PROPOSED SYLLABUS OF COMPUTER SCIENCE AND ENGINEERING

RTM NAGPUR UNIVERSITY, NAGPUR

FOR VII AND VIII SEMESTER

ACADEMIC SESSION: 2015-2016

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE
SEMESTER: SEVENTH (C.B.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING

Sr. No.	Subject	Workload				Credit				Marks				
										Theory		Practical		Total Marks
		L	P	T	Total	L	P	T	Total	Sess.	Univ.	Sess.	Uni.	
1 BECSE401T	Data Warehousing & Mining	4	-	1	5	4	-	1	5	20	80	-	-	100
2 BECSE401P	Data Warehousing & Mining Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
3 BECSE402T	Language Processor	4	-	1	5	4	-	1	5	20	80	-	-	100
4 BECSE402P	Language Processor Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
5 BECSE403T	ELECTIVE-I	4	-	1	5	4	-	1	5	20	80	-	-	100
6 BECSE404T	ELECTIVE-II	4	-	1	5	4	-	1	5	20	80	-	-	100
7 BECSE405P	Project and Seminar	-	3	-	3	-	3	-	3	-	-	25	25	50
	Total	**16**	**7**	**4**	**27**	**16**	**5**	**4**	**25**	**80**	**320**	**75**	**75**	**550**

Elective I: TCP and IP, Advanced Computer Architecture, Big Data Analysis & Business Intelligence, Parallel and Network Algorithm.

Elective II: Computational Geometry, Mobile Computing, Real Time Operating System, Software Architecture, Mainframe Technologies.

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE
SEMESTER: EIGHTH (C.B.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING

Sr. No.	Subject	Workload				Credit				Marks				
		L	P	T	Total	L	P	T	Total	Theory		Practical		Total Marks
										Sess.	Univ.	Sess.	Uni.	
1 BECSE406T	Distributed Operating system	4	-	1	5	4	-	1	5	20	80	-	-	100
2 BECSE406P	Distributed Operating system Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
3 BECSE407T	Information & Cyber Security	4	-	1	5	4	-	1	5	20	80	-	-	100
4 BECSE407P	Information & Cyber Security Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
5 BECSE408T	ELECTIVE-III	4	-	1	5	4	-	1	5	20	80	-	-	100
6 BECSE409T	ELECTIVE-IV	4	-	1	5	4	-	1	5	20	80	-	-	100
7 BECSE410P	Project & Seminar	-	5	-	5	-	5	-	5	-	-	75	75	150
	Total	**16**	**9**	**4**	**29**	**16**	**7**	**4**	**27**	**80**	**320**	**125**	**125**	**650**

Elective III: Pattern Recognition, Soft Computing Techniques, Optimization Techniques, Clustering & Cloud Computing.

Elective IV: Advance Wireless Sensor Network, Digital Image Processing, Natural Language Processing, Digital Forensic.

BECSE401T: Data Warehousing & Mining

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Unit II: Data Warehouse and OLAP Technology for Data Mining**:** Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

Unit III: Mining Frequent Patterns, Associations and Correlations**:** Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining

Unit IV: Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods

Unit V: Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

Unit VI: Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multirelational Data Mining.

Text Book:

1. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier,2nd Edition, 2006.

Reference Books:

1. Data Mining Techniques – Arun K Pujari, 2nd edition, Universities Press.
2. Data Warehousing Fundamentals – Paulraj Ponnaiah Wiley student Edition.

BECSE402T: Language Processor

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to compilers, compilers and translators, Cross Compiler. Phases of compilation and overview.
Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, scanner generator (lex, flex).

Unit II: Syntax Analysis: Syntax specification of programming languages, Design of top-down & bottom-up parsing technique, Design of LL(1) parser. LR parsing: Design of SLR, LALR, CLR parsers. Dealing with ambiguity of the grammar, Parser generator (yacc, bison)

Unit III: Semantic Analysis: Syntax directed definitions, inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions, implementation of SDTS, Evaluation of expressions using semantic actions, Intermediate code representations (postfix, syntax tree, TAC).

Unit IV: Intermediate code generation using syntax directed translation schemes for translation of controls structures, declarations, procedure calls, and Array reference.
Error detection and recovery: Error recovery in LR parsing, Error recovery in LL parsing, automatic error recovery in YACC.

Unit V: Table Management: Storage allocation and run time storage administration, symbol table management.
Code optimization: Sources of optimization, loop optimization, control flow analysis, data flow analysis, setting up data flow equations to compute reaching definitions, available expressions, Live variables.

Unit VI: Code generation: Problems in code generation, Simple code generator, Register allocation and assignment, Code generation from DAG, Peephole optimization.

Text Books:

1. Aho, Sethi, and Ullman; Compilers Principles Techniques and Tools; Second Edition, Pearson education, 2008.
2. Alfred V. Aho and Jeffery D. Ullman; Principles of Compiler Design; Narosa Pub. House, 1977.
3. Vinu V. Das; Compiler Design using Flex and Yacc; PHI Publication, 2008.
4.

Reference Books:

1. Compiler Design by O. G. Kakde.
2. Principles of Compiler Design by V. Raghavan, Tata McGraw Hill Publication Pvt Ltd.

BECSE403T: Elective I: TCP & IP

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Network architecture-Standards, TCP/IP Model Overview, Networking Technologies: LANS, WANS, Connecting Devices. Internetworking concept, Internet Backbones, NAP, ISP's, RFC's, and Internet Standards.

Unit II: Classful Internet address, CIDR-Subnetting and Supernetting, ARP, RARP, OOTP, DHCP.

Unit III: IP Datagram-IP Package-IP forwarding and routing algorithms, computing paths, RIPOSPF, ICMP, IGMP.

Unit IV: TCP header, services, Connection establishment and termination, Interactive data flow, Bulk data flow, Flow control and Retransmission, TCP timers, Urgent Data processing, Congestion control, Extension headers.

Unit V: Switching technology, MPLS fundamentals, signaling protocols, LDP, IP traffic engineering, ECMP, SBR, Routing extensions for traffic engineering, Traffic engineering limitations and future developments.

Unit VI: IP security protocol-IPv6 addresses, Packet format, Multicast, Anycast, ICMPv6, Interoperation between IPv4 and IPv6-QoS, Auto configuration.

Text Books:

1. Douglas E. Comer, "Internetworking with TCP/IP Principles, Protocols, and Architecture"- 5th editions Volume-1, Prentice Hall-2006.
2. Adrian Farrel, "The Internet and its Protocols- A Comparative approach" Morgan Kaufmann, 2004.
3. W.Richard Stevens, "TCP/IP Illustrated, the Protocols", Volume I, Pearson Education India 2003.
4. Behrouz A.Forouzan, "TCP/IP Protocol Suite"-3rd edition-Tata McGraw Hill-2006.

Reference Books:

1. Pete Loshin, "IPv6 Theory, Protocol and Practice, 2nd edition", Morgon Kaufmann- December-2003.
2. Comer D.E & Stevens D.L , "Internetworking TCP/IP- Volume III", Prentice Hall of India –1997.

BECSE403T: Elective I: Advanced Computer Architecture

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (theory) 1 hr (tutorial)	5	100	20	80	100

Unit I: Fundamentals of Computer Design: Defining computer architecture, trends in technology, trends in power in integrated circuits, trends in cost, dependability, and measuring, reporting and summarizing performance.

Unit II: Instruction-Level Parallelism: Concepts and challenges in ILP, basic compiler techniques for Exposing ILP – reducing branch costs with prediction, overcoming data hazards with dynamic scheduling, hardware-based speculation, exploiting ILP using static and dynamic scheduling, limitations of ILP, using ILP support to exploit thread-level parallelism.

Unit III: Vector architecture: SIMD instruction set, extensions for multimedia, graphics processing units, detecting and enhancing loop-level parallelism, centralized shared-memory architectures, performance of shared-memory, multiprocessors, distributed shared memory, directory based coherence, basics of synchronization, models of memory consistency.

Unit IV: Memory Hierarchy Design: Cache performance: Eleven advanced cache optimizations, Protection via virtual memory and virtual machine, Impact of virtual machines on virtual memory and I/O, memory hierarchies, design of memory hierarchies.

Unit V: Introduction to Message passing Architecture: Routing in message passing architecture, message passing programming model, processor support for message passing, message passing versus shared memory architecture.

Unit VI: Storage Systems: Advanced topics in disk storage, definition and examples of real faults and failures, i/o performance, reliability measures and benchmarks – designing and evaluating an i/o system.

Text Books:-

1. William Stallings, "Computer Organization and Architecture, Designing for performance" Prentice Hall,
2. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill.
3. Hesham El-Rewini, Mostafa Abd-El-Barr "Advanced Computer Architecture And Parallel Processing" Wiley Interscience.

Reference Books:-

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture: A hardware/software approach", Morgan Kaufmann /Elsevier Publishers.
2. J. P. Hayes, "Computer Architecture and Organization"; MGH.

BECSE403T: Elective I: Parallel and Network Algorithm

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Parallel computation models, Parallel architectures and topologies, Notion of space and time complexity in parallel and interconnect network environment.

Unit II: Dependence Concept: Single Loop, Double Loop and Perfect Loop Nest. Loop carried and Loop independence dependence, Preliminary loop transformation techniques.

Unit III: Parallel Algorithms and Techniques 1: Parallel Searching and Sorting Techniques. Hyper quick sort.

Unit IV: Parallel Algorithms and Techniques 2: Parallel solutions to linear system of equations, finding roots of non-linear equations, Parallel discrete Fourier transforms

Unit V: Graph and Network Theory 1: Introduction, Shortest Paths, Spanning Trees, Connected Components

Unit VI: Graph and Network Theory 2: Parallel Breadth First Search and Depth First Search, Greedy Algorithms and matroids, Coloring and Matching, Network Flow

Text Books:

1. Dieter Jungnickel, Graphs, Networks, and Algorithms, Third Edition, Springer, 2010.
2. The Design and Analysis of Parallel Algorithms: S.G.Akl, PHI, 1989.
3. Introduction to Parallel Computing: AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, Addison Wesley, Second edition.

Reference Books:

1. An Introduction to Parallel Algorithms: J. JaJa, Addison *Wesley, 1992.*
2. Parallel Programming in C with MPI and OpenMP : M.J.Quinn, McGraw Hill.

BECSE404T: Elective II: Mobile Computing

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	4	100	20	80	100

Unit I: The second generation (2G) systems: GSM services, features, architecture, radio link, channel types, frames, call handling.

Unit II: (Wireless) Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

Unit III: Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

Unit IV : Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Unit V: Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

Unit VI: Protocols and Tools: Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

Text Books:

1. Mobile Computing for begineers, by Raksha Shende.
2. Jochen Schiller, "Mobile Communications", Addison-Wesley. Second edition, 2004.
3. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.

Reference Books:

1. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2004.
2. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden , Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2005.
3. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, second edition, 2003.
4. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003.

BECSE404T: Elective II: Real Time Operating System

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to Real Time Systems: Real time systems, soft vs. hard real time systems, Concept of computer control, sequence, loop and supervisor control, centralized, hierarchical and distributed systems, applications of real time systems, hardware requirement for real time applications, specialized processors, interfaces, communications.

Unit II: Real Time Scheduling: Clock Driven approach, Weighted Round robin approach, Priority Driven approach, Concept of effective release time and deadline, Optimality and non optimality of EDF & LST.
Real Time operating System: Task management, Real Time Clock Handler, Code sharing, Resource Control, Inter task Communication and control.

Unit III: Design of Real Time System: Specification, Preliminary Design, multitasking Approach, monitors, Rendezvous.
Design Analysis: Introduction, Petri nets, Analysis of Petri Nets, Scheduling problem, Real Time Database, Real Time Vs General Purpose Databases, Transaction priorities and Aborts, Concurrency Control, Disk Scheduling Algorithms, Maintaining Serialization Consistency.

Unit IV: Programming Language and Tools: Desired language characteristics, Data typing, Control structures, Facilitating hierarchical decomposition , packages, Run time error handling, Overloading and generics, Multitasking, Low level programming, Task scheduling, Timing specifications, Programming environments, Run time support.

Unit V: Fault Tolerance Techniques: Introduction, Faults, Errors and Failures, Fault types, Detection and Containment, Redundancy, Integrated Failure Handling.

Unit VI: Reliability Evolutions: Introduction, Parameters, Reliability Models for Hardware, Software Error Models.
Commercial Real Time Systems: General concepts, Unix and Windows as RTOS.

Text Book:-

1. Jane W. Liu, "Real-Time Systems" Pearson Education, 2001.

Reference Books:

1. Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008.
2. Jane W. Liu, "Real-Time Systems" Pearson Education, 2001.
3. Krishna and Shin, "Real-TIme Systems," Tata McGraw Hill. 1999.

BECSE404T: Elective II: Software Architecture

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Software process and the role of modeling and analysis, software architecture and software design, architectural styles, architectural patterns, analysis of architectures, formal descriptions of software architectures, architectural description languages and tools, scalability and interoperability issues, web application architectures, case studies.

Unit II: Quality Attributes: Introduction to Quality Attributes, Need of quality attributes, Understanding quality attributes, architecture and quality attributes, achieving quality attributes. Quality attributes in software architecture templates. Deriving Quality Attributes for software architectures.

Unit III: Design patterns: Pattern Systems, Patterns and Software architecture. Software architecture and maintenance management; Design Patterns: history, principles and expectations. Study of representative patterns like Singleton, Factory, Adaptor, Facade, Proxy, Iterator, Observer, Mediator, Composite, chain of ways of using patterns.

Unit IV: Architectural styles: Conventional Architectural styles, Applied Architectures and Styles: Distributed and Networked, Architectures for Network-Based Applications Architectures, Decentralized Architectures, Service-Oriented Architectures and Web Services.

Unit V: Introduction to Middleware: Middleware components, programming models, implementation, systems qualities Moving from qualities to architecture and views ,Components and COTS, Economics- Driven Architecture, Software product line, Software architecture future.

Unit VI: Web Architecture: Introduction to Web Architectures, Client side technologies, Need of Client side technology in multi-tier architectures, Need of server side technology in multi-tier architectures, Server side technologies.

Text Book:

1. "Software Architecture: Foundations, Theory, and Practice" by Richard N. Taylor, Nenad Medvidovic, Eric Dashofy, ISBN: 978-0-470-16774-8.
2. M. Shaw: Software Architecture Perspectives on an Emerging Discipline, Prentice.
3. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Pearson Education Asia.

Reference Books:

1. James L. Weaver, Kevin Mukhar, "Beginning J2EE 1 .4: From Novice to Professional.
2. Jan Bosch, "Design and Use of Software Architectures", Addision-Wesley-Pearson Education.
3. Dikel, D.Met Al, "Software Architecture: Organizational Principles and Pattern", Prentice Hall.

BECSE404T: Mainframe Technologies

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: - Evolution of Mainframe computer, key features , benefits ,Basic IBM Mainframe Architecture, Input/output Devices, Virtual/Real/Auxiliary Storage Concepts, MVS Storage & Control Blocks , Mainframe Operating System.

Unit II: Z/OS Operating System, concepts of Address space, Buffer management, Dataset organization, Virtual Storage Access Method, VSAM overview, VSAM Advantage and Disadvantage, CLUSTER, Data organization of VSAM, Internal Organization of VSAM, Accessing VSAM Data Set, Introduction to CICS , Execution of CICS Application.

Unit III: Job Control language, Basic concept of JCL, Job Processing, JCL Statements and procedures, Data Definition Statements, JOB Statement, EXEC Parameter Coding Data Sets and I/O on DD statement, In-Stream and Catalog Procedures , Generation Data Group (GDG) ,IBM utility programs. SORT/MERGE Utilities.

Unit IV: COBOL Programming Introduction, Evolution & features, COBOL divisions & sections COBOL statements, Redefines Rename & Usage clause, COBOL program structure, data types, COBOL verbs, conditional & sequence control verbs.

Unit V: COBOL File processing, File concepts, Physical & logical records, File Organization, File handling verbs, Sorting & merging of files, Table handling, Character handling, , COBOL subroutines.

Unit VI: Introduction to DB2 , DB2 Objects & Data Types, Structured Query Language, DB2 Interfaces, DB2 application development overview, Embedded SQL Programming, Cursor programming, SQL execution validation, Locking and Concurrency.

Text Book:

Reference Books:

BECSE406T: Distributed Operating System

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Fundamentals: Introduction, Models and Features, Concept of Distributed Operating system, Issues in Design of a Distributed Operating System.
Foundations of Distributed System: Limitations of Distributed Systems, Lamports logical clocks, Vector clocks, Causal ordering of messages, Global state recording, Cuts of a Distributed Computation, Termination Detection.

Unit II: Distributed Mutual Exclusion: Requirement of Mutual Exclusion Algorithm, Non Token Based Algorithm, Token Based Algorithms, Comparative Performance Analysis.

Unit III: Distributed Deadlock Detection: Introduction, Deadlock Handling strategies in Distributed System, Centralized and Distributed Deadlock Detection Algorithms.
Agreement protocols: Introduction, System Model, Classification of Agreement Problems, Solutions to the Byzantine Agreement Problem.

Unit IV: Distributed File system: Introduction to Distributed File System, Architecture, and Mechanism for Building Distributed File System.
Distributed Shared Memory: General Architecture of DSM systems, Algorithm for Implementing DSM, Memory coherence and Coherence Protocols.

Unit V: Distributed Scheduling: Introduction, Issues in Load Distributing, Components of a Load Distributing Algorithm, Load Distributing Algorithms, Requirements for Load Distributing Task Migration, Issues in Task Migration.

Unit VI: Failure Recovery: Recovery in concurrent systems, Consistent set of Checkpoints, Synchronous check pointing and Recovery, Asynchronous check pointing and Recovery.
Fault Tolerance: Introduction, Commit Protocols, Static Voting Protocol, Dynamic Voting Protocol.

Text Books:

1. Mukesh Singhal, NiranjanG, Shivaratri, "Advanced concepts in operating systems: Distributed, Database and Multiprocessor operating systems", TMH, 2001
2. Distributed Systems Concepts and Design – Coulouris, Dollimore, Kindberg Pearson Education.

Reference Books:

1. Andrew S.Tanenbaum, "Distributed operating system", Pearson education, 2003.
2. PradeepK.Sinha, "Distributed Operating System-Concepts and Design", PHI, 2003.

BECSE407T: Information & Cyber Security

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Need of information security- Legal, Ethical and Professional Issues Attributes of security- authentication, access control, confidentiality, authorization, integrity, non-reproduction.
OSI security architecture- attacks, services and mechanisms. Information security management-security policy, standards, guidelines and procedures, security lifecycle. Introduction to cryptography- Classical cryptography. Case-study: Information security management used in organizations, Problems on classical ciphers, Security architecture, and Different standards related to IS.

Unit II: Introduction to Secret key and cryptography, Encrypt given messages using DES, AES, IDEA, Problems on cryptography algorithms, Principles, finite fields, stream cipher, block cipher modes of operation, DES, Triple DES, AES, IDEA, RC5, key distribution

Unit III : Introduction to Public key and Cryptography, Encrypt given messages using ECC, Problems on key generation, cryptography algorithms Principles, Introduction to number theory, RSA- algorithm, security of RSA, Key management-Diffie-Hellman key exchange, man-in-the-middle attack, Elliptical curve cryptography

Unit IV: Study of applications and comparison of authentication functions, MAC, hash functions etc. Implementation and analysis of authentication functions, MAC, hash functions etc. Requirements of message authentication, authentication functions, MAC, hash functions, MD5, SHA-512, HMAC, digital signatures, DSA, PKI, Authentication applications-, X.509, Kerberos.

Unit V : Introduction to Network, Transport and Periphery Security, Study of IPSEC, TLS, and SSL, Firewalls-design principles, trusted systems, Intrusion Detection System, Intrusion Prevention System. Implementation and analysis of IPSEC, TLS, and SSL, Firewalls-design principles, trusted systems, Intrusion Detection System, Intrusion Prevention System IPSEC, TLS, and SSL, Firewalls-design principles, trusted systems, Intrusion Detection System, Intrusion Prevention System. Introduction to cryptography- Classical cryptography.

Unit VI: Study of Security services, web and email security considerations, Electronic commerce security. Implementation and analysis of Security services, web security considerations, Electronic commerce security. Security services, web security considerations, PEM, PGP, S/MIME, Electronic commerce security- SET, Smart cards, strengths of Security services.

Text Book:

1. William Stallings "Cryptography and network security, principles and practices", Pearson.

Reference Books:

1. Bernard Menezes, —Network Security and Cryptography, Cengage Learning.
2. Nina Godbole, Information System Security, Wiley India Pvt.Ltd., ISBN978-81-265-1692-6.
3. Charlie Kaufman, Radia Perlman and mike speciner, "Network security, private communication in a public world"
4. Christopher M. King, Curtis Patton and RSA press, "Security architecture, design deployment and operations".
5. Robert Bragge, Mark Rhodes, Heith straggberg "Network Security, The Complete Reference", Tata McGraw Hill Publication

BECSE408T: Elective-III: Pattern Recognition

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Pattern Recognition Systems, Design Cycle, Applications of pattern recognition, Learning and Adaption-Supervised, Unsupervised and Reinforcement Learning.

Unit II: Probability: Introduction to Probability, Probability of events, Random variables, Probability Distributions, Joint Distribution and Densities, Moments of Random Variables, Estimation of Parameters from samples, Minimum Risk Estimators.

Unit III: Statistical Decision Making: Bayes' Decision Theory, Multiple Features, Conditionally Independent Features, Decision Boundaries, Unequal costs of Error, Estimation of Error Rates, Leaving-one-out Technique, Confusion Matrix, Characteristic Curves.

Unit IV: Classifiers: Hidden Markov Model, Support Vector Machine, Artificial Neural network-back Propagation Algorithm and Fuzzy based classifiers.

Unit V: Non Parametric Decision Making: Introduction**,** Histograms, Kernel and window Estimators, Nearest Neighbor classification Technique, Adaptive Decision Boundaries, Adaptive Discriminate Functions, Minimum Squared Error Discriminate Functions.

Unit VI: Clustering: Introduction, Hierarchical clustering, Partitional Clustering.

Text Book:

1. "Pattern Recognition and Image Analysis"Earl Gose, Richard Johnsonbaugh, and Steve Jost, (PHI).

Reference Book:

1. "Pattern Classification" Richard O Duda, Peter E.Hart, and David G. Stork, (John Wiley).

BECSE408T: Elective III: Soft Computing Techniques

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to Neuro: Fuzzy and Soft Computing**:** Soft Computing Constituents and Conventional AI; Neuro-Fuzzy and Soft Computing Characteristics.
Fuzzy Sets: Introduction Set Theoretic Operations, MF Formulation and Parameterization, Fuzzy Union, Intersection and Complement.
Fuzzy Rules and Fuzzy Reasoning: Extension Principles and Fuzzy Relations, Fuzzy If-Then Rules; Fuzzy Reasoning.

Unit II: Fuzzy Inference Systems: Mamdani Fuzzy Models; Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Other Considerations.
Derivative-Free Optimization: Introduction, Genetic Algorithms; Simulated Annealing; Random Search, Downhill Simplex Search.

Unit III: Adaptive Networks: Introduction, Architecture; Feed-forward Network; Extended Back-propagation for Recurrent Networks; Hybrid Learning Rule.
Supervised Learning Neural Networks, Perceptrons, Back-propagation Multi-layer Perceptrons, Radial Basis Function Networks.

Unit IV: Unsupervised Learning and Other Neural Networks: Competitive Learning Networks, Kohonen Self-Organizing Networks; Learning Vector Quantization; Hebbian Learning, Principal Component Networks, Hopfield Networks.

Unit V: Adaptive Neuro-Fuzzy Inference System**:** ANFIS Architecture, Hybrid Learning Algorithm, ANFIS as Universal Approximator.
Data Clustering Algorithms: K-Means Clustering; Fuzzy C-Means Clustering, Mountain Clustering Method; Subtractive Clustering.

Unit VI: Rulebase Structure Identification: Input Selection, Input Space partitioning, Rulebase Organization, Focus Set-based Rule Combination.
Applications: Printer Character Recognition, Hand-written Numeral Recognition, GA-based Fuzzy Filters.

Text Books:

1. Arvindita Das-"Artifical Intelligence & Soft Computing", Shroff publication.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun and EijiMizutani; Neuro-Fuzzy and Soft Computing – A Computational Approach to Learning and Machine Intelligence; Prentice Hall, 2004.

Reference Books:

1. Timothy J. Ross; Fuzzy Logic with Engineering Applications; McGraw-Hill; 1997.
2. Davis E. Goldberg; Genetic Algorithms: Search, Optimization and Machine Learning; Addison Wesley; 1989.
3. S. Rajasekaran and G. A. V. Pai; Neural Networks, Fuzzy Logic and Genetic Algorithms; Prentice Hall of India; 2003.

BECSE408T: Elective III: Optimization Techniques

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Engineering applications of optimization. Design variables. Constraints, objectives function, variable bounds, statement and formulation of an optimization problem, Example of Optimization problems, classification of optimization problems, different optimization algorithms.

Unit II: Optimal Point: Local optimal point, global optimal point and inflection point.

Unit III: Single Variable Optimization Techniques: Optimality criterion, Bracketing method (Bounding phase method), Region elimination methods (Internal halving method, Golden section search method), Point estimation method (successive quadratic estimation methods), Gradient-based methods (Newton-Raphson method, Bisection method, secant. Cubic search method.), Root finding using optimization techniques.

Unit IV: Multivariable Optimization Techniques: Optimality criterion, Unidirectional search method, Direct Search method (Hooke-Jeeves Pattern Search method, Powell's conjugate direction method), Gradient-based methods (Steepest descent method, Newton's method, and Marquardt's methods)

Unit V: Constrained Optimization Algorithms**:** Kuhn-Tucker conditions, Transformation method (Penalty function method), direct search for constrained minimization (variable elimination method, complex search method)

Unit VI: Linear Programming: Linear programming problems, Simplex method of linear programming techniques.

Text Book:

1. Optimization for Engineering Design by Kalyanmoy Deb. (PHI)

Reference Books:

1. Engg. Optimization by S.S. Rao (New Age)
2. Optimization of Chemical Processes by T.I. Edgar & D.M. Himmelblau (McGraw Hill)
3. Optimization :Theory & Practice by beveridge & Schecter, (McGraw Hill)

BECSE408T: Elective III: Clustering & Cloud Computing

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to Cloud Computing: Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages of Cloud Computing, Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing. Legal issues when using cloud models, challenges in cloud computing.

Unit II: Cloud Computing Architecture**:** Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS), Infrastructure as a Service (IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud.

Unit III: Big Data Analysis, Hadoop and Map Reduce: Introduction, Clustering Big Data, Classification of Big Data, Hadoop MapReduce Job Execution, Hadoop scheduling, Hadoop cluster setup, configuration of Hadoop, starting and stopping Hadoop cluster.

Unit IV: Security in Cloud: Cloud Security Challenges, Infrastructure Security, Network level security, Host level security, Application level security, data privacy, data security, application security, virtual machine security, Identity Access Management, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Unit V: Application Development using C#: Understand object oriented concepts in C#.NET, Creation of UI and event handling, web page creation using ASP.NET, ADO.NET architecture, implementation of data seta, using ADO.NET in console application, using ADO.NET in web application.

Unit VI: Creating Cloud Application using Azure: Creating simple cloud application, configuring an application, creating virtual machine, deployment of application to Windows Azure Cloud, using Azure Storage Services, using Azure Table Service, deployment of application to the production environment.

Text Books:

1. ”Google Compute Engine”, by Mcohen K.Hurley.
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3. Cloud Computing, A Hands-on Approach by Arshdeep Bahga, Vijay Madisetti, Universities Press
4. Microsoft Azure: Enterprise Application Development by R.J.Dudley, N.A.Duchene, SPD Publication

Reference Books:

5. Cloud Computing using Windows Azure by B.M.Harwani, SPD Publication
6. Cloud Computing, Implementation, Management and Security by J.W.Rittinghouse, J.F.Ransome, CRC Press

BECSE409T: Elective IV: Digital Image Processing

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: What is Digital Image Processing, Applications of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of Image Processing System.
Digital Image Fundamentals: Elements of Visual Perception, Image Sampling and Quantization, Basic Relationships between Pixels.
Intensity Transformations: Basic Intensity Transformation Functions, Piecewise-Linear Transformations.

Unit II: Spatial Filtering: Histogram Processing – Histogram Equalization, Histogram Specification, Using Histogram Statistics for Image Enhancement, Fundamental of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.
Color Image Processing: Color Fundamentals, Color Models – RGB Model, CMY and CMYK Model, HSI Model, Pseudo-color Image Processing – Intensity Slicing, Intensity-to-Color Transformations.

Unit III: Filtering in Frequency Domain: Preliminary Concepts, Discrete Fourier Transform of One Variable, Extensions to Functions of Two Variables, Properties of 2-D DFT, Basics of Filtering in Frequency Domain, Image Smoothing using Frequency Domain Filters, Image Sharpening using Frequency Domain Filters; Selective Filtering.

Unit IV: Image Restoration and Reconstruction: Model of Image Degradation/Restoration Process, Noise Model, Restoration in the Presence of Noise only – Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position Invariant Degradations, Inverse Filtering, Wiener Filtering; Constrained Least Squares Filtering, Geometric Mean Filter.

Unit V: Image Compression: Fundamentals – Coding Redundancy, Spatial-Temporal Redundancy, Measuring Image Information, Fidelity Criteria, Image Compression Models, Basic Compression Methods – Huffman Coding, Arithmetic Coding, Run-length Coding, LZW Coding; Digital Image Watermarking.

Unit VI: Image Segmentation: Point, Line and Edge Detection – Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection, The Marr-Hildreth Edge Detector, The Canny Edge Detector, Edge Linking and Boundary Detection; Thresholding – Basic Global Thresholding, Otsu's Method; Region-Based Segmentation – Region Growing, Region Splitting and Merging.
Representation and Description: Boundary Following; Chain Codes; Polygonal Approximations using MPP; Signatures; Skeletons; Shape Numbers; Topological Descriptors.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods; Digital Image Processing; Third Edition; Pearson Education (India); 2014.
2. B. Chanda and D. DuttaMajumdar; Digital Image Processing and Analysis; Prentice Hall of India, 2001.
3. S. Jayaraman, S. Essakkirajan and T. Veerakumar; Digital Image Processing; Tata McGraw Hill; 2009.

Reference Books:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle; Digital Image Processing and Computer Vision; Cengage Learning; 2008.
2. Kenneth R. Castleman; Digital Image Processing; Pearson Education (India); 1996.
3. Anil K. Jain; Fundamentals of Digital Image Processing; PHI Learning; 2013.

BECSE409T: Elective IV: Natural Language Processing

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: NLP tasks in syntax, semantics, and pragmatics, Key issues &Applications such as information extraction, question answering, and machine translation, the problem of ambiguity, The role of machine learning, brief history of the field.

Unit II: N-gram Language Models : Role of language models, Simple N-gram models, Estimating parameters and smoothing, Evaluating language models, Part Of Speech Tagging and Sequence Labeling Lexical syntax, Hidden Markov Models, Maximum Entropy models.

Unit III: Syntactic parsing: Grammar formalisms and tree banks, Efficient parsing for context-free grammars (CFGs), Statistical parsing and probabilistic CFGs (PCFGs), Lexicalized PCFGs.

Unit IV: Semantic Analysis: Lexical semantics and word-sense disambiguation, Compositional semantics, Semantic Role labeling and Semantic Parsing.

Unit V: Information Extraction (IE): Named entity recognition and relation extraction, IE using sequence labeling, automatic summarization Subjectivity and sentiment analysis.

Unit VI: Machine Translation (MT): Basic issues in MT, Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

Text Books:

1. Language Implementation Patterns, by Terence Parr.
2. Speech and Language Processing, by D. Jurafsky and R. Martin (2nd edition), Pearson Publication.

Reference Books:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming*, 1995.*
2. Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal*.NLP*: A Paninian *Perspective, Prentice* Hall, New Delhi, 1994.