

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
PUNJABI UNIVERSITY**

SCHEME AND SYLLABI

OF

COURSEWORK

FOR

**DOCTOR OF PHILOSOPHY
(COMPUTER ENGINEERING)**

**Year 2020
Batch 2020**



**FACULTY OF ENGINEERING AND TECHNOLOGY
PUNJABI UNIVERSITY, PATIALA**

Scheme of Ph.D. (Computer Engineering) Coursework

| S. No. | Subject Code & Title | Contact Hours | | | Sessional *Theory/ **Practical Awards | Theory Exam/ External Practical | Univ. Exam Hrs. | Total Marks |
|--------|------------------------------|---------------|---|---|--|---------------------------------------|-----------------|-------------|
| | | L | T | P | | | | |
| 1. | PCE-101 Research Methodology | 3 | 1 | 0 | 50 | 50 | 3 hrs. | 100 |
| 2. | PCE-102 Machine Learning | 3 | 1 | 0 | 50 | 50 | 3 hrs. | 100 |
| 3. | PCE-150 Research Lab | 0 | 0 | 4 | 60 | 40 | 3 hrs. | 100 |
| 4. | Elective Course | 3 | 1 | 0 | 50 | 50 | 3 hrs. | 100 |

(*Sessional Theory Awards - Two House Tests (30 marks), seminar(s) (10 marks) and assignment(s) (10 marks).

(**Sessional Internal Awards - 20 marks for lab test(s), 20 marks for continuous evaluation, 10 marks for attendance and 10 marks for practical file work)

LIST OF CORE SUBJECTS

PCE-101 RESEARCH METHODOLOGY

PCE-102 MACHINE LEARNING

LIST OF ELECTIVES

PCE-201 DESIGN PRINCIPLES OF OPERATING SYSTEM

PCE-202 DIGITAL IMAGE PROCESSING

PCE-203 SOFTWARE ENGINEERING CONCEPTS AND METHODOLOGIES

PCE-204 CLOUD INFRASTRUCTURE AND SERVICES

PCE-205 ADVANCED COMPUTER ARCHITECTURE

PCE-206 ADVANCED DATA STRUCTURE AND APPLICATIONS

PCE-207 ADVANCED NETWORK SECURITY

PCE-208 SOFTWARE METRICS AND QUALITY MANAGEMENT

PCE-209 ADVANCED DATABASE SYSTEMS

PCE-210 PARALLEL AND DISTRIBUTED COMPUTING

PCE-211 ADVANCED NATURAL LANGUAGE PROCESSING

PCE-212 INTERNET OF THINGS

PCE-213 BIG DATA ANALYTICS

PCE-214 ADVANCED DATA MINING AND ANALYSIS

PCE-215 MULTIMEDIA SYSTEMS

PCE-216 EMBEDDED SYSTEMS

PCE-217 WIRELESS AND MOBILE NETWORKING

PCE-218 COMPUTER ANIMATIONS

PCE-219 ADVANCED ARTIFICIAL INTELLIGENCE

PCE-220 SOFT COMPUTING

PCE-221 ADVANCED COMPUTER CRIME INVESTIGATIONS AND FORENSICS

PCE-101**RESEARCH METHODOLOGY****L-T-P****3- 1- 0****Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** This course requires the prior knowledge of basics of statistics.**Objectives:** To familiarize the students about overall process of designing a research study along with ethical issues in the research.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). –Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A**

Introduction to Scientific Research, Significance of Research, Motivation in Research, Types of research approaches, Quantitative research methods, Research methods versus methodology, Research process, Criteria of good research, Research problems

Necessity of defining the problem, Technique involved in defining the problem, Meaning of research design, Need for research design, Features of a good design, Different research designs, Basic principles of experimental designs, Ethics in research, Building expertise in the areas of interest, generating the base content in the selected area,

Literature survey for research work, arriving at directions of research, Research paper and Thesis Report Writing

Publishing and Patenting: Difference between publishing and patenting; relative importance of various forms of publications; choice of journal and reviewing process; Patent process overview.

Ethical Issues – Ethical Committees – Commercialization – copy right – royalty – Intellectual Property rights and patent law – Track Related aspects of intellectual property Rights – Reproduction of published material – Plagiarism – Citation and Acknowledgement – Reproducibility and accountability

SECTION-B

Statistics and Probability: Introduction to terms: Population, Sampling, Mean, Mode, Median, Variance, Standard deviation, Coefficient of Variation, kurtosis, Range, Correlation and Regression.

Frequency Vs Probability distributions, Probability as a measure of uncertainty, probabilities for events, axioms, probability rules, conditional probability, Bayes' rule, random variables, probability distributions, discrete and continuous distributions, Gaussian, Normal

Sampling, Hypothesis testing, null hypothesis, alternative hypothesis, Statistical Tests: Z Test, T Test, Chi Square Test, and ANOVA Test.

Reference Books:

1. Research Methodology, Methods and Techniques by C.R Kothari Second Revised Edition by New Age International
2. Statistics for Management by D. Levin and David S. Rubin Seventh Edition by Pearson Education.

PCE-102**MACHINE LEARNING****L-T-P****3- 1- 0****Maximum Marks(Internal): 50****Maximum Marks(External): 50****Minimum Pass Marks(External): 50%****Prerequisites:** Basics of artificial intelligence.**Objectives:** To understand the basics of machine learning algorithms through SCIKIT-LEARN library.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**Course Objectives:**

To understand the basic machine learning algorithms using SCIKIT-LEARN library.

To understand the complexity of machine learning algorithms and their usage.

SECTION-A**Introduction:** Applications, Types of Machine learning Systems- Supervised, Unsupervised, Batch, Online, Reinforcement, Decision boundaries, Challenges of Machine Learning**Supervised Learning:** Training, Testing and Validation data, Data Cleaning-Handling Text and categorical attributes, Transformers, Feature Scaling, Linear Regression, Polynomial Regression, Logistic Regression, Cost Function, Gradient Descent-Batch, Stochastic, Mini-batch, Learning Curves, Support Vector Machines (SVM)-Linear and Non-Linear Classification, Kernelized SVM**SECTION-B****Dimensionality Reduction:** Curse of dimensionality, Approaches- Projection, Manifold Learning, PCA-Principal Components, Explained variance ration, choosing number of dimensions, Kernel PCA**Unsupervised Learning:** Clustering- K-Means, Hierarchical, Objective function**Neural Networks:** Model Representation, Back propagation algorithm, Gradient Checking, Binary and Multiclass classification**Reference Books:**

1. Yuxi (Hayden) Liu, "Python Machine Learning By Example", Packt
2. Allen Downey, Jeffrey Elkner and Chris Meyers, "How to Think Like a Computer Scientist, Learning with Python", Green Tea Press Wellesley, Massachusetts
3. David Longbow, "Machine Learning: A Beginners Guide to the Fundamentals of Machine Learning", Paperback
4. Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Paperback

PCE-150**RESEARCH LAB****L-T-P**
0- 0- 4**Maximum Marks(Internal): 60****Maximum Marks(External): 40**

The candidate will be evaluated out of 60 marks by the internal examiner. The external practical examination will be conducted from 40 marks.

Technical Writing using LaTeX:

Introduction to LaTeX, LaTeX Installation, MikTeX, Including figures, tables, enumerations, Managing citations, algorithms etc. Using Math environment, writing mathematical equations, using various LaTeX templates of various journals.

MS-Word:

Managing references in MS- Word, Writing equations, drawing different graphs and creating technical report template in MS-word

Statistical Analysis using Tools:

Implementing various statistics formulae (Mean, Mode, Median, Standard Deviation, Coefficient of variation, correlation and regression and various statistical tests using excel/R-Tool/Python/Excel.

MAT Lab:

Matrix operations and manipulation, Equation writing and plotting 2D, 3D Graphs.
Reference Management Tools: Mendeley, Jab Ref, End note

PCE-201**DESIGN PRINCIPLES OF OPERATING SYSTEM****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%

Prerequisites: This course requires the prior knowledge of Computer fundamentals and data representation.

Objectives: The objective of the course is to give an overview about the Operating System fundamentals. The contents allow the reader to apply these concepts to a real operating system.

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Introduction, OS Structure, services and components, multitasking, multiprogramming, time sharing, Real Time Systems, multithreading, Process Management, CPU scheduling, Deadlocks, Inter-process Communication, Concurrent Processing and concurrency control, Memory management, Virtual memory, Demand Paging and Page Replacement Algorithms

SECTION – B

I/O and Device management, buffering and spooling file management, file storage, Access methods and free space management

Operating System Security: Introduction, External & Operational security. Threat monitoring auditing, Access control, H/W security

Distributed & Multiprocessor system: Introduction to Distributed Operating system, Multiprocessor operating system organization, Recovery and Fault Tolerance

Case study of UNIX / LINUX: Introduction, kernel & shell, file system, shell programming

Reference Books:

1. Silberschatz and Galvin, "Operating System Concepts", Addison-Wesley publishing
2. A. S. Tanenbaum, "Modern Operating Systems", Pearson Education
- 3.H.M. Dietel, "An Introduction to Operating System", Pearson Education
4. William Stallings, "Operating Systems", Pearson Education

PCE-202**DIGITAL IMAGE PROCESSING****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Fundamentals of computer graphics and Signal Processing**Objectives:** To understand various kinds of image transform techniques, compression techniques and morphological techniques.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A**

Introduction and Digital Image Fundamentals: Digital Image representation, Read and display image in C language, Fundamental steps in Image processing, Elements of digital Image processing, Sampling and quantization, some basic relationships like neighbor's connectivity, distance measure between pixels. Image Enhancement methods: Point Operations, Histogram processing, Spatial Domain, Enhancement by point processing, Spatial filters: low pass filters, High pass filter, Median, Max Min, Mean, Alpha-trim, High-boost filter, Laplacian, Gradient filters.

Image Transforms: Discrete Fourier transform, some properties of two-dimensional Fourier transform, Fast Fourier transform, Inverse FFT, Implementation algorithm of FFT, Introduction to Walsh and Haar Transform. Frequency domain filtering algorithms: Lowpass filtering, Highpass, Homomorphic filtering, Color image processing.

Image Restoration: Image Degradation model, Noise Models, Restoration in spatial domain: Mean filter, Order statistic filter, adaptive filter, Inverse filtering, Wiener filter, Constrained least square restoration.

SECTION-B

Image Compression: Coding Inter-pixel and Psycho visual redundancy, Image Compression models, Error free compression: Huffman, Arithmetic, Runlength, Lossy Compression: Block Transform Coding based on DCT, Introduction to still Image Compression standards.

Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region Orientation Segmentation.

Representation and Description: Representation schemes like chain coding, Boundary Descriptors: Fourier, Statistical moments.

Recognition and Interpretation: Elements of Image Analysis, Pattern and pattern classes, Decision Theoretic methods: minimum distance classifier.

Brief Introduction to :Digital Watermarking. Morphological image processing: erosion, Dilation, opening, closing, Hit-or-Miss Transformation.

Reference Books:

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", AWL.
2. Annadurai, "Fundamentals of digital image processing", Pearson Education
3. A.K. Jain, "Fundamentals of Digital Image Processing", Pearson Education.
4. W. K. Pratt, "Digital Image Processing".
5. Ramesh Jain, Brian G. Schunck, "Machine Vision", TMH.

PCE-203 SOFTWARE ENGINEERING CONCEPTS AND METHODOLOGIES**L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Basics of System analysis and design.**Objectives:** Thorough understanding of software Engineering concepts.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A**

Principles and Motivations: History; definitions; why engineered approach to software development; Software development process models from the points of view of technical development and project management: waterfall, rapid prototyping, incremental development, spiral models, Agile Software Development, Emphasis on computer-assisted environments. Selection of appropriate development process.

Software Development Methods: Formal, semi-formal and informal methods; Requirements elicitation, requirements specification; Data, function, and event-based modeling; Some of the popular methodologies such as Yourdon's SAD, SSADM etc; CASE tools-classification, features, strengths and weaknesses; ICASE; CASE standards.

Software Project Management: Principles of software projects management; Organizational and team structure; Project planning; Project initiation and Project termination; Technical, quality, and management plans; Project control; Cost estimation methods: Function points and COCOMO

SECTION-B

Software Quality Management: Quality control, quality assurance and quality standards with emphasis on ISO 9000; Functions of software QA organization does in a project; interactions with developers; Quality plans, quality assurance towards quality improvement; Role of independent verification & validation; Total quality management; SEI maturity model; Software metrics.

Configuration Management: Need for configuration management; Configuration management functions and activities; Configuration management techniques; Examples and case studies.

Software Testing Fundamentals: Basic Terminology, Testing Techniques and strategies.

Brief introduction to various standards related to Software Engineering.

Reference Books:

1. Roger Pressman, Software Engineering - A Practitioners Approach, McGraw Hill(2009).
2. Ian Sommerville, Software Engineering, Addison-Wesley Publishing Company(2006).
3. James F. Peter, Software Engineering - An Engineering Approach, John Wiley & Sons(2006).
4. Pankaj Jalote, An integrated Approach to Software Engineering, Narosa Publishing House(2008).

PCE-204**CLOUD INFRASTRUCTURE AND SERVICES****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%

Objectives: To provide the students a comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Overview of Computing Paradigm- Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud computing; Evolution of cloud computing Business driver for adopting cloud computing ,Introduction to Virtualization and hypervisors.

Cloud Computing Architecture- Cloud computing stack: Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services; Service Models (XaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud

Virtualization: Issues with virtualization, virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, virtualization of data centers, and Issues with Multi-tenancy

Public Cloud Platforms (Google App Engine, AWS,Azure) , Open Source Clouds (Baadal, Open Stack, Cloud Stack), Cloud Programming and Software Environments (Hadoop, GFS, Map Reduce, NoSQL systems, Big Table, HBase, Libvirt, OpenVswitch), Amazon (IaaS), Azure(PaaS), GAE (PaaS)

SECTION-B

Interoperability and Service Monitoring: Issues with interoperability, Vendor lock-in, Interoperability approaches. Service Management in Cloud Computing: Service Level Agreements (SLAs), Billing and Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting Enormously, Managing Data: Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing.

Resource Management and Load Balancing: Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Resource Optimization, Resource dynamic reconfiguration, Scheduling Techniques for Advance Reservation, and Load Balancing, various load balancing techniques.

Cloud Security- Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage, Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

Reference Books:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
3. Cloud Computing: Principles, Systems and Applications (Computer Communications and Networks), Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2010

PCE-205**ADVANCED COMPUTER ARCHITECTURE****L-T-P****3- 1- 0****Maximum Marks(Internal): 50****Maximum Marks(External): 50****Minimum Pass Marks(External): 50%**

Objectives: This Course offers a good understanding of the various functional units of a computer system and prepares a student towards designing a basic computer system. Finally the student will be introduced to the area of advanced computer architectures.

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Parallel computer models: Multiprocessors and multicomputers, Multivector and SIMD computers, Architectural development tracks Program and network properties :Conditions of parallelism, Data and resource dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain size and latency, Program flow mechanisms,Control flow versus data flow,Data flow architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

System Interconnect Architectures: Network properties and routing, Static interconnection networks, Dynamic interconnection Networks, Multiprocessor system interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network. Processors and Memory Hierarchy : Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors Memory Technology :Hierarchical memory technology, Inclusion, Coherence and Locality, Memory capacity planning, Virtual Memory Technology.

SECTION-B

Backplane Bus System: Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt, Cache addressing models, Direct mapping and associative caches. Pipelining :Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch handling techniques, Arithmetic Pipeline Design, Computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pipelines.

Vector Processing Principles: Vector instruction types, Vector-access memory schemes. Synchronous Parallel Processing: SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, SIMD Computers and Performance Enhancement.

Reference Books:

1. Kai Hwang, "Advanced computer architecture"; TMH, 2000.
2. J. P. Hayes, "Computer Architecture and Organization", MGH, 1998.
3. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design", Narosa Pb.
4. D. A. Patterson, J. L. Hennessy, "Computer Architecture: A quantitative approach", Morgan Kauffmann, 2002.
5. Hwang and Briggs, "Computer Architecture and Parallel Processing"; MGH Kauffmann, 2002.

PCE-206 ADVANCED DATA STRUCTURES AND APPLICATIONS**L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Basics of Data Structures**Objectives:** Thorough understanding of Data Structures**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Complexity Analysis & Elementary Data Structures**

Asymptotic notations – Properties of big oh notation – asymptotic notation with several parameters – conditional asymptotic notation – amortized analysis – NP completeness – NP-hard – recurrence equations – solving recurrence equations Arrays, linked lists, trees and sparse matrices.

Heap Structures

Min-max heaps – D-heaps – Leftist heaps – Binomial heaps – Fibonacci heaps – Skew heaps

Search Structures

Binary search trees – AVL trees – 2-3 trees – 2-3-4 trees – Red-black trees – Btrees.

SECTION-B**Graph Algorithms:**

Topological sort, minimum Spanning tree, single-source shortest paths, all-pairs shortest paths, bi-connected components, strongly connected components, cycles, articulation points, bridges.

Applications

Huffman coding – Garbage collection and compaction – Topological sort – Mincut maxflow algorithm – Activity networks – Set representation – Set union and find operations.

Reference Books:

1. E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, Galgotia, 1999.
2. Adam Drozdex, Data Structures and algorithms in C++, Second Edition, Thomson learning – vikas publishing house, 2001.
3. G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Printice –Hall, 1988.
Thomas H.Corman, Charles E.Leiserson, Ronald L. Rivest, "Introduction to Algorithms", PHI.

PCE-207**ADVANCED NETWORK SECURITY****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Thorough understanding of the basics of computer networks and protocols.**Objectives:** To understand the basics of information security and web security.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Introduction to Computer and Information Security:** Definition and Need of Computer Security, Security Basics: Confidentiality, Integrity, Availability, Accountability, Non Repudiation and Reliability. Attacks, Types of Attacks (Active Vs Passive Attacks), Backdoors and Trapdoors, Sniffing and Spoofing, TCP/IP hacking and Man in the Middle Attack. Information Security, Difference between Network and Information Security, Basic Principles of Information Security.**Authentication:** Authorization and Authentication, Guessing Passwords, Brute forcing and Shoulder surfing. Biometrics: Finger prints, Hand prints, Retina Patterns, Voice Patterns.**Cryptography:** Plain Text, Cipher Text, Cryptography, Cryptanalysis, cryptology, encryption, decryption, different types of ciphers: Mono-alphabetic Substitutions such as the Caesar Cipher, Cryptanalysis of Mono-alphabetic ciphers, Polyalphabetic Ciphers such as Vigenere, Vernam Cipher, Stream and Block Ciphers**Secret Key Systems:** The Data encryption Standard (DES), Analyzing and Strengthening of DES, Introduction to Advance Encryption Standard (AES).**SECTION-B****Web Security:** Web security consideration, secure socket Layer protocol, Transport Layer Security Secure Electronic Transaction Protocol.**Firewalls:** Firewall Design principles, Characteristics, Types of Firewall, trusted systems, Virtual Private Networks, DMZ, and Intrusion Detection Systems: Vulnerability Assessment, Misuse Detection, Anomaly Detection, Network-Based IDS, Host-based IDS and Honeypots.**Cyber Crime:** Introduction, Hacking, Digital Forgery, Cyber frauds, cyber laws and IT ACT 2000. Case studies of Cyber Crimes.**Reference Books:**

1. Information Security: Principles and Practices 2nd Edition, Mark S, Merkow and Jim Breithaupt.
2. Principles of Cryptography, William Stallings, Pearson Education
3. "Security in Computing (Second Edition)", Charles P.Pfleeger, 1996, Prentice Hall International, Inc. Cryptography & Network Security, Atul Kahate, TMH

PCE-208 SOFTWARE METRICS AND QUALITY MANAGEMENT**L T P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Thorough understanding of the basics of software engineering concepts.**Objectives:** This course aims to equip students with the knowledge and techniques of professional practices in software processes and activities.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Each section A and B will have five questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Software Metrics:** Measurement in software engineering, software metrics, Metrics data collection and analysis.**Measuring internal product attributes:** Aspects of software size, length, functionality and complexity, measuring structure, types of structural measures, control-flow structure, and modularity and information flow attributes, data structures.**Measuring external product attributes:** Modelling software quality, software reliability, software reliability problem, parametric reliability growth models, predictive accuracy, recalibration of software-reliability growth predictions, importance of operational environment, and wider aspects of software reliability.**Metrics for object-oriented systems and component-based system:** object-oriented metrics and its characteristics various object-oriented, MOOD metrics; component-based metrics and its characteristics and various component-based suites.**Dynamic Metrics:** Runtime Software Metrics, Extent of Class Usage, Dynamic Coupling, Dynamic Cohesion, and Data Structure Metrics.**SECTION-B****Software Quality:** Concepts of software quality, software quality control and software quality assurance, evolution of SQA, major SQA activities and issues, zero defect software.**Software Quality Assurance:** SQA techniques; Management review process, technical review process, walkthrough, software inspection process, configuration audits, and document verification.**Error Reporting, Trend Analysis and Corrective Action:** Identification, Analysis and Correction of defect, implementation of correction, regression testing; Categorization of defect w.r.t development phases; Error quantity, error frequency, program unit complexity, compilation frequency; Corrective action and documenting the corrective action, periodic review of actions taken.**Case Studies:** CASE tools, Quality management standards, Quality standards with emphasis on ISO approach, Capability Maturity Models-CMM and CMMI, TQM Models, Bootstrap methodology, The SPICE project, ISO/IEC 15504, Six Sigma Concept for Software Quality.**Reference Books:**

1. Practical Guide to Software Quality Management (Artech House Computing Library).
2. Quality Software Management, Volume 1: Systems Thinking, Dorset House Publishing.
3. Metrics and Models in Software Quality Engineering, Pearson.
4. Applied Software Measurement by Capers Jones, Tata McGraw Hill.

PCE-209**ADVANCED DATABASE SYSTEMS****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Database fundamentals.**Objectives:** Thorough understanding of Databases.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Introduction:**

Database System Concepts and Architecture, Data Independence, Data Models, SQL: DDL, DML, DCL, Database Integrity, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF.

Advanced Transaction Processing and Concurrency Control:

Transaction Concepts, Concurrency Control: Locking Methods, Timestamping Methods, Optimistic Methods for Concurrency Control, Concurrency Control in Distributed Systems.

Object Oriented and Object Relational Databases:

Object Oriented Concepts with respect to Database Systems, Object Oriented Data Model, OODB, OODBMS, ODMG, ODL, OQL, ORDBMS, ORDBMS Design, ORDBMS Query Language.

Parallel Databases:

Parallel Databases, Distributed Databases, Differences between them, Architecture of Distributed Databases, Architecture of Parallel Databases, Key elements of Parallel Database Processing,

SECTION-B**Distributed Databases:**

Fragmentation, Replication and Allocation for distributed databases, Intra-query parallelism, Inter-query parallelism, Intra-operation parallelism, Inter-operation parallelism.

Backup and Recovery Techniques:

Backup and Recovery Concepts, Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management, Recovery Control in Distributed Systems.

XML and Internet Databases:

Structured, Semi Structured, and Unstructured Data, XML Hierarchical Data Model, XML Documents, DTD, XML Schema, XML Querying: XPath, XQuery.

Emerging Database Technologies:

Introduction to Deductive Database Systems, Temporal Databases, Multimedia Databases, Mobile Databases, Main Memory Databases, Spatial and Multidimensional Databases.

Reference Books:

1. Ramez Elmasri, Shamkant Navathe : Fundamentals of Database Systems, Fifth Edition, Pearson Education, 2007.
2. C.J. Date : An Introduction to Database Systems, Eighth Edition, Pearson Education.
3. Alexis Leon, Mathews Leon : Database Management Systems, Leon Press.
4. S. K. Singh : Database Systems Concepts, Design and Applications, Pearson Education.
5. Raghu Ramakrishnan, Johannes Gehrke : Database Management Systems, Tata McGraw-Hill.
6. Abraham Silberschatz, Henry F. Korth, S. Sudarshan : Database System Concepts, Tata McGraw-Hill.

PCE-210**PARALLEL AND DISTRIBUTED COMPUTING****L-T-P****3- 1- 0****Maximum Marks(Internal): 50****Maximum Marks(External): 50****Minimum Pass Marks(External): 50%**

Objectives: Students will learn about programming paradigms used in parallel computation, about the organization of parallel systems, and about the application of programs and systems to solve interesting problems.

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Fundamental Issues: Parallelism in uniprocessor system, Architectural-classification, Applications of parallel processing

Introduction: Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic. Hardware taxonomy: Flynn's classifications, Handler's classifications.

Basic issues and model Asynchrony, delay, failure concurrency, Communication topology, load balancing, scaling

Parallel Processors: Taxonomy and topology - shared memory mutliprocessors, distributed memory networks. Processor organization - Static and dynamic interconnections. Embeddings and simulations

Performance Metrics: Laws governing performance measurements. Metrics - speedups, efficiency, utilization, communication overheads

SECTION-B

Shared Memory: Models and primitives, PRAM, VRAM, semaphores, spin-locks, Barrier's implementations, NESL, Threads, distributed shared memory

Algorithm Development and Analysis: Parallel algorithms of reduction and scans, Connected components (dense and sparse case), Sorting, distributed algorithms, Clock synchronization

Parallel Architectures: Survey of Architectures KSR, TMC, MasPar, and workstation clusters, Parallel Environments like PVM etc.

Case study of IBM Power4 processor, Inter Processor Communication and Synchronization

Reference Books:

1. Kai, Hwang and Briggs, Parallel Architecture and Computing, Tata McGraw Hill Co.
2. M. J. Quinn. Parallel Computing: Theory and Practice, McGraw Hill, New York, 1994. F.T. Leighton, Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes, Morgan Kaufmann Publishers, San Mateo, California
3. Joseph Ja Ja, An Introduction to Parallel algorithms, Addison Wesley

PCE-211 ADVANCED NATURAL LANGUAGE PROCESSING**L T P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Objectives:** To describe the techniques and algorithms used in processing (text and speech) natural languages.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Introduction:** Natural Languages, Application of Natural Language Understanding, Different levels of language analysis

Regular Expressions, Finite state automata, Morphological analysis: Inflectional and derivational morphology, Finite state morphological parsing.

Probabilistic Theory: Introduction to probability, conditional probability, Bayes' rule and its application.**N Grams:** Introduction, Importance, Unsmoothed N-grams, Normalizing, Maximum Likelihood Estimation, Smoothing and different methods of smoothing. Entropy and Perplexity.**POS Tagging:** Introduction, Word Classes, Rule Based POS, Stochastic POS, Markov assumption, Markov chain, HMM Tagging, Issues of Ambiguity, Multiple tags, Multiple words and unknown words.**SECTION-B****Parsing:** Introduction, Top down parsing, Bottom up parsing, Problems with top down and bottom up parsing, The Earley algorithm.**Feature and Unification:** Introduction, Feature Structures, Unification of Feature Structures. Semantics: Introduction, Semantical Analysis, Lexical Semantics.**Word Sense Disambiguation:** Selectional Restriction based Disambiguation, Robust WSD - Machine learning approaches and dictionary based approaches.**Machine Translation:** Introduction, Different methods of MT.**Speech Processing:** Issues in Speech Recognition, The Sound Structure of Language, Signal processing, Speech Recognition, Prosody and Intonation.**Reference Books:**

1. D. Jurafsky and J. Martin, "Speech and Language Processing", Pearson Education
2. James Allen, "Natural Language Understanding", Pearson Education.
3. Bharati A., Chaitanya V and Sangal R, "Natural Language processing: A Paninian Perspective", Prentice Hall of India.

PCE-212**INTERNET OF THINGS****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Basics of Computer Networks.**Objectives:** The students will be able to understand the fundamentals of IOT along with various IOT devices.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each).Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Introduction & Concepts:** Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels.**M2M to IoT:** The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. A Market Perspective-Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.**M2M and IoT Technology Fundamentals:** Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management**IoT Architecture:** State of the Art - Introduction, State of the art**IoT Reference Architecture:** Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.**SECTION-B****Domain Specific IOTs:** Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.**Industrial Automation:** Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things**IOT Physical Devices & Endpoints:** What is an IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, and Programming & IOT Devices.**Reference Books:**

1. Vijay Madiseti, Arshdeep Bahga, "Internet of Things A Hands-On- Approach",2014
2. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013
3. Daniel Kellmerit, "The Silent Intelligence: The Internet of Things". 2013

PCE-213**BIG DATA ANALYTICS****L T P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Basics of RDBMS.**Objectives:** The students will be able to work with big data platform and explore the big data analytics techniques on business applications.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Each section A and B will have five questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A**

INTRODUCTION TO BIG DATA Introduction– distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce

INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE Big Data – Apache Hadoop & Hadoop Eco System, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce -, Data Serialization

HDFS, HIVE AND HIVEQL, HBASE HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, Hive QL Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper

SECTION-B

SPARK Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib.

NoSQL What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NewSQL

Data Base for the Modern Web Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language.

Reference Books:

1. Boris lublinsky, Kevin t. Smith, AlexeyYakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
2. Chris Eaton,Dirk derooset al. , "Understanding Big data ", McGraw Hill, 2012.
3. BIG Data and Analytics , Sima Acharya, Subhashini Chhellappan, Willey
4. MongoDB in Action, Kyle Banker,Piter Bakkum , Shaun Verch, Dream tech Press
5. Tom White, "HADOOP: The definitive Guide", O Reilly 2012.
6. VigneshPrajapati, "Big Data Analyticswith R and Haoop", Packet Publishing 2013
7. Learning Spark: Lightning-Fast Big Data Analysis Paperback by Holden Karau

PCE-214

ADVANCED DATA MINING AND ANALYSIS**L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** The basics of Machine Learning and database related concepts.**Objectives:** The students will be able to identify appropriate data mining algorithms to solve real world problems.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Introduction to data mining:** Motivation and significance of data mining, data mining functionalities, interestingness measures, classification of data mining system, major issues in data mining.**Data pre-processing:** Need, data summarization, data cleaning, data integration and transformation, data reduction techniques – Singular Value Decomposition (SVD), Discrete Fourier Transform (DFT), Discrete Wavelet Transform (DWT), data discretization and concept hierarchy generalization.**Data warehouse and OLAP technology:** Data warehouse definition, multidimensional data model(s), data warehouse architecture, OLAP server types, data warehouse implementation, on-line analytical processing and mining**Data cube computation and data generalization:** Efficient methods for data cube computation, discovery driven exploration of data cubes, complex aggregation, attribute oriented induction for data generalization.**SECTION-B****Mining frequent patterns, associations and correlations:** Basic concepts, efficient and scalable frequent item-set mining algorithms, mining various kinds of association rules – multilevel and multidimensional, association rule mining versus correlation analysis, constraint based association mining.**Classification and prediction:** Definition, decision tree induction, Bayesian classification, rule based classification, classification by backpropagation and support vector machines, associative classification, lazy learners, prediction, accuracy and error measures.**Cluster analysis:** Definition, clustering algorithms- partitioning, hierarchical, density based, grid based and model based; Clustering high dimensional data, constraint based cluster analysis, outlier analysis – density based and distance based.**Data mining on complex data and applications:** Algorithms for mining of spatial data, multimedia data, text data; Data mining applications, social impacts of data mining, trends in data mining.**Reference Books:**

1. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw-Hill, 2004.
2. Data Mining – Concepts & Techniques; Jiawei Han & Micheline Kamber – 2001, Morgan Kaufmann.
3. Building the Data Warehouses; W.H. Longman, C. Klelly, John Wiley & Sons.
4. Data Mining Introductory and Advanced Topics, Dunham, Pearson Education.

PCE-215

MULTIMEDIA SYSTEMS**L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Prerequisites:** Fundamentals of computer graphics and image processing.**Objectives:** To understand various file formats for audio, video and text media along with technical aspects of Multimedia Systems. The students will also be able to design interactive multimedia software.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Introduction:** Introduction to Multimedia, Introduction to Hypermedia and Hyper Text, Multimedia Systems and Desirable Features, Applications, Trends in Multimedia**Multimedia Technology:** Multimedia software development tools, Multimedia Authoring Tools, Multimedia Standards for Document Architecture, SGML, ODA, Multimedia Standards for Document interchange, MHEG.**Storage Media :** Magnetic and Optical Media, RAID and its levels, Compact Disc and its standards, DVD and its standards,**Image,Graphics and Video:** Graphic/Image File Formats, Graphic/Image Data, Colour in Image and Video, Basics of Video ,Types of Video Signals, Analog Video, Digital Video, TV standards**SECTION-B****Video Compression:** Basics of Information theory, Classifying Compression Algorithms: Lossless, Lossless/Perceptual Compression Algorithms: Entropy Encoding, Run-length Encoding, Huffman Coding, Huffman Coding of Images, Adaptive Huffman Coding, Arithmetic Coding, Lempel-Ziv-Welch (LZW) Algorithm, Source Coding Techniques, Differential Encoding, Scalar Quantization; Lloyd Max, Vector Quantization, Frequency Domain Methods, JPEG Compression, Video Compression; H. 261 Compression, Intra Frame Coding, Inter-frame (P-frame) Coding, MPEG Video Compression, The H.261 and MPEG Video Bit stream.**Audio Compression:** Introduction to MIDI, Audio Compression, Psychoacoustics, Perceptual Audio Coder, Simple Audio Compression Methods; PCM, DPCM, MPEG-1 Audio Compression, ADPCM speech coder, Vocoders: LPC, CELP.

Multimedia System architecture, Components, Quality of service.

Reference Books:

1. Li, Drew , Multimedia Computing, Pearson Education, Latest Edition ,
2. Ralf Steinmetz and Klara Nahrstedt, Multimedia Computing Communications and Applications By Pearson Educations
3. Prabhat K. Andleigh, Kran Thakkar, Multimedia System Design, PHI, Latest Edition
4. Fred Halsall Multimedia Communications, Pearson Education, Latest Edition

PCE-216**EMBEDDED SYSTEMS****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%

Objectives: Students will learn about programming paradigms used in parallel computation, about the organization of parallel systems, and about the application of programs and systems to solve interesting problems

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Introduction to embedded systems definition and Classification, Overview of Processors and hardware units in an embedded system, Software embedded into the system.

Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits Examples of embedded systems: characteristics and requirements, Applications, software issues and architecture.

Interrupt synchronization: General features of interrupts, Interrupt vectors and priorities, External interrupt design approach, Interrupt polling.

Definitions of process, tasks and threads, ISRs and tasks by their characteristics, Operating System Services Goals, Kernel, Process Management, Memory Management, File System Organization and Implementation.

SECTION-B

Real time operating systems: RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics, Round Robin Scheduling, Time Slicing, Rate Monotonics, Preemptive Scheduling, Introduction to Vx Works.

Inter process communication and synchronization, Shared data problem, Use of Semaphore(s), Inter Process Communications using Signals, Semaphore, Message Queues, Mailboxes, Pipes, Remote Procedure Calls (RPCs).

I/O Devices - Synchronous and Asynchronous Communications from Serial Devices, Communication Devices - UART and HDLC - Parallel Port Devices, USB and advanced I/O Serial high speed buses- ISA, PCI, PCI-X and cPCI.

References Books:

1. Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes,
2. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint
3. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001
4. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, John Wiley, 2002

PCE-217**WIRELESS AND MOBILE NETWORKING****L-T-P**
3-1-0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Pre-requisites:** Fundamentals of Computers & Electronics Engineering.**Objectives:** To acquaint the students with the fundamental concepts of wireless communication and digital cellular standards which are helpful in understanding the state-of-the-art technology in mobile communications and wireless networking.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Wireless Communication:** Introduction, Cellular concept, Frequency reuse, Co-channel and adjacent channel interference, Cell splitting, Handover, Call processing.**Digital Cellular Mobile Systems:** Introduction, GSM digital cellular standard: GSM services, GSM architecture, GSM Radio aspects, Security aspects, Handover, Call flow sequence in GSM, Evolutionary directions.**Mobile Radio Propagation:** Small-scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-scale Multipath Measurements, Parameters of Mobile Multipath channels, Types of Small-scale Fading, Rayleigh and Ricean distributions.**SECTION-B****Equalisation, Diversity and Channel Coding:** Introduction, Training A Generic Adaptive Equalizer, Linear Equalizers, Non-Linear Equalization, Algorithm for Adaptive Equalization, Diversity Techniques, RAKE Receiver, Interleaving, Block codes, Convolution Codes and Turbo Codes.**Mobile Data Communications:** Overview of circuit switched and packet switched data services on cellular networks, Wireless local area networks: Introduction, IEEE 802.11 wireless LAN, Support of mobility on the internet: Mobile IP**Reference Books:**

1. Jochen Schiller, "Mobile Communications", Pearson Education
2. Raj Pandya, "Mobile and Personal Communication-System and Services", PHI
3. W. Stallings, "Wireless Communications and Network", Pearson Education
4. T.S. Rappaport, "Wireless Communications: Principles & Practice"

PCE-218**COMPUTER ANIMATIONS****L T P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%

Objectives: Students will learn about programming paradigms used in parallel computation, about the organization of parallel systems, and about the application of programs and systems to solve interesting problems

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Each section A and B will have five questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Introduction to Multimedia Elements: Text, graphics, audio, video and motion graphics.

Introduction Animation: Its definition, Principles of Animation, early examples of Animation, Animation by Computer.

History of Animation: Stop Motion Photo Animation, Zoetrope, Thaumatrope, Cel and Paper Animation, early Disney's Cel Animation Processes.

Applications of Animation: in TV Graphics, Scientific Visualization, Simulation, Architecture, Medical and Film industry.

SECTION-B

Types of Animation: Animation Techniques, File formats for Animation, Cel Animation, Stop Motion Animation, 2-D Animation, 3-D Animation.

Keyframe Animation: Creating Keyframes, Auto Keyframes, Move & Scale Keyframe on the timeline, Animating with constraints & simple controllers, animation Modifiers & complex controllers, function curves in the track view, motion mixer.

Multimedia presentation and authoring: Overview, multimedia authoring metaphor, multimedia production, presentation and automatic authoring, Design paradigms and user interface, overview of tools like adobe premiere, director, flash and Dreamweaver.

Reference Books:

1. NewRiders, "3dsmax7 Fundamentals", BPB, 2005.
2. Isaac Kerlow, "The Art of 3D Computer Animation and Effects", 4th edition, Wiley, 2009
3. The Encyclopedia of Animation Techniques, Richard Taylor, 1996 (India)
4. Rick Parent "Computer Animation: Algorithms and Techniques", 3rd edition, Morgan Kaufmann.
5. A Banerji & A M Gosh, "Multimedia Technologies", Tata Mc Graw Hill

PCE-219**ADVANCED ARTIFICIAL INTELLIGENCE****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%

Objectives: To apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

Instructions for paper-setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.

Instructions for candidates: Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.

SECTION-A

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.

Informed search and exploration – 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 for CSP – Structure of problems - Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.

KNOWLEDGE REPRESENTATION: First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – propositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation - Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects

SECTION-B

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 - Neural networks - Reinforcement learning – Passive reinforcement learning - Active reinforcement learning - Generalization in reinforcement learning

APPLICATIONS : Communication – Communication as action – Formal grammar for a fragment of English – Syntactic analysis – Augmented grammars – Semantic interpretation – Ambiguity and disambiguation – Discourse understanding – Grammar induction - Probabilistic language processing - Probabilistic language models – Information retrieval – Information Extraction – Machine translation.

Reference Books:

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

PCE-220**SOFT COMPUTING****L-T-P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 50%**Objectives:** Introduce students to fuzzy theory from an engineering perspective.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Sections A and B will have four questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A****Soft Computing:** Introduction, Soft vs Hard Computing, Characteristics of Soft Computing, Applications of Soft Computing.**Fuzzy Logic:** Introduction, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Applications.**SECTION-B****Genetic Algorithms (GA):** Introduction, Basic GA framework and architectures, GA operators: Encoding, Selection-I, Selection-II, Crossover-I, Crossover-II, Mutation, Solving single objective optimization problems using GA, Concept of multi-objective optimization problems (MOOP) and issues, Multi-objective Evolutionary Algorithm (MOEA), Non-Pareto approaches to solve MOOP, Pareto-based approaches to solve MOOP, Applications of GA.**Reference Books:**

1. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
2. Fuzzy Logic: A Practical Approach, F. Martin , Mc neill, and Ellen Thro, AP Professional, 2000.
3. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
4. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.
5. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Wiley & Sons, 2002.
6. Soft Computing, D. K. Pratihar, Narosa, 2008.

PCE-221 ADVANCED COMPUTER CRIME INVESTIGATIONS AND FORENSICS**L T P**
3- 1- 0**Maximum Marks(Internal): 50****Maximum Marks(External): 50**
Minimum Pass Marks(External): 40%**Prerequisites:** Basics of Network Security.**Objectives:** The students will be able to learn investigation tools and techniques, analysis of data to identify evidence, Technical Aspects & Legal Aspects related to cyber crime.**Instructions for paper-setter:** The question paper will consist of three sections A, B and C. Each section A and B will have five questions from the respective sections of the syllabus (05 marks each). Section C will have one question with 10 short answer objective type parts (02 marks each), which will cover the entire syllabus uniformly.**Instructions for candidates:** Candidates are required to attempt seven questions selecting three questions each from sections A and B of the question paper and the entire section C.**SECTION-A**

Evolution of computer Technology, emergence of cyber space, Introduction in Cyber law, Components of Cyber Law and Jurisprudence, Cyber Space and Netizen, Approaches for cybercrime investigation, Cyber evidence, Cyber Ethics, Cyber Terror, Child pornography and related crimes, Obscenity on Internet

Cyber Law in India: An Overview of Information Technology Act, 2000, Grey Areas of Information Technology Act, 2000, Amendments of IT ACT, 2000, Digital Signature, Responsibilities of Internet Service Provider (ISP) / Network Service Provider (NSP), Laws related to Intellectual Property Rights.

SECTION-B

Digital Forensics: history and challenges, Type of Digital Forensics, Forensic Psychology and Criminal Profiling for cybercrimes, Overview of operating systems: registry, boot process, file systems, file metadata, hashing, Current Tools of Computer Forensics & Data recovery

Network Forensics: Tracing IP addresses and e-mail header investigations, Malware, Detection of DOS/DDoS attacks, Botnets, Identity Theft, SPAM

Image Forensics: History of Digital Image Forgery, Types of Digital Image Forgery attacks, Classification of digital image forgery detection techniques, Localization of image forgery

Case Study: Cyber Crimes in India

Reference Books:

1. Computer Forensics and Cyber Crime: An Introduction (3rd Edition) by Marjie T. Britz
2. The Information Technology Act, 2000, as Notified by Govt. of India
3. Network Forensics: Tracking Hackers through Cyberspace, Sherri David off, Jonathan Ham Prentice Hall
4. Criminal Psychology and Forensic Technology A Collaborative Approach to Effective Profiling, CRC Press