TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India

Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

2-Years Master of Technology (M. Tech.)
Syllabus for Computer Science and Engineering (CSE)

Second Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	T	P	
Theory					
TIU-PCS-T102	Advanced Computer Networks	3	1	0	4
TIU-PCS-T104	Advanced Operating Systems	3	1	0	4
TIU-PCS-T106	High Performance Computer Architecture	3	1	0	4
TIU-PCS-E1#	Elective – III	3	1	0	4
Practical					
TIU-PCS-S106	Technical Seminar-I	2	0	0	3
Sessional					
TIU-PES-S198	Entrepreneurship Skill Development	0	0	2	2
Total Credits					**21**

ELECTIVE – III					
TIU-PCS-E102	Computer Vision	3	1	0	4
TIU-PCS-E104	Intelligent Systems	3	1	0	4
TIU-PCS-E106	Parallel and Distributed Algorithms	3	1	0	4
TIU-PCS-E108	Advances in Compiler Construction	3	1	0	4
TIU-PCS-E110	Simulations: Modeling and Analysis	3	1	0	4

Approved By:

External Expert VC Registrar Dean of Academics Mentor of the Dept. HOD

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Syllabus

ADVANCED COMPUTER NETWORKS

TIU-PCS-T102

L-T-P:3-1-0 **Credits: 4**

Module I: COMPUTER NETWORKS: Internet architecture and performance modeling, Applications - architectures and examples, Transport protocols - TCP mechanics, congestion control, resource allocation, Internet routing, routing algorithms, BGP, advanced routing concepts, router architectures, Link layer: switching, multiple access, MPLS, Advanced topics: network virtualization, software defined networking

Mudule II : INFORMATION THEORY: Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memory less channels – BSC, BEC – Channel capacity, Shannon limit, Hamming Code, Cyclic Code, Convolution Code, LDPC Code.

Recommended Books:

Text Books:

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill
2. A. Tanenbaum, Computer Networks, PEARSON, 2013
3. R. Bose, “Information Theory, Coding and Cryptography”, TMH 2007

References:

1. K Sayood, “Introduction to Data Compression” 3/e, Elsevier 2006
2. S Gravano, “Introduction to Error Control Codes”, Oxford University Press 2007
3. Amitabha Bhattacharya, “Digital Communication”, TMH 2006

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4. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Fourth Ed., Morgan Kaufmann

ADVANCED OPERATING SYSTEMS

TIU-PCS-T104

L-T-P:3-1-0 **Credits: 4**

Theory and implementation aspects of distributed operating systems. Process synchronization in multiprocessing/multiprogramming systems. Inter-process communication and co-ordination in large distributed systems. Distributed resource management. Fundamentals of real time operating systems. Case studies. Information management in distributed systems: security, integrity and concurrency problems. Fault tolerance issues. OS issues related to the Internet, intranets, pervasive computing, embedded systems, mobile systems and wireless networks. Case studies of contemporary operating systems.

Recommended Books:

Main Reading:

1. AviSilberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley Asia.
2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India.
3. D. M. Dhamdhere, Operating Systems: A Concept-Based Approach, Tata McGraw-Hill.

Supplementary Reading:

1. Charles Crowley, Operating System: A Design-oriented Approach, Irwin Publishing.
2. Gary J. Nutt, Operating Systems: A Modern Perspective, Addison-Wesley.
3. Maurice Bach, Design of the Unix Operating Systems, Prentice-Hall of India.
4. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, O'Reilly and Associates.

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HIGH PERFORMANCE COMPUTER ARCHITECTURE

TIU-PCS-T106

L-T-P:3-1-0 **Credits: 4**

Introduction: Review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance, CISC and RISC processors.

Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques. Compiler techniques for improving performance.

Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.

Instruction-level parallelism: Basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures. Array and vector processors.

Multiprocessor architecture: taxonomy of parallel architectures. Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers.

Non von-Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

Recommended Books:

Main Reading

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.
2. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hill.
3. Kai Hwang and Briggs, Computer Architecture and Parallel Processing, McGraw-Hill

Supplementary Reading

1. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.

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2. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.

COMPUTER VISION
TIU-PCS-E102

L-T-P: 3-1-0 **Credits: 4**

Image Formation and Image Sensing: Perspective Projection, Orthographic Projection, Brightness, Sensing color, Randomness and Noise.

Binary Images: Geometric Properties – Binary Images, Simple Geometric Properties – Area, Position, Orientation, Projections and Associated Problems, Topological Properties – Labeling Components, Connectedness, Sequential Labeling Algorithm, The Additive Set Properties.

Image Processing: Continuous Images – Linear Shift Invariant Systems, Convolution and Point Spread Function, Modulation Transfer Function, Fourier Transform and Filtering, Partial Derivatives and Convolution, Rotational Symmetry and Isotropic Operators, Deblurring, Defocussing and Motion Smear, Correlations and Power Spectrum, Optimal filtering and Noise Suppression.

Reflectance Map: Photometric Stereo - Image Irradiance and Scene Radiance, Bidirectional Reflectance Distribution Function, Extended Light Source, Surface Reflectance Properties, Surface Brightness, Surface Orientation, Reflectance Map, Photometric Stereo.

Shape From Shading: Linear Reflectance Map, Rotationally Symmetric Map, General Case For Shape From Shading For Opaque Objects.

Stereo Vision: Disparity, Conjugate pairs, Epipolar Line, Finding Shape of An Opaque Object Using Stereographic Algorithms, Stereographic Projection Coordinates and its Use in Finding Shape of an Object.

Optical Flow: Apparent Motion, Computing Optical Flow in Continuous and Discrete Cases, Boundary conditions.

Motion Estimation: Rigid body Motion and Its Computation, Discrete Structure Determination From Motion, Focus of Expansion.

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Recommended Books:

Main Reading

1. BKP Horn , Robot Vision, Mit Press
2. Dana Harry Ballard, Christopher M. Brown, Computer vision, Prentice-Hall,

INTELLIGENT SYSTEMS

TIU-PCS-E104

L-T-P: 3-1-0 **Credits: 4**

Introduction: Problem characteristics, issues in design of search algorithms.

Searching: Uninformed search techniques, alterative deepening. Heuristics search techniques, Constraint Satisfaction; Means Ends Analysis; Alternative search techniques, Evolutionary search techniques-working of Genetic Algorithm and simulated annealing

Game-playing: Single player game, Two player game, The Minmax procedure, Minmax Procedure with alpha-beta cutoffs, Quiescent search, search efficiency.

Knowledge representation: The propositional Calculus – resolution in propositional calculus, entailment, PSAT problem, The Predicate calculus – resolution in predicate calculus, quantification, unification, horn clauses.

Expert System: Introduction, knowledge representation in ES, reasoning with uncertain information, Bayes network, D-separation, probabilistic interfacing, inexact reasoning, representing common sense knowledge, non-monotonic and monotonic reasoning, forward and backward chaining.

Neural Network: Introduction to Artificial neural networks, feed forward and feedback networks, perceptions linearly separable and non-separable problems, supervised and unsupervised learning, back propagation algorithm.

Fuzzy Logic: Introduction to fuzzy logic and fuzzy sets, membership function, defuzzification methods, fuzzy arithmetic.

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Main Reading:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall.
2. Rajasekharan, S. Pai, G.A Vijaylakshmi, Neural Neyworks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications

Supplementary Reading:

1. Nils J. Nilsson, Artificial Intelligence: A New Sythesis, Morgan-Kaufmann.
2. Satish Kumar, Neural Networks: A class room approach, Mc-Grow Hill
3. Tom M. Mitchell, Machine Learning, Mc-Graw Hill

PARALLEL AND DISTRIBUTED ALGORITHMS

TIU-PCS-E106

L-T-P: 3-1-0 **Credits: 4**

Fundamentals: Models of parallel and distributed computation, complexity measures.

The PRAM Model: balancing, divide and conquer, parallel prefix computation, pointer jumping, symmetry breaking, list ranking, sorting and searching, graph algorithms, parallel complexity and complexity classes, lower bounds.

Interconnection Networks: topologies (arrays and mesh networks, trees, systolic networks, hyper cubes, butterfly) and fundamental algorithms, matrix algorithms, sorting, graph algorithms, routing, and relationship with PRAM models; Asynchronous Parallel Computation; Distributed Models and Algorithms.

Concepts of Distributed Computation: Termination; Failure tolerance; Network topology.

Distributed Search: Distributed BFS, Random walks; Introduction to Markov processes; Random walks (hitting time, cover time); (s.t)-connectivity.

Distributed Networks: Broadcasting; Robust distributed networks

Recommended Books:

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Main Reading:

1. V. Kumar, A. Grama, A. Gupta, G. Kaarypis, Introduction to Parallel Computing, Addison Wesley Press

ADVANCES IN COMPILER CONSTRUCTION

TIU-PCS-E108

L-T-P: 3-1-0 **Credits: 4**

Review of compiler fundamentals - lexical analysis, parsing, semantic analysis, error recovery and intermediate code generation; Runtime storage management; Code generation; Code improvement - peephole optimization, dependence analysis and redundancy elimination, loop optimization, procedural and inter-procedural optimization, instruction scheduling, optimization for memory hierarchy; Compilation for high performance architecture; Portability and retargetability; Selected topics from compilers for imperative, object-oriented and mark-up languages, parallel and distributed programming and concurrency.

Recommended Books:

Main Reading:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley.
2. Michael L. Scott, Programming Language Pragmatics, Elsevier.

Supplementary Reading:

1. Andrew W. Appel, Modern Compiler Implementation in C/Java, Cambridge University Press.
2. Keith D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier.
3. Allen I. Holob, Compiler Design in C, Prentice-Hall.
4. Steven S. Muchnik, Advanced Compiler Design and Implementation, Elsevier.
5. Randy Allen and Ken Kennedy, Optimizing Compilers for Modern Architectures, Elsevier.

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SIMULATIONS: MODELING AND ANALYSIS

TIU-PCS-E110

L-T-P: 3-1-0 **Credits: 4**

Review of Basic Probability Theory: Random Variables; Simulation Output Data and Stochastic Processes; Estimation of Means, Variances; Correlations Confidence Intervals; Hypothesis Test; Strong Law of Large Numbers.

Basic Simulation Modeling: Systems, Models, and Simulation; Discrete-Event Simulation; Single-Server Queuing System; Advantages, Disadvantages, and Pitfalls of Simulation.

Modeling Complex Systems: List Processing in Simulation; Time-Shared Computer Model; Job-Shop Model.

Output Data Analysis: Transient and Steady-State Behavior of a Stochastic Process; Statistical Analysis for Terminating Simulations; Statistical Analysis for Steady-State Parameters; Multiple Measures of Performance; Time Plots of Important Variables.

Simulation Software: Comparison of Simulation Packages with Programming Languages; Classification of Simulation Software; Desirable Software Features; General-Purpose Simulation Packages; Introduction to MATLAB Simulator; Introduction to NS2 Network Simulator.

References:

1. Sheldon M. Ross: Introduction to Probability Models 7th Edition, Academic Press.
2. A. M. Law and W. D. Kelton: Simulation Modeling and Analysis, 3rd Edition, Mc-Graw Hill, New York, USA.

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