process, Functional & Structural Testing, Testing Activities like Unit, Integration & System Testing, Testing tools and workbenches. User Interface Design: Concepts of UI, Interface Design Model, Internal and External Design, Evaluation, Interaction and Information Display.
Unit: 5	Configuration Management: Concepts in Configuration Management, The Configuration Management Process: Planning and Setting up Configuration Management, Perform Configuration Control, Status Monitoring and Audits. Software Maintenance: What is software maintenance, Maintenance Process & Models, Reverse Engineering, Software re- engineering, Configuration Management issues and concept, Configuration planning & techniques, Software versions and change control process, Documentation.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	R. Pressman, "Software Engineering", 7th Edition, 2002, McGraw-Hill.
2	W.S. Jawadekar, Software Engineering – A Primer, TMH-2008

Reference Books:

1	Software Engineering, Yogesh Singh, New Age Publications, Delhi.
2	Shari Pfleeger, "Software Engineering", 2001, Pearson Education.

Course Code	Course Title	Lecture			
PHCS101DST	Advanced Computer Architecture	L	T	P	Semester: I
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To learn the fundamental aspects of computer architecture design and analysis.
2. To focus on processor design, pipelining, superscalar, out-of-order execution, caches (memory hierarchies), virtual memory, storage systems, and simulation technique.
3. To understand different processor architectures and system-level design processes.

Course Outcomes:

1. Will know about computer performance, instruction set architecture design and implementation
2. Will know about uniprocessor implementation alternatives (single- cycle, multiple-cycle, and pipelined implementations).
3. Understand the organisation and operation of current generation parallel computer systems, including multiprocessor and multicore systems.

Detailed Contents:

Unit: 1	**Review of Basic Organization and Architectural Techniques:** RISC processors, Characteristics of RISC processors, RISC Vs CISC, Classification of Instruction Set Architectures, Review of performance measurements, Basic parallel processing techniques: instruction level, thread level and process level, Classification of parallel architectures.
Unit: 2	**Instruction Level Parallelism:** Basic concepts of pipelining, Arithmetic pipelines, Instruction pipelines, Hazards in a pipeline: structural, data, and control, Hazards, Overview of hazard resolution techniques, Dynamic instruction scheduling, Branch prediction techniques, Instruction-level parallelism using software approaches, Superscalar techniques, Speculative execution.
Unit: 3	**Memory Hierarchies:** Basic concept of hierarchical memory organization, Main memories, Cache memory design and implementation, Virtual memory design and implementation, Secondary memory technology, RAID.
Unit: 4	**Thread Level Parallelism:** Centralized vs. distributed shared memory, Interconnection topologies, Multiprocessor architecture, Symmetric multiprocessors, Cache coherence problem, Synchronization, Memory consistency, Multicore architecture, Review of modern multiprocessors.
Unit: 5	**Process Level Parallelism:** Distributed computers, Clusters, Grid, Mainframe computers. **Peripheral Devices:** Bus structures and standards, Synchronous and asynchronous buses, Types and uses of storage devices, Interfacing I/O to the rest of the system, Reliability and availability, I/O system design, Platform architecture.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Hennessey and Patterson, "Computer Architecture: A quantitative Approach", Morgan Kaufman.
2	

Reference Books:

1	Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill international Edition.
2	Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill

Course Code	Course Title	Lecture			Semester: I
PHCS102DST	Advanced Network Security	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To describe the following electronic payment systems: NetBill, PayWords, MicroMint, fair exchange protocols.
2. To explain the two types of group management techniques: group key agreement and group key distribution.
3. To explain at least on secure MANET routing protocol.

Course Outcomes:

1. Have a knowledge of the threats faced by computer operating systems, applications and networks that originate from network based attacks, intrusion and misuse
2. Have a knowledge of the types of countermeasures that can be put in place in computer systems, networks, and network infrastructures to identify, reduce or prevent problems caused by network attacks or misuse .
3. Be capable of making informed choices of the appropriate countermeasures that should be put in place to protect systems from network attacks or misuse and to maintain network security

Detailed Contents:

Unit: 1	Introduction to the Concepts of Security: The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks.
Unit: 2	Modular arithmetic, prime numbers, relative prime numbers, Euler's function, GCD. Computer-based Symmetric Key Cryptographic Algorithms: Algorithm Types and Modes, International Data Encryption Algorithm (IDEA), RC5, Blowfish, AES, Differential and Linear Cryptanalysis.
Unit: 3	Computer-based Asymmetric Key Cryptography: Brief History of Asymmetric Key Cryptography, An overview of Asymmetric Key Cryptography, Rabin Algorithm, Elgamal Algorithm, Knapsack Algorithm, ID-based cryptography.
Unit: 4	Public Key Infrastructure: Digital Certificates, Private Key Management, The PKI Model, Internet Security Protocols: Secure Socket Layer, Secure Electronic Transaction, SHTTP, Time Stamping Protocol, 3-D Secure Protocol, Electronic payment systems: Electronic billing systems, Micropayments, Fair exchange protocols, E-mail Security.
Unit: 5	Understanding Session Hijacking, Spoofing, TCP Concepts Sequence numbers. Sniffing,, RDDoS, XSS Attack, WLAN Scanners, Securing Wireless Networks, Anonymous Wireless Communication, Jamming and anti-jamming techniques for wireless networks.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Cryptography and Network Security by Behrouz A. Forouzan, 2nd Edition TMH.
2	Cryptography and Network Security, W. Stallings, Prentice Hall, 5th Edition, 20102.
3	Network Security Essentials, William Stallings ,Prentice Hall, 5th Edition, 2013

Reference Books:

1	Firewalls and Internet Security, William R. Cheswick and Steven M. Bellovin, Addison-Wesley Professional, 2ndEdition, 2003.
2	Hackers Beware, Eric Core, EC-Council Press, 2003
3	

Course Code	Course Title	Lecture			Semester: I
PHCS103DST	Neural Network	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.
2. To provide knowledge of types of neural networks
3. To provide knowledge of computation and dynamical systems using neural networks.

Course Outcomes:

1. The role of neural networks in engineering, artificial intelligence, and cognitive modeling.
2. Have an understanding of the concepts and techniques of neural networks through the study of the most important neural network models.
3. Have knowledge of sufficient theoretical background to be able to reason about the behavior of neural networks.

Detailed Contents:

Unit: 1	General characteristics of the human brain, Introduction to Biological Neural Networks, Nerve structure and synapse, Basic concepts of Neural Networks, Characteristics of Neural Networks, Terminologies, Applications of the artificial neural networks.
Unit: 2	Structure of a neural net (topology), Directed graphs, Models of Neuron, Neural Network Architectures, Artificial Neuron, Activation functions, Threshold function, Piecewise linear function, Sigmoidal function, Supervised learning, Unsupervised learning, Re-inforcement learning.
Unit: 3	Knowledge Representation, Artificial Intelligence, Learning rules, Error correction learning, Memory based learning, Hebbian learning, Competitive learning, Boltzmann learning, Single layer perceptron, Multilayer perceptron, Back propagation, Recurrent networks, Network Pruning.
Unit: 4	Adaptive networks, Supervised Learning Neural Networks, Decision-based neural networks, Hierarchical neural networks, Probabilistic neural network, Radial basis function networks, Comparison of RBF Networks and Multilayer perceptron.
Unit: 5	Classification of linearly separable patterns, Boltzmann machine, Sigmoid Belief Networks, Helmholtz machine, Support vector machines, Self organization maps, Genetic Algorithms, Optimization, Prediction Systems, speech and decision-making.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	S. Haykin, "Neural Networks a comprehensive Foundation" second edition, Prentice-Hall India.
2	Laurene Fausett, "Fundamentals of Neural Networks, Architecture, Algorithms, and Applications", Prentice Hall, 1993.
3	Michael A Arbib, "The Handbook of Brain Theory and Neural Networks", Second Edition, MIT Press

Reference Books:

1	Jacek M. Zurada, Introduction to artificial neural systems, Jaico Publ. House, 1994.
2	Anderson, —An introduction to Artificial Neural Networks‖, Prentice Hall
3	B. Yegnanarayana, —Artificial Neural Networks‖, PHI

Course Code	Course Title	Lecture			Semester: I
PHCS104DST	Distributed Databases	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To enhance the previous knowledge of database systems by deepening the understanding of the theoretical and practical aspects of the database technologies and showing the need for distributed database technology to tackle deficiencies of the centralized database systems.
2. To expose active and emerging research issues in distributed database systems and application development
3. To apply theory to practice by building and delivering a distributed database query engine, subject to remote Web service calls.

Course Outcomes:

1. Explain the techniques used for data fragmentation, replication, and allocation during the distributed database design process.
2. Evaluate simple strategies for executing a distributed query to select the strategy that minimizes the amount of data transfer.
3. Describe distributed concurrency control based on the distinguished copy techniques and the voting methods.

Detailed Contents:

Unit: 1	Transaction and schedules, Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concepts in Recoverable and Cascade less schedules.
Unit: 2	Lock based protocols, time stamp based protocols, Multiple Granularity and Multisession Techniques, enforcing serializablity by Locks, multiple lock modes, Architecture for locking scheduler.
Unit: 3	Introduction to distributed databases, advantages and disadvantages of distributed database, additional functions of Distributed database, distributed DBMS, Distributed Transactions Management, Fragmentation and Replication Techniques, Fragmentation schema, allocation schema data replication.
Unit: 4	Recovery and atomicity in Distributed Databases, Traditional recovery techniques, Log based recovery, recovery techniques used for ensuring atomicity, Recovery with Concurrent Transactions, Checkpoints, Algorithm for recovery.
Unit: 5	Distributed Query Processing, Semi joins, general queries Cost based query optimization for Distributed database, integrity constraints in distributed database, Distributed Deadlock.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Silberschatz, orth and Sudershan, Database System Concept, Mc Graw Hill
2	
3	

Reference Books:

1	Garcia-Molina, Ullman,Widom,' Database System Implementation' Pearson Education
2	Ceei and Pelagatti,'Distributed Database', TMH. M.Tamer Ozsu, 'Principles of distributed database Systems' second edition Pearson education
3	

Course Code	Course Title	Lecture			Semester: I
PHCS105DST	Machine Learning	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To understand the basic building blocks and general principles that allow one to design machine learning algorithms
2. To become familiar with specific, widely used machine learning algorithms
3. To learn methodology and tools to apply machine learning algorithms to real data and evaluate their performance.

Course Outcomes:

1. Develop an appreciation for what is involved in learning from data.
2. How to apply a variety of learning algorithms to data.
3. How to perform evaluation of learning algorithms and model selection.

Detailed Contents:

Unit: 1	Introduction: Defining learning systems, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation, supervised learning, unsupervised learning, Reinforcement learning, learning algorithms.
Unit: 2	Decision Tree Learning: Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting, noisy data, and pruning.
Unit: 3	Ensemble Learning: Bagging, boosting, and Ada-Boost. Experimental Evaluation of Learning Algorithms, Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.
Unit: 4	Rule Learning: Translating decision trees into rules. Artificial Neural Networks: Neurons and biological motivation. Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and back propagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.
Unit: 5	Support Vector Machines: Maximum margin linear separators. Kernels for learning non-linear functions. Bayesian Learning: theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logisitic regression. Bayes nets and Markov nets for representing dependencies. Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples. k-Nearest-neighbor algorithm, Case-based learning

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

	Text Books:
1	Machine Learning – Tom M. Mitchell, - MGH
2	Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)
3	
	Reference Books:
1	Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge University Press.
2	Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc., 2001
3	Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995

Course Code	Course Title	Lecture			Semester: I
		L	T	P	
PHCS106DST	Fuzzy Systems	3	1	0	
Version:	**Date of Approval:**				

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To understand basic knowledge of fuzzy sets and fuzzy logic
2. To apply basic knowledge of fuzzy information representation and processing
3. To uunderstand the basic notion of computational verb controllers

Course Outcomes:

1. Identify different neural network architectures, their limitations and appropriate learning rules for each of the architectures.
2. Demonstrate knowledge and understanding of fuzzy system as they apply in engineering and science.
3. Develop models for different applications using fuzzy system and MATLAB

Detailed Contents:

Unit: 1	Introduction, Basic Types, Basic Concepts, Representations of Fuzzy Sets, Extension Principle for Fuzzy Sets, Types of Operations. Fuzzy Complements, Fuzzy Intersections: t- Norms. Fuzzy Unions: t-Conorms, Combinations of Operations. Aggregation Operations. Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals, Arithmetic Operations on Fuzzy Numbers, Fuzzy Equations.
Unit: 2	Crisp versus Fuzzy Relations, Projections and Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on a Single Set. Fuzzy Equivalence Relations, Fuzzy Compatibility Relations. Fuzzy Ordering Relations, Fuzzy Morphisms, Sup-i Compositions of Fuzzy Relations, Compositions of Fuzzy Relations.
Unit: 3	Fuzzy Measures, Fuzzy Sets and Possibility Theory, Classical Logic: An Overview. Multivalued Logics. Fuzzy Propositions. Fuzzy Quantifiers. Linguistic Hedges. Inference from Conditional Fuzzy Propositions. Inference from Conditional and Qualified Propositions. Inference from Quantified Propositions, Information and Uncertainty, Nonspecificity of Fuzzy Sets. Fuzziness of Fuzzy Sets. Principles of Uncertainty.
Unit: 4	Fuzzy Expert Systems: An Overview. Fuzzy Implications. Selection of Fuzzy Implications. Multiconditional Approximate Reasoning. The Role of Fuzzy Relation Equations, Fuzzy Controllers: Overview, Fuzzy Neural Networks. Fuzzy Automata. Fuzzy Dynamic Systems.
Unit: 5	Fuzzy Databases. Fuzzy Information Retrieval, Individual Decision Making, Multiperson Decision Making, Multicriteria Decision Making, Multistage Decision Making, Fuzzy Systems and Genetic Algorithms.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	George J. Klir, Bo Yuan, "Fuzzy Sets and Fuzzy Logic", PHI
2	
3	
Reference Books:	
1	Witold Pedrvcz and Femando Gomide. "An Introduction to Fuzzy Sets", PHI
2	
3	

Course Code	Course Title	Lecture			Semester: I
PHCS107DST	Advanced Operating System	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To read classic systems papers that shaped the field.
2. To present technical materials to others both orally and in written form.
3. To improve the accuracy and precision with which you express ideas.

Course Outcomes:

1. Master understanding of design issues associated with operating systems
2. Master various process management concepts including scheduling, synchronization, deadlocks
3. Be familiar with various types of operating systems including UNIX

Detailed Contents:

Unit: 1	**Introduction:** Operating system concept - processes and threads, process model, process creation, process termination, process hierarchies, and process states, Implementation of processes, Threads- Thread model, thread usage, Implementation of threads in user space and kernel, Hybrid implementations.
Unit: 2	**Inter Process Communication:** Race conditions, critical regions, Mutual Exclusion with busy waiting, sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing; Scheduling- scheduling in batch systems, Interactive systems, Real time systems, Thread scheduling.
Unit: 3	**Deadlocks:** Introduction, Deadlock Detection and Recovery – Deadlock Detection with one resource of each type, with multiple resource of each type, recovery from deadlock; Deadlock Avoidance, Deadlock Prevention.
Unit: 4	**Memory and Device Management:** Introduction, Swapping, Paging, Virtual memory – Demand paging, page replacement Algorithms; File System Management- Organization of File System, File Permissions, MS DOS and UNIX file system case studies, NTFS; Device Management- I/O Channels, Interrupts and Interrupt Handling, Types of device allocation.
Unit: 5	**Distributed Operating Systems:** Distributed operating system concept – Architectures of Distributed Systems, Distributed Mutual Exclusion, Distributed Deadlock detection, Agreement protocols, Threads, processor Allocation, Allocation algorithms , Distributed File system design; Real Time Operating Systems: Introduction to Real Time Operating Systems, Concepts of scheduling , Real time Memory Management.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Mukesh Singhal and Niranjan, "Advanced Concepts in Operating Systems", TMH, 1st Edition, 2001.
2	Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education, 2nd Edition, 2006
3	

Reference Books:

1	Andrew S. Tanenbaum, "Distributed Operating Systems", Pearson Education, 2nd Edition, 2001.
2	Pradeep K. Sinha, "Distributed Operating Systems and concepts", PHI, First Edition, 2002
3	

Course Code	Course Title	Lecture			
PHCS108DST	Real Time Systems	**L**	**T**	**P**	**Semester:** I
Version:	**Date of Approval:**	3	1	0	

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To explain the basic concepts of RTS and resource allocation techniques of RTS.
2. To introduce the features specific for Real Time Systems.
3. To discuss the various issues involved in Real Time System design and development

Course Outcomes:

1. Understand real time systems and real time operating systems.
2. Illustrate the various real time design principles.
3. Aanalyze the various risks associated with real time system.

Detailed Contents:

Unit: 1	**Real-time systems:** Real-time systems models, Types of real-time systems, internal structure of real-time systems, Performance measures, Examples of real-time systems and real-world applications, Modeling & Designing real-time systems.
Unit: 2	**Real-Time Process Management:** Task scheduling for Uniprocessor systems, handling priorities with critical section, interrupts, task allocation & scheduling for multiprocessor systems, adaptive scheduling.
Unit: 3	**Programming Environment:** In depth Knowledge of RTOS programming languages, tools & techniques.
Unit: 4	**Real-Time System Design:** Design techniques for Reliability, Fault Tolerance & other application specific quality considerations.
Unit: 5	Trends in Real-Time System Design & Development in fields such as Robotics. Introduction to research topics.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1. A.C. Shaw, Real-Time Systems and Software, Wiley.
2. J.E. Cooling, Real-Time Software Systems, International Thompson Computer Press
3. Real-Time Systems Design and Analysis, P.H. Laplante, IEEE Press

Reference Books:

1. Real-Time Systems, J. Liu, Prentice-Hall, 2000
2. Real-Time Computer Control, R. Bennett, Prentice-Hall
3. Real-Time Systems, C.M. Krishna and K.G. Shin, McGraw-Hill

Course Code	Course Title	Lecture			Semester: I
PHCS109DST	Software Metrics	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To provide an overview of Software Metrics – Measurement – Metric Types – Scales.
2. To give examples of where Metrics are used and explain some of the issues with Software Metrics.
3. To look at why Software Metrics is important with regard to Object Oriented programming.

Course Outcomes:

1. To be able to lead and implement measurement plans for process and product assessment.
2. To be able to analyze data for project estimation, planning and quality control in software projects.
3. Outlines some of the plans for the future.

Detailed Contents:

Unit: 1	**Software Quality Assurance Framework:** What is Quality? Software Quality Assurance, Components of Software Quality Assurance, Software Quality Assurance Plan. Steps to develop and implement a Software Quality Assurance Plan.
Unit: 2	**Quality Standards:** ISO 9000 and Comparison ISO Standards, CMM, CMMI, PCMM, 3 Sigma, 6 Sigma, Software Quality Models.
Unit: 3	**Measurement basics:** What is Software Metrics?, Application Areas of Metrics, Categories of Metrics, Measurement Scale, Axiomatic Evaluation of Metrics on Weyuker's Properties. Analyzing the Metric Data: Summary statistics for preexamining data, Metric Data Distribution, Outlier Analysis, Correlation Analysis, Exploring Analysis.
Unit: 4	**Measuring Structure and Size:** Size Estimation, Halstead Software Science Metrics, Information flow Metrics, Measuring Quality, Software Quality metrics based on Defects, Usability Metrics, Testing Metrics, Reliability Models.
Unit: 5	**Object Oriented Metrics:** Coupling Metrics, Cohesion Metrics, Inheritance Metrics, Size Metrics, Reuse Metrics, Empirical software engineering, research in software quality

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education (Singapore) Pvt. Ltd., 2002.
2. Norman E. Fenton and Shari Lawrence, "Software Metrics", PfleegerThomson, 2003.
3. D. Galin, "Software Quality Assurance: From Theory to Implementation", Addison Wesley.

Reference Books:

1. Allan C. Gillies, "Software Quality: Theory and Management", Thomson Learning, 2003
2. Mike Konrad and Sandy Shrum, CMMI, Mary Beth Chrissis, Pearson Education (Singapore) Pvt Ltd, 2003
3. Mordechai Ben Menachem/Garry S. Marliss, "Software Quality", Thomson Learning.

Course Code	Course Title	Lecture			Semester: I
PHCS110DST	Software Quality Engineering	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To describe approaches to quality assurance Understand quality models
2. Evaluate the system based on the chosen quality model.
3. To identify applicable measurements for the verification and validation effort.
4. To execute the test design.

Course Outcomes:

1. Describe different approaches to testing software applications Analyze specifications and identify appropriate test generation strategies.
2. Develop an appropriate test design for a given test object.
3. Evaluate the testing effort based on adequate measures.

Detailed Contents:	
Unit: 1	**Introduction:** Defining Software Quality, Software Quality Attributes and Specification, Cost of Quality, Defects, Faults, Failures, Defect Rate and Reliability, Defect Prevention, Reduction, and Containment, Overview of Different Types of Software Review, Introduction to Measurement and Inspection Process, Documents and Metrics.
Unit: 2	**Software Quality Metrics:** Product Quality Metrics: Defect Density, Customer Problems Metric, Customer Satisfaction Metrics, Function Points, In-Process Quality Metrics: Defect Arrival Pattern, Phase-Based Defect Removal Pattern, Defect Removal Effectiveness, Metrics for Software Maintenance: Backlog Management Index, Fix Response Time, Fix Quality, Software Quality Indicators.
Unit: 3	**Software Quality Management and Models:** Modeling Process, Software Reliability Models: The Rayleigh Model, Exponential Distribution and Software Reliability Growth Models, Software Reliability Allocation Models, Criteria for Model Evaluation, Software Quality Assessment Models: Hierarchical Model of Software Quality Assessment.
Unit: 4	**Software Quality Assurance:** Quality Planning and Control, Quality Improvement Process, Evolution of Software Quality Assurance (SQA), Major SQA Activities, Major SQA Issues, Zero Defect Software, SQA Techniques, Statistical Quality Assurance, Total Quality Management, Quality Standards and Processes.
Unit: 5	**Software Verification, Validation & Testing:** Verification and Validation, Evolutionary Nature of Verification and Validation, Impracticality of Testing all Data and Paths, Proof of Correctness, Software Testing, Functional, Structural and Error-Oriented Analysis & Testing, Static and Dynamic Testing Tools, Characteristics of Modern Testing Tools.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	Jeff Tian, Software Quality Engineering (SQE), Wiley-Interscience, 2005; ISBN 0-471-71345-7.
2	
Reference Books:	
1	Metrics and Models in Software Quality Engineering, Stephen H. Kan, Addison- Wesley (2002), ISBN: 0201729156
2	

Course Code	Course Title	Lecture			Semester: I
		L	T	P	
PHCS111DST	Wireless Mobile Networks	3	1	0	
Version:	**Date of Approval:**				

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To know the basics of wireless communication & how communication takes place in wireless networks.
2. To know Cellular communication, G.S.M and CDMA.
3. To know Mobile TCP.

Course Outcomes:

1. New trends in mobile/wireless communications networks.
2. The characteristics of mobile/wireless communication channels.
3. How to pursue research in the area of wireless communication.

Detailed Contents:

Unit: 1	Introduction, Fundamentals of cellular systems, mobile ad-hoc and sensor networks, wireless PAN/LAN/MAN. Overview of probability theory, traffic theory, queuing theory, and discrete event driven simulations.
Unit: 2	Mobile radio propagation, multi-path propagation, path loss, slow fading, fast fading. Channel coding and Error Control Techniques. Cellular concept, frequency reuse, cell splitting, cell sectoring.
Unit: 3	Multiple radio access protocols, CSMA, CSMA/CD, CSMA/CA. Static and dynamic channel allocation techniques.
Unit: 4	Mobile Communication Systems: Registration, Roaming, Multicasting, Security and Privacy. Optical Networking.
Unit: 5	Wireless sensor networks, MAC protocols for wireless sensor networks, routing in sensor networks. Wireless PAN (Bluetooth), Wireless LAN (Wi-Fi), Wireless MAN (WiMAX)

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Dharma Prakash Agrawal and Qing-An Zeng, *Introduction to Wireless and Mobile Systems*, Tomson, 2010, 3rd edition (ISBN-13: 978-1-4390-6205-0; ISBN-10: 1-4390-6205-6).
2	

Reference Books:

1	Vijay K. Grag and Joseph E. Wilkes, *Wireless and Personal Communications Systems*, 1996 (ISBN: 0-13-234626-5).
2	Christian Huitema, *Routing in the Internet,* Prentice Hall, 1995 (ISBN: 0-13-132192-7).

Course Code	Course Title	Lecture			Semester: I
		L	T	P	
PHCS112DST	Natural Language Processing	3	1	0	
Version:	**Date of Approval:**				

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To understand natural language processing and to learn how to apply basic algorithms in this field.
2. To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics, as well as the resources of natural language data - corpora.
3. To conceive basics of knowledge representation, inference, and relations to the artificial intelligence.

Course Outcomes:

1. The students will get acquainted with natural language processing and learn how to apply basic algorithms in this field.
2. They will understand the algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics, as well as the resources of natural language data - corpora.
3. They will also grasp basics of knowledge representation, inference, and relations to the artificial intelligence

Detailed Contents:

Unit: 1	**Introduction:** Introduction to the Morphology, Syntax, Semantics by linking the "linguistics view" (computational linguistics) with the "artificial intelligence view" (natural language processing).
Unit: 2	**Morphology:** Analysis and generation of language on word level: e.g. problems with compounding and idiomatic phrases, homophonous strings as well as loan words and their processing using e.g. finite state automata as well as semantic networks. Ambiguities in words like "pen" and "pipe", but will also discuss some complex strings.
Unit: 3	**Syntax:** Analysis and generation of language on phrasal and sentence level: e.g. applications such as machine translation and grammar checking and the processing using phase structure grammars as well as unification based formalisms and relating those formalisms to recursive transition networks (RTNs) as well as augmented transition networks (ATNs).
Unit: 4	**Semantics:** Language ambiguities on the level of "meaning": represented by case structures and conceptual dependency structures. We will look at famous utterances such as: Colourless green ideas sleep furiously. And will discuss why the machine runs into problems during analysis, and how these problems can be overcome.
Unit: 5	**Applications of NLP:** Machine Translation, Grammar Checkers Dictation, Automatic Document Generation, NL Interfaces.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	Daniel Jurafsky, James H. Martin "Speech and Language Processing" Second Edition, Prentice Hall, 2008.
2	Chris Manning and Hinrich Schütze, "*Foundations of Statistical Natural Language Processing"*, MIT Press. Cambridge, MA: May 1999.
3	
Reference Books:	
1	Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2	Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.

Course Code	Course Title	Lecture			Semester: I
		L	T	P	
PHCS113DST	Applied Cryptography	3	1	0	
Version:	**Date of Approval:**				

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To understand how cryptographic algorithms keys and protocols, and an appropriate hardware (software) environment can solve security problem (confidentiality, integrity, authenticity).
2. To Show how security is achieved in real life systems in areas of telecom, government/identity, buildings/transportation, payment.
3. To know real-life applications of encryption, Message Authentication Codes (MAC) and Digital Signatures in smart cards and terminals, personal identity and crypto currency systems.

Course Outcomes:

1. Learning how security problems are solved in the industry, and understanding why specific choices are made.
2. Understanding security (attacks and defenses) in complex real life systems and the role of keys, cryptographic algorithms and protocols, tamper resistant hardware and other types of countermeasures.
3. Study of entity authentication and data authentication, challenge-response.

Detailed Contents:

Unit: 1	Basic Encryption and Decryption: introduction to Ciphers, Monoalphabetic Substitutions such as the Caesar Cipher, Cryptanalysis of Monoalphabetic Ciphers, Polyalphabetic Ciphers such as Vigenere Tableaux, Cryptanalysis of Polyalphabetic Ciphers, Perfect Substitution Cipher such as the Vernam Cipher, Stream and Block Ciphers.
Unit: 2	Encryption; authentication; symmetric cryptography, asymmetric cryptography: public-key cryptosystems; digital signatures, message authentication codes. Steganography, One-way functions; pseudo-randomness and random number generators.
Unit: 3	Remote user authentication, notions of security; zero knowledge/ interactive proofs, multi-party cryptographic protocols, key exchange and applications.
Unit: 4	Cryptanalysis of cryptographic primitives and protocols, such as by side-channel attacks, differential cryptanalysis, or replay attacks; and cryptanalytic techniques on deployed systems.
Unit: 5	Advanced Topics - ECC, DNA cryptography, quantum cryptography, Digital Watermarking. Digital signatures: Definitions and applications, Lamport and Merkle schemes. overview of signatures based on discrete-log. certificates and trust management. , SSL/TLS and IPsec, Privacy mechanisms.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Handbook of Applied Cryptography by A. Menezes, P. Van Oorschot, S. Vanstone.
2	Cryptography by Behrouz A. Forouzan,TMH
3	Cryptography and Network Security by Stalling, PHI

Reference Books:

1	Cryptography & security services , Mechanism & application By Mogollon , Manuel , Cyber tech. Pub.
2	Cryptography and hardware security By Stalling, W PHI.

Course Code	Course Title	Lecture			Semester: I
		L	T	P	
PHCS114DST	Human Computer Interaction	3	1	0	
Version:	**Date of Approval:**				

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To provides a basic understanding of Human interfaces, their design principles ,tools as well as interfaces through thought process
2. To learn the design principles of developing a Human Computer Interface.
3. To Study of tools and devices required for designing a good interface

Course Outcomes:

1. Understand fundamental design and evaluation methodologies of human computer interaction.
2. Demonstrate knowledge of human computer interaction design concepts and related methodologies.
3. Apply theories and concepts associated with effective work design to real-world application.

Detailed Contents:

Unit: 1	**Introduction:** Importance of user Interface –Characteristics of graphical and web user interfaces, importance of good design. Benefits of good design, Principles of good Screen design.
Unit: 2	System menus and navigation schemes, kinds of windows, device based controls, screen based controls, test and messages.
Unit: 3	Feedback, guidance and assistance, Internationalization and Accessibility, graphics, icons and images, colors, layout windows and pages.
Unit: 4	**Interaction design** - introduction, goals, usability. Conceptualizing interaction problem space, conceptual models, interface metaphors, interaction paradigms, cognition, conceptual framework for cognition, collaboration, communication, social mechanisms conceptual frame work.
Unit: 5	Affective aspects, Expressive interface, user frustration agents process of interaction design, activities, characteristics, practical issues, life cycle models, design , prototyping and conceptual design, physical design, evaluation, framework, testing modeling users-kinds of tests, doing user testing, experiments, predictive model.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	The essential guide to user interface design, Wilbert O Galitz, Wiley DreamTech. Designing the user interface. 3rd Edition Ben Sheidermann, Pearson Education Asia.
2	Preece, Rogers, Sharp, "interaction design", John Wiley 2002
3	Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education

Reference Books:

1	Sheiderman B Desiging the user interface, "Strategies for Effective Human Computer Interaction" , 2nd ed. Addison Wesley , 1992 Pub.
2	Sudifte AG , "Human Computer Interface Design" , 2nd ed, Macmillan ,1995

Course Code	Course Title	Lecture			Semester: I
PHCS115DST	Bioinformatics	L	T	P	
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To understand the new field of bioinformatics (computational biology).
2. To be aware of how machine learning techniques can be employed in this area.
3. To concentrate on modern bioinformatics applications, particularly those which make good use of pattern recognition and machine learning methods

Course Outcomes:

1. To have a basic knowledge of modern molecular biology and genomics.
2. To understand the advantages and disadvantages of different machine learning techniques in bioinformatics and how the relative merits of different approaches can be evaluated by correct benchmarking techniques.
3. To understand how theoretical approaches can be used to model and analyse complex biological systems

Detailed Contents:

Unit: 1	**Introduction: biology, physics:** Biological hierarchy, Information stages, Physical processes, **Methods of gene sequencing:** Detailed discussion on Sequences searching methods.
Unit: 2	**Gene expression:** Current and prospective methods of gene profiling. Data acquisition. Data standardization. Linear approximations of data; DNA chips, Protein targeting, Data normalization, Linear view.
Unit: 3	**Statistics approaches:** Probabilistic notions, Multivariate issues, Clustering, Information handling, Experimental and computational methods of structure determination for proteins and nucleic acids.
Unit: 4	**Ontology:** Annotation of genes, their products and functions. System biology, evolution, hierarchy, Medical informatics, Software support: Software availability, Software targets, Text parsing, BioPerl. Statistics, R-system.
Unit: 5	**Recent Advances & Applications of Bio-Informatics:** Recent trends in Computing with bio-systems.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	David W. Mount, "Bioinformatics, Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press.
2	Andreas D. Baxevanis, "Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins", Second Edition
3	D.E. Krane and M.L. Raymer, "Fundamental Concepts of Bioinformatics", Pearson Education, 2003

Reference Books:

1	B. Bergeron, "Bioinformatics Computing", Prentice –Hall, 2003.
2	Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids", Cambridge University Press

Course Code	Course Title	Lecture			Semester: I
		L	T	P	
PHCS116DST	Information Security and Cyber Laws	3	1	0	
Version:	**Date of Approval:**				

Scheme of Instruction			**Scheme of Examination**		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To develop the skills to imbibe the Information Security issues at technological ground and then relate it to complex cyber world legal problems.
2. To give a detailed understanding of national and international regulatory paradigms and its mechanics regarding Cyber Law.
3. To study of cyber-security and the regulation of the Internet and the Internet of Things.

Course Outcomes:

1. Understand the structure, mechanics and evolution of the Internet in the context of emerging crime threats and technological and other trends in cyberspace.
2. Evaluate the effectiveness of cyber-security, cyber-laws (e.g. the Budapest Convention) and other countermeasures against cybercrime and cyber warfare.
3. Understand the different theoretical and cross-disciplinary approaches (criminological, political, legal and information security/management).

Detailed Contents:

Unit: 1	Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages 18 Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Principles of Information Security: Confidentiality, Integrity Availability and other terms in Information Security.
Unit: 2	Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards. Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems.
Unit: 3	Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls: Design and Implementation Issues, Policies.
Unit: 4	IT Act; The rights the various parties have with respect to creating, modifying, using distribution. Computer Software and Intellectual Property-Objective, Copyright Protection, Reproducing, Defenses, Patent Protection. Database and Data Protection-Objective.
Unit: 5	Introduction to Trade mark – Trade mark Registration Process – Post registration Procedures – Trade mark maintenance. Introduction to Copyrights – Principles of Copyright Principles -The subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership. Introduction to Trade Secret – Maintaining Trade Secret.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:	
1	Godbole," Information Systems Security", Willey
2	Merkov, Breithaupt," Information Security", Pearson Education
3	Sood,"Cyber Laws Simplified", Mc Graw Hill
Reference Books:	
1	Furnell, "Computer Insecurity", Springer
2	Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill
3	IT Act 2000

Course Code	Course Title	Lecture			
PHCS117DST	Advanced Networks	L	T	P	Semester: I
Version:	Date of Approval:	3	1	0	

Scheme of Instruction			Scheme of Examination		
No. of Periods	:	60 Hrs.	Maximum Score	:	100
Periods/ Week	:	4	Internal Evaluation	:	30
Credits	:	4	End Semester	:	70
Instruction Mode	:	Lecture	Exam Duration	:	3 Hrs.

Course Objectives:

1. To provide a broad coverage of introductory and advanced topics in the field of computer networks.
2. To have depth knowledge of computer networks.
3. To recognize the different internetworking devices and their functions.

Course Outcomes:

1. Analyze the services and features of the various layers of data networks.
2. Design, calculate, and apply subnet masks and addresses to fulfill networking requirements.
3. Analyze the features and operations of various application layer protocols such as Http, DNS, and SMTP.

Detailed Contents:

Unit: 1	Requirements, Network architecture, Networking principles, Network services and Layered architecture, Network services and Layered architecture, Future networks (Internet, ATM, Cable TV, Wireless – Bluetooth, Wi-Fi, WiMax, Cell phone)
Unit: 2	Virtual circuits, Fixed size packets, Small size packets, Integrated service, History, Challenges, ATM Network protocols, IP over ATM, Wireless networks: Wireless communication basics, architecture, mobility management, wireless network protocols. Ad-hoc networks Basic concepts, routing; Bluetooth (802.15.1), Wi-Fi (802.11), WiMAX (802.16), Optical Network: links, WDM system, Optical LANs, Optical paths and networks.
Unit: 3	Control of networks: objectives and methods of control, Circuit switched networks, ATM networks. Mathematical background for control of networks like Circuit switched networks, Datagram and ATM networks.
Unit: 4	Routing architecture, Routing between peers (BGP) , IP switching and Multi-Protocol Label Switching (MPLS), MPLS Architecture and related protocols, Traffic Engineering (TE) and TE with MPLS, NAT and Virtual Private Networks (L2, L3, and Hybrid), CIDR –Introduction, CIDR addressing, CIDR address blocks and Bit masks.
Unit: 5	Mobile IP- characteristics, Mobile IP operation, Security related issues. Mobility in networks, Voice and Video over IP (RTP, RSVP, QoS) IPv6: Why IPv6, basic protocol, extensions and options, support for QoS, security, etc., neighbour discovery, auto-configuration, routing. Application Programming Interface for IPv6.

Examination and Evaluation Pattern: It include both internal evaluation (30 marks) comprising two class sessional exams/ assignments/ quiz/ seminar presentation etc. and external evaluation (70 marks) which is mainly end semester examination.

Text Books:

1	Tanenenbaum, " Computer Network",PHI.
2	

Reference Books:

1	Srinivasan Keshav" An Engineering Approach To Computer Networking ",Pearson
2	D. Bertsekas , R Gallagar ,"Data Networks and Internets" PHI.