ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
GUWAHATI

Course Structure and Syllabus
(From Academic Session 2018-19 onwards)

B.TECH

COMPUTER SCIENCE AND ENGINEERING

8th SEMESTER

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Course Structure
(From Academic Session 2018-19 onwards)

B.Tech 8th Semester
Semester VIII/ B.TECH/CSE

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	CSE1818PE5*	Program Elective-5	3	0	0	3	30	70
2	CSE1818PE6*	Program Elective-6	3	0	0	3	30	70
3	CSE1818OE4*	Open Elective-4	3	0	0	3	30	70
4	CSE1818OE5*	Open Elective-5	3	0	0	3	30	70
Practical								
1	CSE181822	Project-2	0	0	12	6	100	50
TOTAL			12	0	12	**18**	**220**	**330**
Total Contact Hours per week : 24								
Total Credit: 18								

PROGRAMME ELECTIVE – 5 SUBJECTS		
Sl. No	**Subject Code**	**Subject**
1	CSE1818PE51	Cryptography and Network Security
2	CSE1818PE52	Speech and Natural Language Processing
3	CSE1818PE53	Parallel Computing
4	CSE1818PE5*	Any other subject offered from time to time with the approval of the University

PROGRAMME ELECTIVE – 6 SUBJECTS		
Sl. No	**Subject Code**	**Subject**
1	CSE1818PE61	Big Data Analytics
2	CSE1818PE62	Computer Vision
3	CSE1818PE63	Neural Networks and Deep Learning
4	CSE1818PE6*	Any other subject offered from time to time with the approval of the University

OPEN ELECTIVE – 4 SUBJECTS		
Sl. No	**Subject Code**	**Subject**
1	CSE1818OE41	Artificial Intelligence
2	CSE1818OE42	Quantum Computing
3	CSE1818OE43	Optimization Techniques in Machine Learning
4	CSE1818OE4*	Any other subject offered from time to time with the approval of the University

OPEN ELECTIVE – 5 SUBJECTS		
Sl. No	**Subject Code**	**Subject**
1	CSE1818OE51	Internet of Things
2	CSE1818OE52	Computational Number Theory
3	CSE1818OE53	Electronic Design Automation
4	CSE1818OE54	Soft Computing
5	CSE1818OE5*	Any other subject offered from time to time with the approval of the University

Detailed Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818PE51	**Cryptography and Network Security**	**3-0-0**	**3**

MODULE 1: Symmetric Ciphers - Overview: Services, Mechanisms and Attacks, The OSI Security Architecture, A Model of Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography, Block Cipher and the Data Encryption Standard: Simplified DES, Block Cipher Principles, the DES, the Strength of DES, Differential and Linear Cryptanalysis. Symmetric Ciphers: Triple DES, Blowfish. Confidentiality using Conventional Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation.

MODULE 2: Public Key Encryption, Digital Signatures - Number Theory, Prime Numbers Format's and Euler's Theorems, Testing for Primality, Public Key Cryptography and RSA: Principles of Public Key Cryptosystems, the RSA Algorithms, Key Management, Diffie-Hellman Key Exchange.

MODULE 3: Authentication Protocols - Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, MD5 Message Digest Algorithms, Digital Signatures and Authentication Protocols: Digital Signatures, Authentication Protocols, Digital Signature Standards.

MODULE 4: Network Security - Authentication Applications: Kerberos, X.509 Directory Authentication Service. Electronic Mail Security: Pretty Good Privacy. IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulation Security Pay load, Web Security: Web Security Requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

MODULE 5: System Security- Intruders, Malicious Software, Viruses and Related Threats, Counter Measures, Firewalls and its Design Principles.

Text/Reference Books:

1. William Stallings, Cryptography and Network Security, 4th Edition, Pearson Education/PHI, 2006
2. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: Private Communication in PublicWorld, 2nd Edition, 2011, Pearson Education.
3. Atul Kahate, Cryptography and Network Security, TMH. (2003)

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818PE52	**Speech and Natural Language Processing**	**3-0-0**	**3**

MODULE 1: Phases in natural language processing, applications, Text representation in computers, encoding schemes, Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank,WordNet, VerbNet etc., Resource management with XML, Management of linguistic data with the help of GATE, NLTK.

MODULE 2: Regular expressions, text normalization, stemming, Morphology with Finite State Transducer, N-gram language models, smoothing, text categorization using Naïve Bayes

MODULE 3: Part of Speech tagging- Stochastic POS tagging, HMM, Viterbi algorithm, Handling of unknown words

MODULE 4: Parsing- probabilistic parsing, dependency parsing

MODULE 5: Information Extraction: named entity recognition, relation extraction, event extraction

MODULE 6: Semantics- Meaning representation, semantic analysis, lexical semantics, Word Sense Disambiguation

MODULE 7: Discourse- Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure

MODULE 8: Information Retrieval- Vector space model, term weighting, homonymy, polysemy, synonymy, improving user queries

MODULE 9: Overview of machine translation, question answering, dialog systems and chatbots

Text/Reference Books:

1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2e, Pearson Education, 2009
2. James A., Natural language Understanding 2e, Pearson Education, 1994
3. Bharati A., Sangal R., Chaitanya V., Natural language processing: a Paninian perspective, PHI, 2000
4. Siddiqui T., Tiwary U. S., Natural language processing and Information retrieval, OUP, 2008

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818PE53	**Parallel Computing**	**3-0-0**	**3**

MODULE 1: Introduction: Why parallel computing; Ubiquity of parallel hardware/multi-cores; Processes and threads; Programming models: shared memory and message passing; Speedup and efficiency; Amdahls Law

MODULE 2: Introduction to parallel hardware: multi-cores and multiprocessors; shared memory and message passing architectures; cache hierarchy and coherence; sequential consistency

MODULE 3: Shared memory parallel programming: Synchronization: Locks and barriers; Hardware primitives for efficient lock implementation; Lock algorithms; Relaxed consistency models; High-level language memory models (such Java and/or C++); Memory fences. Developing parallel programs with UNIX fork model: IPC with shared memory and message passing; UNIX semaphore and its all-or-none semantic, developing parallel programs with POSIX thread library: Thread creation; Thread join; Mutex; Condition variables, developing parallel programs with OpenMP directives: Parallel for; Parallel section; Static, dynamic, guided, and runtime scheduling, Critical sections and atomic operations, Barriers, Reduction

MODULE 4: Message passing programming: Distributed memory model, Introduction to message passing interface (MPI), Synchronization as Send/ Receive pair, Synchronous and asynchronous Send/Receive, Collective communication: Reduce, Broadcast, Data distribution, Scatter, Gather; MPI derived data types.

MODULE 5: Basic Parallel Algorithmic Techniques: Pointer Jumping, Divide-and-Conquer, Partitioning, Pipelining, Accelerated Cascading, Symmetry Breaking, Synchronization (Locked, Lock-free), Parallel Algorithms: Searching, Merging, Sorting, Prefix operations, matrix computation

MODULE 6: Introduction to GPU programming: GPU architecture, introduction to CUDA programming, Concept of SIMD and SIMT computation, thread blocks, Warps, global memory, shared memory, thread divergence in control transfer, introduction to PGAS programming paradigms, Transactional memory paradigm, speculative parallelization

Text/Reference Books:

1. Peter S Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann, 2011
2. M Herlihy and N Shavit, The Art of Multiprocessor Programming Morgan Kaufmann, 2008
3. JL Hennessy and DA Patterson, Computer Architecture: A Quantitative Approach, 4th Edition, Morgan Kaufmann India, 2006
4. DE Culler and JP Singh with A Gupta, Parallel Computer Architecture: A Hardware/Software Approach Morgan-Kaufmann, 1998
5. A Grama, A Gupta, G Karypis, and V Kumar, Introduction to Parallel Computing, 2nd Ed., Addison-Wesley, 2003
6. MJ Quinn, Parallel Computing: Theory and Practice, Tata McGraw Hill, 2002

7. DB Kirk and W-m W Hwu, Programming Massively Parallel Processors, Morgan Kaufmann, 2010
8. Parallel Programming in C with MPI and Open MP by M J Quinn
9. Introduction to Parallel Computing by Ananth Grama, George Karypis,Vipin Kumar, and Anshul Gupta
10. Programming Massively Parallel Processors by D.Kirk and W. Hwu

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818PE61	**Big Data Analytics**	**3-0-0**	**3**

MODULE 1: Introduction to Big Data, introduction to Enabling Technologies for Big Data, introduction to Big Data Platforms, introduction to Big Data Storage Platforms for Large Scale Data Storage, introduction to Big Data Streaming Platforms for Fast Data, Relationships and Representations, Graph Databases

MODULE 2: Introduction to Big Data Applications using machine learning

MODULE 3: Introduction to Spark, introduction of big data Machine learning with Spark, Language processing with Spark, Analysis of Streaming Data with Spark, Applications of Spark ML Library, Basic Neural Network and Tensor Flow

MODULE 4: Introduction to Big Data Applications: Graph Processing, Analysis of Images, Question Answer Systems, Page Rank like Search systems, Analysis of Streaming Data with Tensor Flow, VoltDB, Data Flow Engines and other memory databases

Text/Reference Books:

1. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley, 2014
2. Dirk Deroos et al., Hadoop for Dummies, Dreamtech Press, 2014.
3. Chuck Lam, Hadoop in Action, December, 2010.
4. Leskovec, Rajaraman, Ullman, Mining of Massive Datasets, Cambridge University Press.
5. I.H. Witten and E. Frank, Data Mining: Practical Machine learning tools and techniques.
6. Erik Brynjolfsson et al., The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies, W. W. Norton & Company, 2014.

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818PE62	**Computer Vision**	**3-0-0**	**3**

MODULE 1: Introduction- Machine vision systems, optics and lenses, image sensors, human vision and Neuro-visual model; Marr's paradigm; Imaging geometry - world co-ordinate system and camera co-ordinate system, co-ordinate transformations, projection geometry, camera calibration, radiometry.

MODULE 2: Early processing and image filtering: Noise removal, region segmentation, concept of primal sketch, scale space, edge detection and localization, edge linking, Hough transform, corner and junction detection. Reflectance map and photometric stereo: Image brightness and radiometry, image formation and surface reflectance under different conditions, reflectance map and bidirectional reflectance distribution function, photometric stereo recovering albedo and surface orientation, shape from shading.

MODULE 3: Range measurement and recovering scene geometry: Binocular technique stereo pair, epipolar line and plane, Stereo matching, photogrammetry, monocular technique -texture processing and shape from texture, depth from focusing and symmetry, different range finder (active) - laser range finder, light-stripe method.

MODULE 4: Motion estimation: Motion field, optical flow - smoothness, boundary conditions, discontinuities of optical flow, block-based method, pre-recursive method, Bayesian method, Motion segmentation method, motion from points and lines, token tracking, stereo and motion tracking, use of Kalman filter, focus of expansion, structure from motion, motion compensated filtering and restoration, video compression, active and passive surveillance.

MODULE 5: Representation and analysis of polyhedral scene: understanding line drawings, gradient and dual space, generalized cylinder, volumetric representation, edge and junction labeling; labeling and recognition of scene objects; Construction of model-base and visual learning, model-based recognition system - Acronym, model based recognition from sparse
range data, 3D model based vision system, scene understanding. Special systems for computer vision: Visual information processing architecture, language and control, Applications

Text/Reference Books:

1. D. H. Ballard and C. M. Brown: Computer Vision, Prentice Hall, New York, 1986.
2. R. M. Haralick, L. G. Shapiro: Computer and Robot Vision, Addison-Wesley Pub Co, reading, Mass., 1992.
3. Y. Shirai: Three-Dimensional Computer Vision, Springer-Verlag Berlin, 1988.
4. B. K. P. Horn: Robot Vision, MIT Press, Cambridge, 1986.

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818PE63	**Neural Networks and Deep Learning**	**3-0-0**	**3**

MODULE 1: Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent: Momentum, Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam , Feed forward Neural Networks, Representation Power of Feed forward Neural Networks, Feed forward Neural Networks and Back propagation

MODULE 2: Principal Component Analysis and its interpretations, Singular Value Decomposition, Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders, Regularization: Bias Variance Tradeoff, regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout

MODULE 3: Greedy Layer wise Pre-training, Better activation functions, better weight initialization methods, Batch Normalization

MODULE 4: Convolutional Neural Networks, CNN architectures: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs

MODULE 5: Encoder Decoder Models, Attention Mechanism, Attention over images

Text/Reference Books:

1. Ian J. Goodfellow, Yoshua Bengio and Aaron Courville, Deep learning, MIT Press. (2016)

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818OE41	**Artificial Intelligence**	**3-0-0**	**3**

MODULE 1: Scope of AI -Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction.

MODULE 2: Problem solving - State space search; Production systems, search space control: depth-first, breadth-first search, heuristic search - Hill climbing, best-first search, tabu search, Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony Optimization, branch and Bound, A*, IDA*, divide and conquer approaches, beam stack search, Problem Reduction, Goal Trees, AO*, Rule Based Systems, Rete Net means-ends analysis

MODULE 3: Knowledge Representation- Predicate Logic: Unification, modus pones, resolution, dependency directed backtracking. Rule based Systems: Forward reasoning: conflict resolution, backward reasoning, Structured Knowledge Representation: Semantic Nets: slots, exceptions and default frames, conceptual dependency, scripts.

MODULE 4: Handling uncertainty and learning- non-Monotonic reasoning, probabilistic reasoning, use of certainty factors, fuzzy logic, Concept of learning, learning automation, learning by inductions, neural nets.

MODULE 5: Game Playing: Minimax Algorithm, Alpha-Beta Algorithm, SSS*.

MODULE 6: Planning and Constraint Satisfaction: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graph plan, Constraint Propagation.

Text/Reference Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.
2. E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1992
3. N.J. Nilsson, "Principles of AI", Narosa Publishing House, 2000
4. Robin R Murphy, Introduction to AI Robotics PHI Publication, 2000
5. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992
6. R.J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill International Edition, Singapore, 1992
7. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013
8. Eugene Charniak, Drew McDermott. Introduction to Artificial Intelligence, Addison Wesley, 1985

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818OE42	**Quantum Computing**	**3-0-0**	**3**

MODULE 1: Introduction to quantum computing, Quantum bits, Bloch sphere representation of a qubit, qubit measurement, multiple qubits, measuring multiple qubit systems, quantum systems evolution

MODULE 2: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

MODULE 3: single qubit gates, multiple qubit gates, design of quantum circuits

MODULE 4: Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.

MODULE 5: Classical computation on quantum computers, relationship between quantum and classical complexity classes, Deutsch's algorithm, Deutsch's-Jozsa algorithm, quantum computer prototype, factoring and the RSA, factoring and period finding, quantum Fourier transform, Shor's algorithm, Grover search.

Text/Reference Books:

1. 1 Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press, 2002
2. 2 Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific, 2004
3. 3 Pittenger A. O., An Introduction to Quantum Computing Algorithms
4. P Kaye, R Laflamme and M Mosca , An Introduction to Quantum Computing

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818OE43	**Optimization Techniques in Machine Learning**	**3-0-0**	**3**

MODULE 1: Application of Continuous optimization in learning model parameters and application of discrete optimization in inference and auxiliary tasks such as feature selection, data subset selection, model compression

MODULE 2: Basics of Continuous Optimization, Convexity and non-smooth calculus tools, Gradient Descent, Projected/Proximal gradient descent, Sub Gradient Descent, Accelerated Gradient Descent (momentum), Newton & Quasi Newton, examples in data science

MODULE 3: Important standard classes such as linear and quadratic programming, semidefinite programming, second-order cone programming

MODULE 4: Fundamentals of discrete optimization, basic forms of combinatorial optimization, submodular functions and Applications in Machine Learning, Sub modularity and Convexity, Submodular Minimization, Submodular Maximization, Sub-gradient methods for non-differentiable functions

MODULE 5: Real world applications in feature selection, summarization and diversified search, structured prediction, data subset selection and model compression

Text/Reference Books:

1. Convex Optimization: Algorithms and Complexity by Sébastien Bubeck
2. Convex Optimization by Stephen Boyd and Lieven Vandenberghe
3. Convex Analysis by R. T. Rockafellar, Vol. 28 of Princeton Math. Series, Princeton Univ. Press, 1970
4. Linear Algebra and Its Applications by Gilbert Strang
5. Nonlinear Programming: 2nd Edition by Dimitri P. Bertsekas
6. Numerical Optimization by Nocedal, Jorge, Wright, Stephen
7. An Introduction to Optimization by E.K. P Chong and S.H.Zak
8. Introduction to Nonlinear Optimization - Theory, Algorithms and Applications by Amir Beck

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818OE51	**Internet of things**	**3-0-0**	**3**

MODULE 1: Introduction to IoT: Importance of IoT, applications and technologies, connecting terminologies and network configurations, Sensors and transducers, Actuators, Basics of Networking, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, UAV networks

MODULE 2: Interoperability in IoT, Introduction to Arduino Programming, integration of Sensors and Actuators with Arduino, introduction to Python programming, architecture and components of Raspberry Pi, implementation of IoT with Raspberry Pi

MODULE 3: Introduction to SDN, basic concepts and components of SDN, open flow protocol, APIs in SDN, SDN for IoT, wireless sensor networks and software defined WSNs

MODULE 4: Data Handling and Analytics, Cloud computing, Sensor-Cloud

MODULE 5: Fog Computing: Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring

Text/Reference Books:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818OE52	**Computational Number Theory**	**3-0-0**	**3**

MODULE 1: Algorithms for integer arithmetic: Divisibility, GCD, modular arithmetic, modular exponentiation, Montgomery arithmetic, congruence, Chinese remainder theorem, Hensel lifting, orders and primitive roots, quadratic residues, integer and modular square roots, prime number theorem, continued fractions and rational approximations.

MODULE 2: Representation of finite fields: Prime and extension fields, representation of extension fields, polynomial basis, primitive elements, normal basis, optimal normal basis, irreducible polynomials.

MODULE 3: Algorithms for polynomials: Root-finding and factorization, Lenstra-Lenstra-Lovasz algorithm, polynomials over finite fields.

MODULE 4: Elliptic curves: The elliptic curve group, elliptic curves over finite fields, Schoof's point counting algorithm.

MODULE 5: Primality testing algorithms, Fermat test, Miller-Rabin test, Solovay-Strassen test, AKS test, Integer factoring algorithms: Trial division, Pollard rho method, p-1 method, CFRAC method, quadratic sieve method, elliptic curve method.

MODULE 6: Computing discrete logarithms over finite fields: Baby-step-giant-step method, Pollard rho method, Pohlig-Hellman method, index calculus methods, linear sieve method, Coppersmith's algorithm.

Text/Reference Books:

1. A. Das, Computational number theory, Chapman and Hall/CRC.
2. V. Shoup, A computational introduction to number theory and algebra, Cambridge University Press.
3. M. Mignotte, Mathematics for computer algebra, Springer-Verlag.
4. I. Niven, H. S. Zuckerman and H. L. Montgomery, An introduction to the theory of numbers, John Wiley.
5. J. von zur Gathen and J. Gerhard, Modern computer algebra, Cambridge University Press.
6. R. Lidl and H. Niederreiter, Introduction to finite fields and their applications, Cambridge University Press.
7. A. J. Menezes, editor, Applications of finite fields, Kluwer Academic Publishers.
8. J. H. Silverman and J. Tate, Rational points on elliptic curves, Springer International Edition.
9. D. R. Hankerson, A. J. Menezes and S. A. Vanstone, Guide to elliptic curve cryptography, Springer-Verlag.

10. A. Das and C. E. Veni Madhavan, Public-key cryptography: Theory and practice, Pearson Education Asia.
11. 11.H. Cohen, A course in computational algebraic number theory, Springer-Verlag

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818OE53	**Electronic Design Automation**	**3-0-0**	**3**

MODULE 1: VLSI design automation tools, an overview of the features of practical CAD tools, Modelsim, Leonardo spectrum, ISE 13.1i, Quartus II, VLSI backend tools

MODULE 2: Synthesis and simulation using HDLs: Logic synthesis using VERILOG and VHDL. Memory and FSM synthesis, Performance driven synthesis, Types of simulation. Static timing analysis. Formal verification, Switch level and transistor level simulation.

MODULE 3: Circuit simulation using Spice: Circuit description.AC, DC and transient analysis. Advanced spice commands and analysis, Models for diodes, transistors and OPAMP, Digital building blocks. A/D, D/A and sample and hold circuits, Design and analysis of mixed signal circuits.

MODULE 4: System Verilog: Introduction, Design hierarchy, Data types, Operators and language constructs, Functional coverage, Assertions, Interfaces and test bench structures.

MODULE 5: Mixed signal circuit modeling and analysis, concept of system on chip. introduction to Cypress Programmable System on Chip (PSoC), Structure of PSoC, PSoC Designer, PSoC Modules, Interconnects, memory management, global resources, and design examples.

Text/Reference Books:

1. M.J.S.Smith, "Application Specific Integrated Circuits",Pearson, 2008.
2. M.H.Rashid, "Introduction to PSpice using OrCAD for circuits and electronics", Pearson, 2004.
3. S.Sutherland, S. Davidmann, P. Flake, "System Verilog For Design",(2/e), Springer,2006.
4. Z. Dr Mark, "Digital System Design with System Verilog ", Pearson, 2010.
5. Robert Ashby, "Designer's Guide to the Cypress PSoC, Newnes (An imprint of Elsevier)", 2006
6. O.H. Bailey, "The Beginner's Guide to PSoC", Express Timelines Industries Inc.

Course Code	Course Title	Hours per week L-T-P	Credit C
CSE1818OE54	**Soft Computing**	**3-0-0**	**3**

MODULE 1: Introduction - What is soft computing, Differences between soft computing and hard computing, Soft Computing constituents, Methods in soft computing, Applications of Soft Computing.

MODULE 2: Introduction to Genetic Algorithms- Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators- methods of selection, crossover and mutation, simple GA(SGA), other types of GA, generation gap, steady state GA, Applications of GA

MODULE 3: Neural Networks- Concept, biological neural system, Evolution of neural network, McCulloch-Pitts neuron model, activation functions, feed forward networks, feedback networks, learning rules – Hebbian, Delta, Perceptron learning and Windrow-Hoff, winner-take-all.

MODULE 4: Supervised learning- Perceptron learning, single l layer/multilayer perceptron, linear separability, hidden layers, back propagation algorithm, Radial Basis Function network; Unsupervised learning - Kohonen, SOM, Counter-propagation, ART, Reinforcement learning, adaptive resonance architecture, applications of neural networks to pattern recognition systems such as character recognition, face recognition, application of neural networks in image processing.

MODULE 5: Fuzzy systems - Basic definition and terminology, set-theoretic operations, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules& Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making; Neuro-fuzzy modeling- Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rule base Structure Identification and Neuro-Fuzzy Control , Applications of neuro-fuzzy modeling.

MODULE 6: Swarm Intelligence- What is swarm intelligence, Various animal behavior which has been used as examples, ant colony optimization, swarm intelligence in bees, flocks of birds, shoals of fish, ant-based routing, particle swarm optimization

Text/Reference Books:

1. S.N. Shivanandam, Principle of soft computing, Wiley, ISBN13: 9788126527410 (2011)
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edition, 2003.
5. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
6. David E. Goldberg, Genetic Algorithms in Search, Optimization & Machine Learning, Addison Wesley, 1997.

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