Second Year – Second Semester

Computer Organization and Architecture (PCCS-221)

Professional Core (PC); 4 Credits (3-1-0)

Objectives:

To expose the students to the following:

1. How Computer Systems work & the basic principles
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

Unit	Contents	No. of Lectures
Unit 1	**Functional blocks of a computer:** CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs. **Data representation:** signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.	**15**
Unit 2	**Introduction to x86 architecture.** CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. Memory system design: semiconductor memory technologies, memory organization. Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB	**20**
Unit 3	**Pipelining**: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors,	**10**

	Concurrent access to memory and cache coherency.	
Unit 4	**Memory organization:** Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.	**10**
		55

Reference/Text Books:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, 5th Edition "Computer Organization", McGraw-Hill, 2002.
2. Ghosh T.K, "Computer Organization and Architecture", Tata McGraw-Hill,2011.
3. Computer System Architecture –Third Edition-by M. Morris Mano.
4. William Stallings, "Computer Organization and Architecture – Designing for performance", 7th Edition, Pearson Education, 2006.
5. Behroozparahami, "Computer Architecture"Oxford University Press-Eighth Impression, 2011.

   David A. Patterson and John Hennessy L, "Computer Architecture-AQuantitative Approach", Fifth edition, Elsevier, a division of reed India Private Limited, 2012.

Discrete Mathematics (PCCS -222)
Professional Core (PC); 4 Credits (3-1-0)

Objectives:

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Unit	Contents	No. of Lectures
Unit1	**Sets, Relation and Function:** Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. **Principles of Mathematical Induction:** The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.	**10**
Unit2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.	**06**
Unit3	**Propositional Logic:** Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.	**08**
Unit4	**Algebraic Structures and Morphism:** Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	**06**
Unit5	**Graphs and Trees:** Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.	**08**

		38

References/Text Books:

1. Koshy, Discrete Structures, Elsevier Pub. 2008
2. Kenneth H. Rosen, Discrete Mathematics and Its Applications, 6/e, McGraw-Hill, 2006.
3. B. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, 5/e, Prentice Hall, 2004.

Database Management System (PCCS-223)
Professional Core (PC); 4 Credits (3-0-2)

Objectives:

1. To understand difference between storing data in FMS and DBMS and advantages of DBMS.
2. To understand conceptual and physical design of a database.
3. To understand RDBMS and queries to design database and manipulate data in it.
4. To know basic database backup and recovery

Unit	Contents	No. of Lectures
Unit 1	**Database Management System:** Introduction, Definition of DBMS, File processing system Vs DBMS, Limitation of file processing system, Comparison of File processing system and DBMS, Advantages and Disadvantages of DBMS, Users of DBMS - Database Designers, Application programmers, Sophisticated Users, End Users, Capabilities of good DBMS, Overall System structure	**06**
Unit 2	**Data Models:** Introduction, Data Models, Object Based Logical Model, Record Base Logical Model - a. Relational Model, b. Network Model, c. Hierarchical Model, Entity Relationship Model, Entity Set, Attribute, Relationship Set, Entity Relationship Diagram (ERD), Extended features of ERD	**03**

Unit 3	**Relational Databases:** Introduction, Terms - a. Relation, b. Tuple, c. Attribute, d. Cardinality, e. Degree, f. Domain, Keys - Super Key, Candidate Key, Primary Key, Foreign Key - Relational Algebra, Operations - a. Select, b. Project, c. Union, d. Difference, e. Intersection, f. Cartesian Product, g. Natural Join	**06**
Unit 4	**Relational Database Design:** Introduction, Anomalies of un normalized database, Normalization - Normal Form, 1NF, 2 NF, 3 NF.	**10**
Unit 5	**SQL (Structured Query Language):** Introduction, History Of SQL, Basic Structure, DDL Commands, DML Commands, Simple Queries, Nested Queries, Aggregate Functions, Clauses.	**08**
Unit 6	**Transactions and Concurrency Control:** ACID Property,Serializability, time stamp, locking protocol, granuality.	**06**
Unit 7	**Tree Structured Indexing:** Introduction, Index Sequential Access Method (ISAM), Structure of index sequential File, B+ Tree : A Dynamic Index Structure, Operations on B+ Tree - a. Search, b. Insertion, c. Deletion	**05**
		44

References/Text Books:

1. Henry korth and A. Silberschatz, Database System Concepts, McGraw Hill
2. Bipin Desai, An Introduction to Database Systems, Galgotia
3. Michael J. Folk, Greg, Riccardi, File Structure, Pearson Education
4. Jeff Parkins and Bryan Morgan, Teach Yourself SQL in 14 days,
5. SAMS Publishing C.J. Date, An Introduction to Database Systems

Theory of Computation (PCCS-224)

Professional Core (PC); 4 Credits (3-1-0)

Objective:

1. The objective of the course is to develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language
5. convert them into normal forms. Prove equivalence of languages accepted by Push Down Automata and languages
6. generated by context free grammars Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Unit	Contents	No. of Lectures
Unit1	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.	**10**
Unit2	Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.	**10**
Unit3	Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	**10**
	Turing machines: The basic model for Turing machines (TM), Turing-recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines,	

	nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.	
		30

Reference/Text Books:

1. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F.
2. Let us C by YashwantKanitkar
3. C Programming by Dennis Richie.

Web Technology (PCCS-225)

Professional Core (PC); 3 Credits (3-0-2)

Objectives:

1. Students should be able to design and implement a basic website.
2. Students should be able to implement different navigation strategies.
3. Students should be able to use client-side technologies (XHTML, CSS, forms, JavaScript).
4. Students should be able to develop simple back-end database to support a website.

Unit	Contents	No. of Lectures
Unit 1	Basic design and implementation of websites, Back-end data management	**12**
Unit 2	Discussion of different navigation and organizational strategies	**12**
Unit 3	Client-side technologies including HTML5, CSS, JavaScript, JSON, and JQuery	**12**

Unit 4	Server-side technologies emphasizing implementations in PhP, Emerging technologies	**12**
		48

Reference/Text Books:

1. Web Programming Step by Step, J. Miller, V. Kirst, Marty Stepp, Step by Step Publishing; 2nd edition (2012)

Cyber Security and Cyber Laws (OECS-226)
Open Elective Course (OEC); 4 Credits (3-1-0)

Objectives:

1. To create a secure cyber ecosystem in the country, generate adequate trust and confidence in IT system and transactions in cyberspace and thereby enhance adoption of IT in all sectors of the economy.
2. To enable effective prevention, investigation and prosecution of cybercrime and enhancement of law enforcement capabilities through appropriate legislative intervention.
3. To enable Protection of information while in process, handling, storage & transit so as to safeguard privacy of citizen's data and reducing economic losses due to cybercrime or data theft.

Unit	Contents	No. of Lectures
Unit 1	Introduction to Information Systems, Types of Information Systems; Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance; Cyber Security, and Security Risk Analysis.	**08**
	Application security (Database, E-Mail and Internet), Data Security	

Unit 2	Consideration-Backups; Security Threats – Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software; Threats to E-Commerce- Electronic Payment System, e-Cash, Credit/Debit Cards.	**07**
Unit 3	Introduction to Cryptography, Basic terms of Cryptography; Plaintext, Cipher text, Key; Concepts of Cryptography: Transposition, Substitution, Rotation Cipher, Symmetric Key & Asymmetric key; Data Encryption System (DES), Advanced Encryption System (AES) and RSA algorithm.	**06**
Unit 4	Developing Secure Information System, Application Development Security, Security Architecture & Design; Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, access control and CCTV.	**10**
Unit 5	IT Act, Copyright Act, Patent Law, IPR, Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copyright Law, Software License, Semiconductor Law.	**10**
		41

Reference/Text Book:

1. Introduction to Information Security and Cyber Law; by SURYA P. TRIPATHI, R. Geol, P.K Shukla.