Central Institute of Technology Kokrajhar

Dept. of Computer Science and Engineering

B. Tech Syllabus (5th Semester)

Subject Code	Subject Name	Type	L	T	P	C
UCSE501	Computer Network	Compulsory	3	0	0	6
UCSE502	Operating System	Compulsory	3	0	0	6
UCSE503	Formal Language and Automata Theory	Compulsory	3	0	0	6
UCSE511	Information Theory and Coding	Professional Elective	3	0	0	6
UCSE512	Advance Computer Architecture	Professional Elective	3	0	0	6
UCSE513	Artificial Intelligence	Professional Elective	3	0	0	6
UCSE514	Web and Internet Technology	Professional Elective	3	0	0	6
UHSS501	Industrial Management and Entrepreneurship	Compulsory	3	0	0	6
UCSE571	Computer Network Lab	Compulsory	0	0	3	3
UCSE572	Operating System Lab	Compulsory	0	0	3	3
UCSE573	Hardware Lab	Compulsory	0	1	3	5
Total Contact Hours			15	1	9	41

[Note: Only one of the professional electives mentioned above can be selected]

Detailed Syllabus:

Computer Network (UCSE501)

L-T-P: 3-0-0
Credits: 6

Prerequisites:Programming for Problem Solving (UCSE201)

Module 1: Introduction [4L]
History of networking, OSI, TCP/IP and other networks models, Examples of Networks:Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN.

Module 2: Physical Layer [6L]
Design issues, physical media introduction, transmission media, types of media, guided media,unguided media, copper, twisted pair, coaxial cables, UTP, STP, fiber-optic cables, workingprinciple of fiber optic cables, wireless, microwave, satellite, switching and encodingasynchronous communications; Narrow band, broadband, ISDN and ATM.

Module 3: Data link layer [6L]
Design issues, framing, error detection and correction, CRC, Elementary Protocol stop and wait,Sliding Window, Slip, Data link layer in HDLC, Internet, ATM. Data Link sublayers, ALOHA,MAC, LLC, MAC addresses, CSMA, CSMA/CD. IEEE 802.X Standard Ethernet, wirelessLANS. Bridges.

Module 4: Network Layer [8L]
Design issues, packet structure, IP addressing, different versions of IP address, classes of IP,concept of private/public IP, subnetting, CIDR, virtual circuit and datagram subnets-Routing,routing algorithm, routing protocols, distance vector routing protocol, link state routing protocol,routing information protocol and its versions, shortest path routing, flooding, hierarchicalrouting, broadcast, multicast, anycast, dynamic routing. Congestion, Congestion ControlAlgorithms – General Principles – of Congestion prevention policies. Internetworking: TheNetwork layer in the internet and in the ATM Networks.

Module 5: Transport Layer [6L]
Design issues, Transport Services, Connection management, three-way handshaking protocols,TCP and UDP protocols; ATM AAL Layer Protocol, socket, port, client/server communication.

Module 6: Application Layer [5L]
HTTP, SMTP, POP, IMAP, DHCP, DNS, FTP, Telnet, Network Security, TLS, SSL, WWW.

TEXT BOOKS:
1. Computer Networks — Andrew S Tanenbaum,4th Edition. PearsonEducation/PHI
2. Data Communications and Networking – Behrouz A. Forouzan.Third EditionTMH.

REFERENCES:

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, PearsonEducation
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

Operating System (UCSE502)

L-T-P: 3-0-0
Credits: 6

Module 1: Introduction [3L]
Introduction: Objectives and functions of OS, Evolution of Operating Systems,

Module 2: Process [4L]
Structuraloverview Process description and control: Process states, Process description, Processcontrol, Process and threads, Examples of process description

Module 3: CPU Scheduling [6L]
Uniprocessorscheduling: Types of CPU scheduling, CPU Scheduling algorithms.

Module 4: Process Synchronization [6L]
Concurrency: Principles of concurrency, mutual exclusion, Software and Hardwareapproaches, Semaphores, Monitors, Message passing, readers/writers problem, Dining philosopher's problem.

Module 5: Deadlock [4L]
Principles of deadlock, Deadlock prevention, Detection and avoidance,

Module 6: Memory Management [7L]
Memory management requirements, Loading program into mainmemory, Virtual memory, Hardware and control structures, OS software, Examples ofmemory management.

Module 7:I/O and Disk[7L]
I/O management and disk scheduling

Module 8: File Management [5L]
File management and security: Overview of filemanagement, File organization and access, File directories, File sharing, Record blocking,Secondary storage management, Case study: Unix file system, inodes, inode assignment to anew file, super block.

Text Books:
1. A. Silbershatz, P.B. Galvin and Gagne, "Operating System Concepts", Addison- Wesley,2005.
2. Maurice J. Bach "The design of the UNIX operating system", Eastern Economy Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2004.

Reference Books:
1. A. S. Tanenbaum "Operating System Design and Implementation", 3rd Ed., Practice Hallof India, 2004.
2. W. Stalling, "Operating Systems: Internals and Design Principles", 5th Ed., Prentice Hallof India, 2007.

3. H. N. Dietel “An Introduction to Operating Systems”, Addison Wesley, 1990.

Formal Language and Automata Theory (UCSE503)

L-T-P: 3-0-0

Credits: 6

Prerequisite:
UMA302 – Discrete Mathematics

Module 1: Introduction [2L]
Finite Sets, Power Set, Cardinality of finite sets, Cartesian Product, Set operations, Properties of Sets, Functionsand Relations, Countability, Graph, Tree, Transition system, Transition diagram.

Module 2: Finite State Machine [4L]
Definition, Alphabet, String, Language, Formal language, Natural language, Concepts of DFA and NFA withexamples, Regular language, Conversion of NFA to DFA, minimization of FSM, Mealy and Moore Machine.

Module 3: Regular Language [4L]
Regular set, expression, Arden’s theorem, Finite Automata construction from a regular expression, Conversion ofFinite Automata to Regular expressions. Non regular language, Pumping lemma of regular language, closureproperties of regular language.

Module 4: Introduction to Grammar [5L]
Definition, regular grammar, right and left linear grammar, equivalence between regular linear grammar and FA,inter conversion, Context free grammar, derivation trees, sentential forms, right most and leftmost derivation ofstrings, left recursion, left factoring.

Module 5: Context Free Grammars [5L]
Ambiguity in context free grammars. Minimization of Context Free Grammars. Chomsky normal form, Greibacknormal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL (proofs omitted).

Module 6: Push Down Automata [5L]
Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by emptystate and its equivalence. Equivalence of CFL and PDA, interconversion. (Proofs not required). Deterministic andNondeterministic PDA.

Module 7: Turing Machine [4L]
Turing Machine, definition, model, design of TM, Computable functions, recursive, recursively enumerablelanguages. Church’s hypothesis, counter machine, types of Turing machines (proofs not required), Turingmachine as a transducer.

Module 8: Computability Theory [6L]
Chomsky hierarchy of languages, linear bounded automata and context sensitive language, LR(0) grammar,decidability of, problems, Universal Turing Machine, undecidability of posts. Correspondence problem, Turingreducibility, Definition of P and NP problems, NP complete and NP hard problems.

Text Books:
1. An Introduction to Formal Languages and Automata - Peter Linz, Sixth Edition.
2. Introduction to Automata Theory Languages and Computation, Hopcroft H.E. and Ullman J. D. PearsonEducation

References:
1. Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekaran, 2nd edition, PHI
2. Introduction to languages and the Theory of Computation,John C Martin, TMH
3. Elements of Theory of Computation, Lewis H.P. & Papadimition C.H. Pearson /PHI
4. Introduction to Theory of Computation –Sipser 2nd edition Thomson

Information Theory and Coding (UCSE511)

L-T-P: 3-0-0

Credits: 6

Prerequisites:
UCSE302 Discrete Mathematics
UCSE403 Design and Analysis of Algorithms

Module 1:Information Theory [12L]
Entropy, its characterization and related properties, Huffman codes, Shannon-Fano coding,robustness of coding techniques, Information measure-noiseless coding, discrete memorylesschannel – channel capacity, fundamental theorem of information theory.

Module 2: Coding Theory [12L]
Error correcting codes: minimum distance principles, Hamming bound, general binary code,group code, linear group code, Convolution encoding: algebraic structure, Gilbert bound, Threshold decoding: threshold decoding for block codes, Cyclic binary codes: BCH codes, generalized BCH code and decoding, optimum codes,concepts of non-cyclic codes.

Module 3: Combinatorial Designs [10L]
Definitions of BIBD, Hadamard Designs, Latin Squares, Mutually Orthogonal Latin Squares,Orthogonal Arrays.Constructions of codes using designs: Example: Hadamard codes.

Module 4: Network Coding [11L]
Fundamentals of Network Coding: Butterfly networks, graphs and networks, The max-flow min-cut theorem, the multi-source multicast problem, deterministic codedesign for network coding, randomized network coding application of network coding

Texts / References:
1. J. A. Thomas and T. M. Cover: Elements of information theory, Wiley, 2006.
2. J. H. van Lint: Introduction to Coding Theory, Third Edition, Springer, 1998.
3. F. J. MacWilliams and N.J. Sloane: Theory of Error Correcting Codes, Parts I and II,North-Holland, Amsterdam, 1977.
4. D. Stinson: Combinatorial Designs: Constructions and Analysis, Springer, 2003
5. P. J. Cameron and J. H. van Lint: Designs, Graphs, Codes and their Links, CambridgeUniversity Press, 2010.
6. C. Fragouli and E. Soljanin: Network Coding Fundamentals, Now Publisher, 2007.
7. M. Medard and A. Sprintson, (editors): Network Coding – Fundamentals andApplications, Acadamic Press, 2012.
8. C. Fragouli, J. Le Boudec, J. Widmer: Network coding: An instant primer
9. W. Ryan and S. Lin, Channel Codes: Classical and Modern, Cambridge UniversityPress, 2009.
10. R. B. Ash, Information Theory, Dover Publications, 1990.
11. D. J. Mackay, Information Theory, Inference and Learning Algorithms, CambridgeUniversity Press, 2003.

Advance Computer Architecture (UCSE512)

L - T - P: 3 - 0 - 0

Total Credits: 6

Prerequisites:
1. UCSE401 - Computer Organization and Architecture
2. UECE306 - Digital Electronics and Logic Design

Module 1: Introduction[4L]
Fundamentals of computer Design, Technology trends, Cost performance analysis.

Module2:**Parallel Architecture [3L]**
Parallel processing architectures, Flynn's classification, PRAM model.

Module3: **Pipelined Architecture [8L]**
RISC philosophy and overview of pipelined architecture. Performance evaluation of pipelined architecture. Limitations of scalar pipelines, Pipeline Hazards and Analysis, Branch Prediction, MIPS Pipeline for Multi-Cycle Operations.

Module4:ILP[7L]

Instruction level parallelism, Limitations.

Module5: Multiprocessor based Architecture [8L]
Multiprocessor and Thread Level Parallelism,

Module6: superscalar architecture [6L]
Dynamic pipelines, superscalar techniques, performance evaluation of superscalar architectures, VLIW architecture, data-level parallelism.

Module7: Memory system design [5L]
Introduction, Optimization of cache, Virtual memory and Virtual machines, Fallacies and pitfalls.

Module8: Storage system design [4L]
Introduction, Faults and failures, I/O performance.

Books:
Computer Architecture - A Quantitative Approach,5th edition, John L. Hennessy, David A. Patterson.
Computer Architecture and Parallel Processing- Kai Hwang and A. .Brigggs International Edition, McGraw Hill
Advanced Computer Architecture: D. Sima, T. fountain, P. Kacsuk, Pearson
Parallel Computer Architecture: D. Culler, J.P.Singh, A.Gupta, Elsevier

Artificial Intelligence (UCSE513)

L - T - P: 3 - 0 - 0

Total Credits: 6

Prerequisites:
UCSE302 Discrete Mathematics
UCSE403 Design and Analysis of Algorithms

Module 1: Introduction [3L]
AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept ofrationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

Module 2: Searching [8L]
Searching for solutions, uninformed search strategies – Breadth first search, depth first search, Depth limitedsearch, Iterative deepening depth first search bi-direction search - comparison. Search with partial information(Heuristic search) Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions.Local search Algorithms, Hill climbing, simulated, annealing search, local beam search, genetic algorithms.

Module 3: Game Playing [5L]

Adversarial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning,Evaluation functions, cutting of search.

Module 4: Knowledge Representation & Reasons logical Agents [9L]
Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propositionallogic, Resolution, Forward & Backward Chaining.First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts, forwardchaining, Backward chaining, Resolution

Module 5: Planning [5L]
Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state–space search, Forward states spare search, Backward states space search, Heuristics for state space search.Planning search, planning with state space search, partial order planning Graphs.

Module 6: Learning [4L]
Forms of learning, Induction learning, Learning Decision Tree, Statistical learning methods, learning withcomplex data, learning with Hidden variables – The EM Algorithm, Instance Based learning, Neural Networks.

Text Book:
1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/PearsonEducation.
2. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition.

Web and Internet Technology (UCSE514)

L - T - P: 3 - 0 - 0

Total Credits: 6

Module1: Web Basics and Overview[6L]
Introduction to Internet, World Wide Web, Web browser,Web server, Internet services, Web services, URL, DNS.Internet communication protocols such as HTTP and its different versions, FTP,SMTP, POP, MIME, Email Privacy such as Pretty Good Privacy (PGP), and PrivacyEnhanced Email (PEM).

Module2: Client/Server Computing[6L]
What is C/S Computing, Fat client VS Fat Servers, N-tieredSoftware Architecture, Middleware, Distributed Object Models such Common ObjectRequests Broker Architecture (CORBA), Distributed Component Object Model(DCOM), Java Remote Method Invocation (JRMI) and Enterprise Java Bean (EJB).

Module3: Markup Languages and their Grammars[5L]

SGML, HTML, XHTML, XML, XSL, CSS, Document type definition, Object Models, Presenting XML, Using XML Processors:DOM and SAX.

Module4:Client-Side programming[12L]
HTML, CSS, JavaScript, AJAX, jQuery, Server-Side programming: PHP, JSP, ASP, CGI, Web Database Connectivity, Overview of Java, JAVA Applet, JAVA Servlets.Overview of Bootstrap, BS Grids

Module5: **Web Browser[6L]**
Browser Architecture, Document Object Model (DOM), DOM Tree,Render Tree, Rendering Engine and its use on various browsers, case study onbrowser architectures of Mozilla Firefox, Google Chrome, and IE.Web Server Apache Architecture: Web Server Architecture, Server Features,Configuration of Apache and IIS.

Module 6: Web Security[5L]
Web security threats, Firewalls, Proxy Servers, Cryptography, DigitalSignature, Digital Certificates, Secure Socket Layer (SSL), S-HTTP, SecureElectronic Transaction (SET), 3D Secure Protocol.

Text Books:
1. Web Technologies: A Computer Science Perspective by Jaffrey C. Jackson, Prentice Hall,2007
2. Web Technologies: TCP/IP to Internet Application Architecture by Achyut S. Godbole andAtul Kahate, Tata McGraw-Hill Education, 2003, 5th Reprint 2006
3. Robert W Sebesta, “Programming the World Wide Web”, Pearson Education, 2013

Reference Books:
1. Dynamic Web Publishing Unleashed, Shelly Powers et al., 2nd Edition, Sams, 1997
2. Java 1.2 Unleashed, Jamie Jaworski, 4th Edition, Sams, 1998
3. CGI by Example, Jeffry Dwight et.al., Que, 1996.
4. Using Active Server Pages, Scot Johnson et.al., Que, 1997
5. Chris Bates, “Web Programming, building internet applications”, 2nd edition, John Wiley& Sons, 2002.

Industrial Management and Entrepreneurship (UHSS501)

L - T - P: 3 - 0 - 0

Total Credits: 6

Unit:1
Meaning and Concept of Management, Principles and function of Management, Concept of Organizational Behaviour, Function of a Manager—Planning, Organizing, Coordinating and Controlling, Motivation—implication of Managers and application. Leadership, Qualities and Styles of Leadership, Decision making process.

Unit:2

Individual Process in Organizations-Perception, attitude and personality, Factors that affect them, How they influence people. Group Process in Organizations, Group formation, Group effectiveness, Group Conflict.

Unit:3

Evolution, Role and Status of Human Resource Management in India. Recruitment and Selection Process in Organization- Job Analysis-Job Specification-Selection Process-Test and Interview. Trade Union and Collective Bargaining.

Unit:4

Entrepreneurship-Meaning, Types of entrepreneur, Qualities of an entrepreneur, Role of Entrepreneur,Factors affecting entrepreneurial growth. Entrepreneurship Development Programme-Concept, Objective and Importance, Engineer Entrepreneurship Training Programme Scheme, Modern Marketing, Tools for Entrepreneurs, Concept of Start –up and Process for generating start up.

Unit: 5

Small Scale Industry-Definition, Types of Small Scale Industry, How to Set up Small Scale Industry, Role and Problem of Small Scale Industry, Meaning of IPR , Concept of Joint Stock Company, Private and Public Limited Company, Source of Finance for Entrepreneur-Bank, Government and Financial Institutions etc.

Reference Books :

I) S.S. khanka-OrganisationalBehaviour ,S.Chand& Company , New Delhi
II) S.S.Sarkar, R.K.Sharma and S.K.Gupta – Business Organisation and Entrepreneurship Development, Kalyani Publishers , New Delhi
III) Arbinda Debnath – Principles of Management , BLG Publication , Guwahati
IV) L.M. Pradad - Principles and Practice of Management ,S.Chand& Company, New delhi
V) S.S. Khanka – Entrepreneurial Development ,S.Chand& Company , New-Delhi
VI) M.B. Shukla –Entrepreneurship and Small Business Management ,Kitab Mahal, Guwahati
VII) Kanchan Bhatia and Shweta Mittal – Management Concept and Practice ,Variety Books Publishers & Distributors
VIII) Arabinda Debnath – Industrial Management and Entrepreneurship , Kalyani Publishers

Computer Network Lab (UCSE571)

L-T-P: 0-0-3
Credits: 3

Unit 1: Introduction to Networks

Lab 1: Identify the different types of networks LAN, MAN, WAN in the campus and make areport
Lab 2: Identify and list out all the important devices of networking. Explore how the devices getconnected to each other and able to communicate with each other and make a report.
Lab 3: Setup a packet tracer in your lab/home computer and make a layout of network usingdifferent components

Unit 2: Physical Layer

Lab 4: Setup a LAN that can communicate among the virtual devices inside the packet tracer
Lab 5: Extend the LAN that is set up in Lab 4 for so that it works in the real world. Setup aphysical LAN network using UTP cables, RJ45, Crimpers, switch/hub and machines connectedusing this setup should communicate with each other.
Lab 6: Explore possibility of setting up fiber optic connection physically. Identify variouscomponents required for setting up a fiber optic connection.

Unit 3: Data link layer
Lab 7: Using packet tracer/wireshark identify the data link layer frame structure
Lab 8: Perform some lab work that demonstrates MAC, ARP etc.

Unit 4: Network Layer
Lab 9: Create a network and multiple subnetworks in the packet tracer and make them able tocommunicate with each other.
Lab 10: Lab that demonstrate routing in the packet tracer
Lab 11: Configure routing with various protocols like RIP, BGP, EGP etc

Unit 5: Transport Layer
Lab 12: Write a C/C++/Java program to demonstrate socket programming
Lab 13: Write a program to demonstrate client/server communication protocol

Unit 6: Application
Lab 14: Configure an SMTP/IMAP/POP to send/receive email, DHCP server to allocate IPaddresses, HTTP server to serve html documents, ftp to access files, ssh to access remote server.

References:
Software: CISCO Packet tracer, Boson NetSim
OS: Linux/Windows having specialised software installed for the specific purpose.
Application Softwares: DHCP Server, FTP Server: filezilla server, openftp, opensmtpd, HTTP-Apache, nginx, SSH-OpenSSH, termius,sshd,putty

Operating System Lab (UCSE572)

L-T-P: 0-0-3

Credits: 3

List of Programs:
1. Simple Unix-C (at least two) programs using system calls to read and write strings onstandard I/O devices and files.
2. Implementation of starting a new process, replacing a process image, duplicating aprocess image, waiting for a process, zombie process.
3. Implementation of the Dining Philosopher problem using shared memory and semaphore.

4. Implementation of a bounded-buffer problem using shared memory and semaphore.
5. Implementation of FCFS process scheduling techniques.
6. Implementation Shortest Job First (both preemptive and non-preemptive version)process scheduling techniques.
7. Implementation Round Robin process scheduling techniques.
8. Implementation for simulating page replacement algorithms like FIFO, Optimal andLRU.
9. Implementation of threads using POSIX or using thread class in Java.
10. Implementation of (at least one) deadlock avoidance techniques.

Text Books:

1. Stevens, “UNIX programming”, Pearson Education, Pearson Education, 2004.

Hardware Lab (UCSE573)

L-T-P: 0-1-3

Credits: 5

HDL: Verilog/VHDL

List of experiments:

1. Realization of basic digital circuits: Half adder, Full Adder, Ripple Carry Adder, Adder/Subtractor, Multiplexer/Demultiplexer.
2. Complex Arithmetic Units:Carry Lookahead Adder, Unsigned Multiplication, Signed Multiplication, Systolic Array Multiplication, Division
3. Realization of Logic Units: 16 bits greater than, 16 bits less than, 16 bit equals to
4. Development of a 16-bit ALU

Books:

The Verilog® Hardware Description Language 5th Edition by Donald E. Thomas , Philip R. Moorby