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

4-Years B.Tech. Curriculum and Syllabus for Computer Science and Engineering (CSE)

Seventh Semester

S. No	Course Code	Course Title	Contact Hrs. / Week			Credit
			L	T	P	
THEORY						
1	TIU-UCS-T401	Career Advancement and Skill Development	2	1	0	3
2	TIU-UCS-T403	Cryptography and Network Security	3	0	0	3
3	TIU-UCS-T409	Artificial Intelligence & Soft Computing	3	0	0	3
4	TIU-UMG-T404	Engineering economics & financial accounting	3	0	0	3
5	TIU-UCS-E4##	Elective -I	3	0	0	3
PRACTICAL						
1	TIU-UCS-P499	Project	0	0	3	6
SESSIONAL						
1	TIU-UES-S499	Entrepreneurship Skill Development	0	0	3	2
TOTAL CREDIT						23

S.No	ELECTIVE – I					
1	TIU-UCS-E403	Mobile Computing and Wireless Communication	3	1	0	3
2	TIU-UCS-E409	Machine Learning	3	1	0	3
3	TIU-UCS-E411	Advanced Graph Theory	3	1	0	3
4	TIU-UCS-E415	Information Theory and Coding	3	1	0	3

Approved By:

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

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

SYLLABUS

Career Advancement & Skill Development
TIU-UTR-T401

L-T-P: 2-1-0 **Credit: 3**

CRYPTOGRAPHY & NETWORK SECURITY
TIU-UCS-T403

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

Introduction: Basic objectives of cryptography, secret-key and public-key cryptography, one-way and trapdoor one-way functions, cryptanalysis, attack models, classical cryptography.
Block ciphers: Modes of operation, DES and its variants, RCS, IDEA, SAFER, FEAL, BlowFish, AES, linear and differential cryptanalysis.
Stream ciphers: Stream ciphers based on linear feedback shift registers, SEAL, unconditional security.
Message digest: Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions.
Public-key parameters: Modular arithmetic, gcd, primality testing, Chinese remainder theorem, modular square roots, finite fields.
Intractable problems: Integer factorization problem, RSA problem, modular square root problem, discrete logarithm problem, Diffie-Hellman problem, known algorithms for solving the intractable problems.
Public-key encryption: RSA, Rabin and EIGamal schemes, side channel attacks.
Key exchange: Diffie-Hellman and MQV .
Digital signatures: RSA, DSA and NR signature schemes, blind and undeniable signatures.
Entity authentication: Passwords, challenge-response algorithms, zero-knowledge protocols.
Standards: IEEE, RSA and ISO standards.

Approved By:

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

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

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

Network security: Certification, public-key infra-structure (PKI), secure socket layer (SSL), Kerberos.
Advanced topics: Elliptic and hyper-elliptic curve cryptography, number field sieve, lattices and their applications in cryptography, hidden monomial cryptosystems, cryptographically secure random number generators.

Recommended Books:

Main Reading:

1. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press.
2. William Stallings, Cryptography and Network Security: Principles and Practice, Prentice Hall of India.
3. Neal Koblitz, A course in number theory and cryptography, Springer.

Supplementary Reading:

1. Johannes A. Buchmann, Introduction to Cryptography, Undergraduate Text in Mathematics, Springer.
2. Doug Stinson, Cryptography Theory and Practice, CRC Press.
3. Das and C. E. VeniMadhavan, Public-Key Cryptography: Theory and Practice, Pearson Education Asia.

Approved By:

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

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

Artificial Intelligence & Soft Computing

TIU-UCS-T409

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

Introduction of AI: Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents : Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving: Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Search techniques: Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies: Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic: Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Approved By:

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

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

Representing knowledge using rules: Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Planning: Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Natural Language processing: Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Learning: Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Expert Systems: Representing and using domain knowledge, expert system shells, knowledge acquisition.

Introduction of soft Computing,: What is soft computing, soft computing vs. hard computing, various types of soft computing, application of soft computing.

Genetic Algorithm: natural evaluation: chromosome, natural selection, crossover, mutation.

Genetic algorithms- Chromosomes, Fitness function, population, GA operators, Elitism, GA parameters, Convergence.

Multi-objective Genetic Algorithm- MOO problem formulation, The Pareto-optimal Front, Pareto-optimal Ranking. Simulated Annealing.

Fuzzy Set Theory: Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and

Approved By:

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

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

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

Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models.

Neural Networks: Structure and function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, Characteristics and application of ANN, Perceptron training algorithm, neural network architecture, Activation function, learning by neural nets, Linear separability, Widrow & Hebb's learning rule/delta rule, ADALINE, MADALINE, Hetero-associative nets, Hopfield networks, MAXNET, Kohonen Self-Organizing Networks, Learning Vector Quantization, Hebbian Learning, Backpropagation, Mutilayer Perceptrons, Radial Basis Function Networks, Unsupervised Learning Neural Networks, Competitive Learning Networks.

Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. Artificial Intelligence, Russel, Pearson

MOBILE AND WIRELESS COMPUTING
TIU-UCS-E403

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

Introduction: Challenges in mobile computing, coping with uncertainties, resource poorness, bandwidth, etc. Cellular architecture, co-channel interference, frequency reuse, capacity increase by cell splitting. Evolution of mobile system: CDMA, FDMA, TDMA, GSM.

Approved By:

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

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

Mobility Management: Cellular architecture, Co-channel interference, Mobility: handoff, types of handoffs; location management, HLR-VLR scheme, hierarchical scheme, predictive location management schemes. Mobile IP, cellular IP.

Publishing & Accessing Data in Air: Pull and push based data delivery models, data dissemination by broadcast, broadcast disks, directory service in air, and energy efficient indexing scheme for push based data delivery.

File System Support for Mobility: Distributed file sharing for mobility support, Coda and other storage manager for mobility support

Ad hoc Network Routing Protocols: Ad hoc network routing protocols, destination sequenced distance vector algorithm, cluster based gateway switch routing, global state routing, fish-eye state routing, dynamic source routing, ad hoc on-demand routing, location aided routing, zonal routing algorithm.
Mobile Transaction and Commerce: Models for mobile transaction. Kangaroo and joey transactions, team transaction. Recovery model for mobile transactions. Electronic payment and protocols for mobile commerce.

Recommended Books:

Main Reading:
1. Jochen Schiller, “Mobile Communications”, Addison-Wesley
Supplementary Reading:
1. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley

MACHINE LEARNING

TIU-UCS-E409

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

Approved By:

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

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

Introduction: Introduction to learning. The concept of learning task. General-to -specific ordering of hypotheses. Inductive learning concept. version space, Types of learning- Supervised, unsupervised, semi-supervised, reinforcement learning.

Regression: Concept of regression. Linear regression, non-linear regression. Concept of regularizers. Ridge regression and shrinkage. Fundamentals of statistics.

Decision tree Learning: Hypothesis space search, Design of the decision tree for a real-life problem**.**

Artificial Neural Networks: Thresholds, perceptrons, multilayer perceptron algorithm. Classification of MLP, Recurrent networks.

Probabilistic Machine Learning: Bayes theorem, Bayes classifier, discriminant analysis, optimal representation of data in eigen space.

Classification: SVM, Concept of Kernels, Kernel SVM.

Clustering: K-means clustering

Recommended Books:

Main Reading

1. Pattern Classification., Richard, Duda, Peter Hart and David Stork, Wiley Interscience.
2. Machine Learning., Tom Mitchell, Tom, McGraw-Hill
3. Neural Networks and Learning Machines 3 Edition (English, Paperback, Simon Haykin)

Supplementary Reading

1. The Elements of Statistical Learning: Data Mining, Inference and prediction., Hastie, T.,
2. R. Tibshirani and J.H Friedman . , NY. Springer, ISBN: 9780387952840

Approved By:

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

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

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

3. Information Theory, Interference and learning algorithms. MacKay, David, Cambridge, UK, Cambridge University Press

ADVANCED GRAPH THEORY

TIU-UCS-E411

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

Review of basics: Graphs and digraphs, incidence and adjacency matrices, isomorphism, the automorphism group; Trees: Equivalent definitions of trees and forests, Cayley's formula, the Matrix-Tree theorem, minimum spanning trees. Cut vertices, cut edges, bonds, the cycle space and the bond space, blocks, Menger's theorem; Paths and Cycles: Euler tours, Hamilton paths and cycles, theorems of Dirac, Ore, Bondy and Chvatal girth, circumference,

Matchings: Matchings: Berge's Theorem, perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, Petersen's theorem, algorithms for matching and weighted matching (in both bipartitie and general graphs), factors of graphs (decompositions of the complete graph), Tutte's f-factor theorem;

Extremal Problems: Extremal problems: Independent sets and covering numbers, Turan's theorem, Ramsey theorems; Colorings: Brooks theorem, the greedy algorithm, the Welsh-Powell bound, critical graphs, chromatic polynomials, girth and chromatic number, Vizing's theorem; Graphs on surfaces: Planar graphs, duality, Euler's formula, Kuratowski's theorem, toroidal graphs, 2-cell embeddings, graphs on other surfaces.

Directed Graphs : Tournaments, directed paths and cycles, connectivity and strongly connected digraphs, branching.

Networks and flows: Flow cuts, max flow min cut theorem, perfect square.

Random Graphs: The basic models - use of expectations, simple properties of almost all graphs, almost determined variables – use of variance, Hamiltonian cycles, the phase transition.

Recommended Books:

Approved By:

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

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

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

Main Reading

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.
3. Frank Harary, Graph Theory, Narosa.

Supplementary Reading

1. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall.
2. Bollobas, Bela, Modern Graph Theory, Springer.
3. R. Diestel, Graph Theory, Springer.

INFORMATION THEORY AND CODING

TIU-UCS-E415

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

Information Theory: Uncertainty and information, average mutual information and entropy.

UNIT I

Source Coding: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, coding for Discrete less sources, Source coding theorem, fixed length and variable length coding, properties of prefix codes.

UNIT II

Shannon-Fano Coding, Huffman code, Huffman code applied for pair of symbols, efficiency calculations, Lempel-Ziv codes.

UNIT III

Linear Block Codes: Introduction to Linear block codes, Generator Matrix, Systematic Linear Block

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

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

codes, Encoder Implementation of Linear Block Codes, Parity Check Matrix, Syndrome testing, Error Detecting and correcting capability of Linear Block codes.

UNIT IV

Hamming Codes, Probability of an undetected error for linear codes over a Binary Symmetric Channel, Weight Enumerators and Mac-Williams identities, Perfect codes, Application of Block codes for error control in data storage Systems.

UNIT V

Cyclic Codes: Algebraic structure of cyclic codes, Binary Cyclic code properties, Encoding in systematic and non-systematic form, Encoder using (n-k) bit shift register, Syndrome Computation and Error detection, Decoding of Cyclic Codes.

UNIT VI

Convolutional Codes: encoding of Convolutional codes, Structural properties of Convolutional codes, state diagram, Tree diagram, Trellis Diagram, maximum, Likelihood decoding of Convolutional codes.

UNIT VII

Viterbi Algorithm, Fano, Stack Sequential decoding algorithms, Application of Viterbi and sequential decoding.

UNIT VIII

Bch Codes: Groups, fields, binary Fields arithmetic, construction of Falois fields GF (2m), Basic properties of Falois Fields, Computation using Falois Field GF (2m) arithmetic, Description of BCH codes, Decoding procedure for BCH codes.

Recommended Books:

Main Reading

1. SHU LIN and Daniel J. Costello, Jr. “Error Control Coding – Fundamentals and Applications”, Prentice Hall Inc.

Approved By:

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

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

Supplementary Reading:

1. Bernard sklar,"Digital Communications – Fundamental and Application", Pearson Education, Asia.
2. Man Young Rhee, "Error Control Coding Theory", McGraw Hill

Approved By:

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