KAMARAJ
COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)
S.P.G.Chidambara Nadar - C.Nagammal Campus
S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near VIRUDHUNAGAR).

B.E. COMPUTER SCIENCE AND ENGINEERING
REGULATION – 2020
AUTONOMOUS SYLLABUS
CHOICE BASED CREDIT SYSTEM
VII TO VIII SEMESTER CURRICULUM AND SYLLABI

VISION:

To make the Department of Computer Science and Engineering the unique of its kind in the field of Research and Development activities in this part of world.

MISSION:

To impart highly innovative and technical knowledge to the urban and unreachable rural student folks in Computer Science and Engineering through "Total Quality Education".

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1: Apply the necessary mathematical tools and fundamental knowledge of computer science & engineering to solve variety of engineering problems.

PEO 2: Develop software based solutions for real life problems and be leaders in their profession with social and ethical responsibilities.

PEO 3: Pursue life-long learning and research in selected fields of computer science & engineering and contribute to the growth of those fields and society at large.

PROGRAM OUTCOMES:

After going through the four years of study, the Computer Science and Engineering graduates will have the ability to

POs	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/evelopment of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 : Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO2 : Problem - Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	CS1771	Cloud Computing	PC	3	3	0	0	3
2	IT1671	Cryptography and Network Security	PC	3	3	0	0	3
3	GE1671	Total Quality Management	HS	3	3	0	0	3
4	PE5	Professional Elective V	PE	3	3	0	0	3
5	PE6	Professional Elective VI	PE	3	3	0	0	3
6	OE2	Open Elective – II*	OE	3	3	0	0	3
		Online Course**						
PRACTICALS								
7	IT1681	Cryptography and Network Security Laboratory	PC	4	0	0	4	2
8	CS1781	Cloud Computing laboratory	PC	4	0	0	4	2
9	CS1721	Capstone Project	EEC	4	0	0	4	2
			TOTAL	**30**	**18**	**0**	**12**	**24**

SEMESTER VIII

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	OL2	Online Course – II**	OL	0	0	0	0	3
PRACTICALS								
2	CS1821	Project work	EEC	16	0	0	16	8
			TOTAL	16	0	0	16	11

***** Course from the Curriculum of other UG programmes.

** Students shall complete online course in this semester. Credits earned will be added in consolidated mark statement.

PROFESSIONAL ELECTIVES (PEs)

PROFESSIONAL ELECTIVE V (SEMESTER VII)

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	IT1631	Blockchain Technologies	PE	3	3	0	0	3
2	AD1601	Computer Vision	PE	3	3	0	0	3
3	AD1602	Deep Learning	PE	3	3	0	0	3
4	AD1535	Human Computer Interaction	PE	3	3	0	0	3
5	CS1731	Parallel Algorithms	PE	3	3	0	0	3
6	CS1732	Software Project Management	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE VI (SEMESTER VII)

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	CS1733	2D & 3D Techniques for Graphics Modeling and Simulation	PE	3	3	0	0	3
2	AD1702	Natural Language Processing	PE	3	3	0	0	3
3	CS1734	Principles of Cyber Security	PE	3	3	0	0	3
4	CS1735	Randomized Algorithms	PE	3	3	0	0	3
5	CS1736	Risk Modeling and Assessment	PE	3	3	0	0	3
6	AD1633	Robotics and Intelligent Systems	PE	3	3	0	0	3

Open Elective – II (Semester VII)

Offered to ECE, EEE, EIE, MECH, MTR

SL NO.	COURSE CODE	COURSE NAME	CATEGORY	CONTACT PERIODS	L	T	P	C
1	OCS171	Software Engineering Fundamentals	OE	3	3	0	0	3

CS1771 **CLOUD COMPUTING**

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basic concepts of cloud computing and its principles.
- Make use of virtualization techniques in cloud computing
- Explain various service models and resource management in cloud computing.
- Expose to cloud programming model and software environment.
- Understand security and resource allocation issues in cloud computing.

UNIT I INTRODUCTION, PRINCIPLES AND ARCHITECTURE 9

Cloud Computing : Reference model -characteristics and challenges –historical development building cloud computing environment –Computing platforms and Technologies –Parallel Vs distributed computing –Elements of parallel and distributed computing –Technologies for distributed computing -Cloud Computing Architecture : NIST Cloud Computing Reference Architecture –Types of Clouds -economics –Open challenges. Web services SOA, REST.

UNIT II VIRTUALIZATION 9

Characteristics of virtualized environments -Taxonomy of virtualization techniques – Execution virtualization -Machine reference model -Hypervisors -Hardware virtualization techniques -Operating system-level virtualization -Application-level virtualization -Virtualization and cloud computing -Pros and cons of virtualization - Technology examples -Xen: Para-virtualization -VMware: Full virtualization and binary translation -Microsoft Hyper-V -Management of Virtual Machines for Cloud infrastructure –Anatomy –distributed management –scheduling techniques –Capacity management to meet SLA commitment.

UNIT III CLOUD INFRASTRUCTURE AND RESOURCE MANAGEMENT 9

Cloud Computing and Services Model –Public, Private and Hybrid Clouds –Cloud Eco System IaaS -PaaS –SaaS -Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development –Design Challenges -Inter Cloud Resource Management –Resource Provisioning and Platform Deployment –Global Exchange of Cloud Resources -Resource Scheduling for cloud computing –Economic Models

for resource allocation –Heuristics models for task execution –Real time scheduling in cloud computing.

UNIT IV **CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENT** **9**

Cloud capabilities and platform features –data features and databases -Parallel and Distributed Programming Paradigms –Hadoop – HDFS - MapReduce –Mapping Applications – Cloud Platforms - Google App Engine -Amazon Web Service – Microsoft Azure -Cloud Software Environments –Eucalyptus -Open Nebula - OpenStack –Cloudsim programming. Case Study: GoGrid -Rackspace.

UNIT V **SECURITY IN THE CLOUD AND RESOURCE MANAGEMENT** **9**

Cloud Computing Risk Issues – Cloud Computing Security Challenges – Cloud Computing Security Architecture – Trusted cloud Computing – Identity Management and Access Control – Autonomic Security Dynamic Resource Allocation Using Virtual Machines for Cloud Computing Environment.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain the basic concepts of cloud computing and its principles

CO2: Apply virtualization techniques for efficient resource utilization

CO3: Summarize various models, services and resource management in cloud computing

CO4: Apply cloud services in different programming models and software environment

CO5: Interpret security and resource allocation issues in cloud computing

TEXT BOOKS

1. Kai Hwang, Geoffery C Fox & Jack J Dongarra, 2012, *Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet*, 1st ed, Morgan Kaufman Publisher, an Imprint of Elsevier.
2. John W Rittinghouse & James F Ransome, 2017, *Cloud Computing: Implementation, Management and Security*, CRC Press.

REFERENCE BOOKS

1. Rajkumar Buyya, Christian Vecchiola & Thamarai Selvi, 2013, *Mastering Cloud Computing*, Tata Mcgraw Hill
2. Toby Velte, Anthony Velte & Robert Elsenpeter, 2009, *Cloud Computing -A Practical Approach*, Tata Mcgraw Hill
3. George Reese, 2009, *Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice),* O'Reilly.

IT1671 CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Learn the fundamental concepts and techniques in cryptography
- Illustrate the symmetric cryptosystem with respect to block ciphers and stream ciphers
- Explore knowledge on Asymmetric cryptosystems
- Understand the various message authentication principals and data integrity algorithms
- Acquire background knowledge of various security practices and system level security

UNIT I CLASSICAL CRYPTOSYSTEM 9

OSI security architecture: Security services, Security mechanism, Security attacks – Network Security model – Introduction to cryptosystem: Symmetric cryptosystem, Asymmetric cryptosystem – Perfect Secrecy – Classical symmetric techniques: Substitution: Caesar cipher, Shift cipher, Playfair cipher, Hill cipher, Vigenere cipher, Autokey cipher, One time pad, Transposition: Rail fence, Row columnar transposition – Introduction to modern cryptosystem.

UNIT II MODERN SYMMETRIC CRYPTOSYSTEM 9

Mathematics for Symmetric model: Algebraic structures, Modular arithmetic, Congruence and matrices, Groups, Rings, Fields, Finite fields, Euclid's algorithm – Mode of operations: Electronics codebook, Cipher block chaining, Cipher feedback, Output feedback, Counter – Differential and linear cryptanalysis – Block Ciphers: Block cipher design principles, Standard Data Encryption Standard (SDES), Data Encryption Standard (DES), Advanced Encryption Standard (AES) – Stream ciphers: Stream cipher design principles, RC4, IDEA.

UNIT III ASYMMETRIC CRYPTOSYSTEM 9

Mathematics for asymmetric model: Primes, Primality Testing, Factorization, Euler's totient function, Fermat's and Euler's Theorem, Chinese Remainder Theorem,

Exponentiation and logarithm – Asymmetric cryptosystem: RSA – Key distribution – Diffie Hellman – ElGammal cryptosystem – Elliptic curve cryptosystem.

UNIT IV INTEGRITY AND MESSAGE AUTHENTICATION 9

Authentication requirements – Authentication function – Message Authentication Code (MAC) – Hash function – Secure Hash Algorithm (SHA) – HMAC and CMAC – Digital signature – DSS – Entity authentication: Biometrics, Passwords, Challenge Response protocols – Kerberos – X.509.

UNIT V SYSTEM SECURITY AND SECURITY PRACTICES 9

Intrusion Detection System (IDS) – Malicious software: Trapdoor, Trojan horses, Logic bombs, Viruses, Worms, etc. – Firewalls: Types of firewall, Firewall configuration – E-mail security: PGP, S/MIME – IP security: AH, ESP, IKE – Web security: SSL, TLS, SET.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Select an appropriate classical symmetric cryptosystem to provide data security

CO2: Apply the mathematical concepts for symmetric block ciphers and stream ciphers

CO3: Choose an appropriate asymmetric cryptosystem and key management to ensure a secure transmission for a real world scenario.

CO4: Make use of the hash functions and digital signatures to provide authentication and integrity to a cryptosystem.

CO5: Illustrate various real time practices that provide Email security, network security and system security

TEXT BOOKS

1. William Stallings, 2017, *Cryptography and network Security*, 7th ed, Pearson.
2. Behrouz A Foruzan, 2007, *Cryptography and Network Security*, Tata McGraw Hill.
3. Shyamala, CK, Harini, N & Padmanabhan, TR, *Cryptography and Network Security*, Wiley India Pvt. Ltd

REFERENCE BOOKS

1. Wade Trappe & Lawrence C Washington, 2007, *Introduction to Cryptography with coding theory*, 2nd ed, Pearson.
2. Charles P Pfleeger & Shari Lawrence Pfleeger, 2006, *Security in computing*, 3rd ed, Prentice Hall of India.
3. Charlie Kaufman, Radia Perlman & Mike Speciner, *Network Security: PRIVATE Communication in a PUBLIC World*, Prentice Hall.

GE1671 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Learn the concepts of quality and quality management, TQM framework, Barriers and Benefits of TQM.
- Apply the Principles and techniques of Quality Management for real time.
- Understanding the need and importance of quality assurance and certification.

UNIT I INTRODUCTION 9

Concept of Quality and Quality Management- Determinants of quality of product & service-Quality vs. Reliability-- Definition of TQM-- Basic concepts of TQM -- TQM Framework- Barriers to TQM –Benefits of TQM.–Gurus of TQM (Brief introduction)- Quality statements – vision, mission, Policy.

UNIT II PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT 9

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi, Shingeo and Walter Shewhart - Concepts of Quality circle, Japanese 5S principles and 8D methodology.

UNIT III TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT 9

Quality functions development (QFD) – Benefits, Voice of customer, information Organisation, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation-Taguchi techniques.

UNIT IV STATISTICAL QUALITY CONTROL 9

Juran’s concept of quality cost-components of Quality Cost- Statistical Quality Control – Inspection, Sampling, Sample Size, Sampling Plan, AQL, OC curve, Producer Risk, Consumer Risk, AOQ, AOQL, Control Charts & Control Limits – X, R & S charts and their application- causes of variations – Assignable & Random; Runs-Test, Chart-Sensitivity Test and Run-Sum Test; Normal-Distribution curve and concept of Six Sigma.

UNIT V QMS- QUALITY MANAGEMENT SYSTEM 9

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Apply TQM concepts in a selected enterprise

CO2: Apply TQM principles in a selected enterprise

CO3: Explain Taguchi's techniques, Performance Measures, QFD and HOQ.

CO4: Explain Six Sigma concept and apply Traditional tools, new tools and Benchmarking for statistical quality control.

CO5: Confirm quality standards and implementing QMS in business organization.

TEXT BOOKS

1. Suganthi L & Anand Samuel, 2004, *Total Quality Management*, Prentice Hall Publications.
2. Dale H Besterfiled, Carol B Michna, Glen H Besterfield, Mary B Sacre, Hemant Urdhwareshe & Rashmi Urdhwareshe, 2013, *Total Quality Management*, Revised 3rd ed, Indian Reprint, 6th Impression, Pearson Education Asia.

REFERENCE BOOKS

1. Rose JE, 1997, *Total Quality Management,* S Chand & Co.
2. Kiran DR, 2016, *Total Quality Management: Key concepts and case studies*, Butterworth – Heinemann Ltd.
3. Shridhara Bhat K, 2016, *Total Quality Management: Text and Cases*, 2nd ed, Himalaya Publishing House India.

IT1681 **CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Implement various classical symmetric cryptosystem
- Get familiarized with different modern symmetric and asymmetric cryptosystems
- Utilize the key exchange algorithm to secure the private key
- Build data integrity algorithms to provide data integrity and authentication
- Make use of various open source tools like GnuPG, KF sensor, Snort, etc

LIST OF EXPERIMENTS

1. Implementation of Classical Substitution Crypto Algorithms to provide Confidentiality
    a. Implementation of Caesar Cipher and Shift Cipher
    b. Implementation of Playfair Cipher
    c. Implementation of Vigenere Cipher
    d. Implementation of Hill Cipher
2. Implementation of Classical Transposition Crypto Algorithms to provide Confidentiality
    a. Implementation of Row - Columnar Transformation
    b. Implementation of Rail fence
3. Implementation of Modern Private Key Cryptosystem Algorithms to provide Confidentiality
    a. Apply DES algorithm for practical applications
    b. Apply AES algorithm for practical applications
4. Implementation of Public Key Cryptosystem to provide Confidentiality and Authentication
    a. Implement RSA Algorithm
5. Implement the Diffie-Hellman Key Exchange algorithm
6. Implementation of Cryptographic Algorithms to provide Data Integrity and Authentication
    a. Calculate the message digest of a text using the SHA algorithm.
    b. Implement the Signature Scheme - Digital Signature Standard.

7. Demonstration on Usage of Modern Tools in Securing a System
    a. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG)
    b. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
    c. Setup a honey pot and monitor the honeypot on network (KF Sensor)
    d. Automated Attack and Penetration Tools
    e. Defeating Malware i) Building Trojans ii) Rootkit Hunter

TOTAL: 60 PERIODS

EQUIPMENTS NEEDED (FOR 30 STUDENTS)

S.NO.	NAME OF THE EQUIPMENT	QTY.
1	Personal Computers (Intel Core i3, 250 GB, 4 GB RAM)	30
2	Printer	1
3	Software: C / C++ / Java or equivalent compiler Tools: GnuPG, Snort, KF sensor, N-Stalker, GMER	30

OUTCOMES

CO1: Implement appropriate classical symmetric cryptosystem to provide data security.

CO2: Make use of modern symmetric and asymmetric cryptosystem to enhance data security.

CO3: Apply the key exchange algorithm to securely exchange symmetric keys.

CO4: Implement an appropriate hash algorithm and digital signature to provide integrity and authentication.

CO5: Examine the security of the network system using open source tools.

CS1781 CLOUD COMPUTING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Learn how to use Cloud Services
- Implement Virtualization
- Build Private Cloud using Openstack /Eucalyptus
- Build Hadoop cluster and execute programs
- Implement Task Scheduling algorithms using Cloudsim
- Execute version control commands using Github / Gitbash

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8 & Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
2. Create instances and volume attachment in AWS.
3. Setup a Private Cloud Using Open Stack or Eucalyptus
4. Install Open Stack Object Storage -Swift in Ubuntu.
5. Implement OpenStack Nova – Compute and Image services –Glance.
6. Setup Openstack Using DevStack.
7. Install a Single node hadoop cluster.
8. Implement Map Reduce concept for an application.
9. Implement Task Scheduling algorithms using CloudSim.
10. Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories using Git Bash and Git Hub.

TOTAL: 60 PERIODS

EQUIPMENTS NEEDED (FOR 30 STUDENTS)

S.NO.	NAME OF THE EQUIPMENT	QTY.
1	Personal Computers (Intel Core i3, 250 GB, 8 GB RAM)	30
2	Printer	1
3	Oracle Virtual Box, Ubuntu Guest OS, GAE, Docker, Cloud Sim, Java NetBeans, Hadoop, Openstack	30

OUTCOMES

CO1: Create virtual machines from available physical resources.

CO2: Create virtual machines using Openstack/Eucalyptus.

CO3: Build single node Hadoop cluster.

CO4: Apply task scheduling algorithms in Cloudsim.

CO5: Make use of version control commands for file management.

CS1821 **PROJECT WORK**

L	T	P	C
0	0	16	8

OBJECTIVES:

To enable the students to

- Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same
- Train the students in preparing project reports and to face reviews and viva voce examination

The students in a group of 3 to 4 works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

.

TOTAL: 240 PERIODS

OUTCOMES

CO1: Identify challenging engineering problems/Societal needs to propose project-based solutions

CO2: Build critical-thinking and analytical decision-making capabilities to find solution by formulating proper methodology

CO3: Analyze various algorithmic strategies using technological tools to provide software solutions

CO4: Develop solutions to identified problems

CO5: Complete an independent project, resulting in at least a publication in reputed journals or conference proceedings

IT1631 BLOCKCHAIN TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the needs of cryptographic algorithms in blockchain technologies
- Describe the operational and functional aspects of trading and mining
- Know about the bitcoin consensus
- Explain various algorithms that supports distributed consensus
- Realize the usage of Hyper ledger fabric and ethereum in various fields

UNIT I INTRODUCTION TO BLOCKCHAIN 7

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II BITCOIN AND CRYPTOCURRENCY 9

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network.

UNIT III BITCOIN CONSENSUS 10

Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , BitcoinPoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment-Paxos.

UNIT IV DISTRIBUTED CONSENSUS 9

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance.

UNIT V **HYPER LEDGER FABRIC, ETHERUM AND BLOCKCHAIN APPLICATIONS** **10**

Hyper Ledger Fabric: Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle-Design and issue Crypto currency, Mining, DApps, DAO Blockchain Applications: Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases –Finance.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain the need of cryptographic algorithms in blockchain technology

CO2: Apply the functional/operational aspects of trading and mining using crypto currencies

CO3: Explain the Bitcoin census, Proof of work and its design issues

CO4: Paraphrase the algorithms used to provide distributed concensus

CO5: Illustrate the architectures of Hyperledger fabric, Ethereum and the impact and the challenges in implementing Blockchain in domains like IoT, governance, finance, Health care etc.

TEXT BOOKS

1. Imran Bashir, 2020, *Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more*, 3rd Ed, Packt Publishing
2. Narayanan, A, Bonneau, J, Felten, E, Miller, A & Goldfeder, S, 2016, *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction*, Princeton University Press.

REFERENCE BOOKS

1. Arshdeep Bahga & Vijay Madisetti, 2017, *Blockchain Applications : A Hands-On Approach*.

2. Andreas Antonopoulos & Satoshi Nakamoto, 2014, *Mastering Bitcoin*, O'Reilly Publishing.
3. Roger Wattenhofer, 2016, *The Science of the Blockchain*, Create Space Independent Publishing Platform
4. Alex Leverington, 2017, *Ethereum Programming*, Packt Publishing Limited

AD1601 **COMPUTER VISION**

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Review image processing techniques for computer vision.
- Understand histograms and binary vision.
- Understand geometric transformations and edge detection.
- Understand features and recognition techniques.
- Study about video tracking and panoramas.

UNIT I OPENCV AND BASIC OPERATIONS ON IMAGES 9

History of OpenCV - Built-in Modules - Setting up OpenCV on Your Computer - Stereo Matching – Homography Estimation in Video - Circle and Line Detection - Image Segmentation - Bounding Box and Circle - Image Inpainting - Displaying Images from Disk in a Window - The cv::Mat Structure - Converting Between Color-spaces - GUI Track- Bars and Callback Functions - ROIs: Cropping a Rectangular Portion out of an Image - Accessing Individual Pixels of an Image – Videos.

UNIT II IMAGES, HISTOGRAMS, BINARY VISION 9

Simple pinhole camera model – Sampling – Quantisation – Colour images – Noise – Smoothing –1D and 3D histograms - Histogram/Image Equalisation - Histogram Comparison - Back-projection - k-means Clustering – Thresholding - Threshold Detection Methods - Variations on Thresholding - Mathematical Morphology – Connectivity.

UNIT III EDGES AND GEOMETRIC TRANSFORMATIONS 9

Problem Specification and Algorithm - Affine Transformations - Perspective Transformations - Specification of More Complex Transformations – Interpolation - Modelling and Removing Distortion from Cameras - Edge Detection - Contour Segmentation - Hough Transform.

UNIT IV FEATURES AND RECOGNITION 9

Moravec Corner Detection - Harris Corner Detection - FAST Corner Detection – SIFT - Other Detectors – Template Matching - Chamfer Matching - Statistical Pattern

Recognition - Cascade of Haar Classifiers - Other Recognition Techniques – Performance.

UNIT V VIDEO AND PANORAMAS 9

Moving Object Detection – Tracking - Video Datasets and Formats - Metrics for Assessing Video Tracking Performance – Affine Transformations - Perspective Transformations - Image panorama.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Implement fundamental image processing techniques required for computer vision

CO2: Apply thresholding and find histograms

CO3: Apply geometric transformations and edge detection to images

CO4: Apply various feature extraction techniques

CO5: Implement image panorama and video tracking

TEXT BOOKS

1. Kenneth Dawson-Howe, 2014, *A Practical Introduction to Computer Vision with OpenCV*, Wiley.
2. Samarth Brahmbhatt, 2013, *Practical OpenCV*, Apress.

REFERENCE BOOKS

1. Adrian Kaehler, Gary Bradski, 2017, *Learning OpenCV 3: Computer Vision in C++ with the OpenCV Library*, 1st ed, O'Reilly Media.
2. Prateek Joshi, David Millán Escrivá, Vinicius Godoy, 2016, *OpenCV by Example*, Packt Publishing.
3. Adrian Rosebrock, 2016, *Practical Python and OpenCV*, 2nd ed, Py Image Search.

AD1602 **DEEP LEARNING**

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Present the mathematical, statistical and computational challenges of building neural networks
- Study different models in ANN and their applications
- Understand deep learning concepts with Convolutional Neural Network case studies
- Perform multimedia analytics using CNN
- Familiarize advanced deep learning techniques

UNIT I NEURAL NETWORKS 9

Fundamentals of Neural Networks–Comparison of Biological and Artificial Neurons - Perceptron – Model of Artificial Neuron – Neural Network Architectures – Learning Methods : Error Correction Learning – Memory Based Learning – Hebbian Learning – Delta Hebbian Learning – Competitive Learning – Boltzman learning– Taxonomy of Neural Network Architectures – Applications.

UNIT II ARTIFICIAL NEURAL NETWORKS ARCHITECTURES 9

Feed forward network – Error Back Propagation – Stochastic and Gradient Descent: Radial basis network – Regularization network – kohenen Self Organising Map (kSOM) – Linear Vector Quantization: Recurrent Neural Network – Vanishing Gradient Problem – LSTM network.

UNIT III CONVOLUTIONAL NEURAL NETWORK 9

CNN Architecture – Convolution Filter Functions –ReLU function –Pooling – min, max, average pooling – Striding – Padding – Rollout – Softmax functions – Case Study: CNN based MNIST datasets analysis using Tensor flow.

UNIT IV MULTIMEDIA ANALYTICS 9

Audio file analytics – Tensor flow audio spectrum libraries – Video event detection using CNN – Case Study: Voice Recognition using CNN –Music Recommended Systems using CNN – Object tracking using CNN in video files.

UNIT V ADVANCED DEEP LEARNING TECHNIQUES 9

Deep Belief Networks – Deep Boltzman Machine – Deep Associative Memory networks – Generative Neural Networks – Deep fake Technology –Case Study on designing deep learning solutions for identifying fake finger prints, fake images and videos.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain the basic concepts of neural networks

CO2: Paraphrase various ANN models

CO3: Illustrate Convolutional Neural Network

CO4: Apply Convolutional Neural Network for multimedia analytics

CO5: Summarize various deep learning techniques

TEXT BOOK

1. Ian Goodfellow, Yoshua Bengio & Aaron Courville, 2016, *Deep Learning*, MIT Press.

REFERENCE BOOKS

1. Cosma, Rohilla & Shalizi, 2015, *Advanced Data Analysis from an Elementary Point of View*.
2. Deng & Yu, 2013, *Deep Learning: Methods and Applications*, Now Publishers.
3. Michael Nielsen, 2015, *Neural Networks and Deep Learning*, Determination Press.

AD1535 HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Learn the foundations of Human Computer Interaction.
- Become familiar with the design technologies for individuals and persons with disabilities.
- Understand the user models, social organizational issues and stakeholder requirements of HCI.
- Understand the concepts of mobile HCI.
- Learn the guidelines for designing simple user interfaces.

UNIT I FOUNDATIONS OF HCI 9

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity.

UNIT II DESIGN AND SOFTWARE PROCESS 9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III MODELS AND THEORIES 9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements –Communication and collaboration models.

UNIT IV MOBILE HCI 9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V WEB INTERFACE DESIGN 9

Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Outline the fundamental design and evaluation methodologies of HCI

CO2: Demonstrate the guidelines, principles, and software process influencing HCI

CO3: Identify the stakeholder requirements and choose the appropriate models

CO4: Explain the HCI implications for designing Mobile application

CO5: Develop user interface for a given application

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd & Russell Beale, 2004, *Human Computer Interaction*, 3rd ed, Pearson Education (UNIT I, II & III).
2. Brian Fling, 2009, *Mobile Design and Development*, 1st ed, O"Reilly Media Inc., (UNIT –IV).
3. Bill Scott & Theresa Neil, 2009, *Designing Web Interfaces*, 1st ed, O"Reilly. (UNIT-V).

CS1731 **PARALLEL ALGORITHMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Explain the fundamentals of parallel algorithms.
- Describe the various sequential models of parallel algorithms.
- Explain SIMD algorithms and their applications in sorting and matrix multiplication
- Illustrate the use of parallel searching algorithms in MIMD
- Comprehend the parallelization of sorting and graph algorithms.

UNIT I INTRODUCTION **9**

Need for Parallel Processing – Data and Temporal Parallelism – Models of Computation – RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organizations – PRAM Algorithm – Analysis of PRAM Algorithms-Parallel rogramming Languages.

PRAM ALGORITHMS: Parallel Algorithms for Reduction – Prefix Sum – List Ranking – Preorder Tree Traversal – Searching -Sorting – Merging Two Sorted Lists – Matrix Multiplication – Graph Coloring – Graph Searching.

UNIT II SEQUENTIAL MODEL **9**

LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one. Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost- optimality, An example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

UNIT III SIMD ALGORITHMS **9**

2D Mesh SIMD Model – Parallel Algorithms for Reduction – Prefix Computation – Selection – Odd-Even Merge Sorting – Matrix Multiplication, Hypercube SIMD Model – Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model – Parallel Algorithms for Reduction –Bitonic Merge Sort – Matrix Multiplication – Minimum Cost Spanning Tree.

UNIT IV MIMD AND SEARCHING ALGORITHMS 9

UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer – Parallel Quick Sort – Mapping Data to Processors. Parallel Searching Algorithm, Kth element, Kth element in X+Y on 8 PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

UNIT V SORTING AND GRAPH ALGORITHMS 9

Parallel Sorting : Networks, Parallel Merging Algorithms on CREW/EREW/MCC, Parallel Sorting Networks CREW/EREW/MCC/, linear array. Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms-Permutation, Combinations, Derangements.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain the fundamentals of parallel algorithms

CO2: Explain the various sequence models of parallel algorithms

CO3: Make use of SIMD algorithms for sorting and Matrix multiplication

CO4: Develop parallelized algorithms in MIMD for sorting, searching and matrix multiplication

CO5: Apply parallelization for sorting and graph algorithms

TEXT BOOK

1. Michael J. Quinn, 2017, *Parallel Computing: Theory & Practice*, 2nd ed, Tata McGraw Hill.

REFERENCE BOOKS

1. M Sasikumar, Dinesh Shikhare and P Ravi Prakash, 2013, *Introduction to Parallel Processing*, PHI learning.
2. M.J. Quinn, 2011, *Designing Efficient Algorithms for Parallel Computer,* 2nd ed, McGrawHill. University press.
3. S.G.Akl, 1989, *The Design and Analysis of Parallel Algorithms*, PHI, Delhi.

CS1732 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Familiarize with Software Project Management concepts
- Identify the appropriate techniques for the intended project life cycle and estimate the effort
- Understand the objectives of activity planning and risk management
- Explore the concepts of project management and control
- Provide the basic ideas of staffing in software projects

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models – mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II A Parametric Productivity Model – Staffing Pattern.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking –

Change control- Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain Project Management principles while developing software

CO2: Apply the appropriate techniques for software effort estimation

CO3: Interpret the activities in a project and manage risks

CO4: Summarize project management and control

CO5: Demonstrate staff selection process and the issues related to people management

TEXT BOOK

1. Bob Hughes, Mike Cotterell & Rajib Mall, 2017, *Software Project Management*, 6th ed, Tata McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Robert K Wysocki, 2011, *Effective Software Project Management,* 8th ed, Wiley Publication.
2. Walker Royce, 1998, *Software Project Management*, 6th ed, Addison-Wesley.
3. Gopalaswamy Ramesh, 2013, *Managing Global Software Projects*, McGraw Hill Education (India), 14th Reprint.

CS1733	2D & 3D TECHNIQUES FOR GRAPHICS MODELING AND SIMULATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basic concepts of graphics modelling and animation.
- Familiarize with different 2D modelling techniques.
- Be exposed to the techniques for modelling 3D objects.
- Learn about different 3D texturing and rendering techniques.
- Gain knowledge about the simulation techniques used for 3D object modelling.

UNIT I INTRODUCTION TO MODELLING, ANIMATION AND MAX INTERFACE 10

Introduction to computer based animation - basic types of animation: real time, non-real-time- definition of modelling - creation of 3d objects - exploring the max interface, controlling & configuring the viewports - customizing the max interface & setting preferences - working with files - importing & exporting, selecting objects - setting object properties - duplicating objects - creating & editing standard primitive and extended primitives objects - transforming objects – pivoting – aligning.

UNIT II 2D MODELLING 10

Understanding 2D Splines& shape - Extrude & Bevel 2D object to 3D - Understanding Loft & terrain - Modelling simple objects with splines - Understanding morph, scatter, conform connect compound objects- blob mesh – Boolean Proboolean and procutter compound object.

UNIT III 3D MODELLING AND ANIMATION 9

Modelling with Polygons - using the graphite - working with XRefs - Building simple scenes - Building complex scenes with XRefs using assets tracking - deforming surfaces - mesh modifiers - modelling with patches and NURBS - Creating Keyframes - auto keyframes - move & scale keyframe on the timeline - simple controllers, animation modifiers – complex controllers - Camera effects: function curves in the track view - motion mixer - configuring & aiming cameras - camera

motion blur – camera depth of field - camera tracking - using basic lights & lighting techniques - working with advanced lighting - light tracing – radiosity.

UNIT IV 3D TEXTURING AND RENDERING 9

Using material editor and the material explorer - creating and applying standard materials - adding material details with maps - creating compound materials and material modifiers - unwrapping UVs & mapping texture - using atmospheric and render effects - Rendering with V-Ray - V-ray light setup - V-ray rendering settings – HDRI Illumination - Fine-tuning shadows.

UNIT V 3D SIMULATION 7

Bind to Space Warp object - Gravity, wind, displace force object – deflectors - FFD space warp, wave, ripple, bomb - Creating particle system through parray - understanding particle flow user interface – working principle of particle flow – hair and fur modifier - cloth and garment maker modifiers.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain the basic concepts of modelling and animation.

CO2: Describe 2D graphics modelling techniques.

CO3: Summarize 3D modelling and animation techniques.

CO4: Explain about various texturing and rendering methods used for 3D graphics modelling.

CO5: Illustrate the usage of 3D simulation techniques in 3D graphics modelling.

TEXT BOOKS

1. Michael E Mortenson, 2010, *3D Modelling, Animation, and Rendering*, Create space publishers.

2. Boardman Ted, 2014, *3dsmax 7 Fundamentals*, Pearson Education.

REFERENCE BOOKS

1. Boris Kulagin, 2008, *3ds Max 8 from Modelling to Animation*, Bpb publishers.
2. Michael G, 2004, *3D Modelling and Animation*, Igi Publishers.
3. Lance Flavell, 2010, *Beginning Blender: Open Source 3D Modelling, Animation, and Game Desig*n, Apress publishers.

AD1702 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Learn the fundamentals of natural language processing
- Understand the use of CFG and PCFG in NLP
- Understand the role of semantics of sentences and pragmatics
- Apply the NLP techniques to IR applications

UNIT I INTRODUCTION 9

Origins and challenges of NLP – Processing Indian Languages – NLP applications - Language Modeling: Grammar-based LM, Statistical LM - Regular Expression basics – Corpora - Preprocessing - Text tokenization – Stemming – Lemmatization – Removing stop-words - Minimum Edit Distance - Sign language basics

UNIT II WORD LEVEL ANALYSIS 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Back off – Word Classes - Part-of-Speech Tagging - Named Entities and Named Entity Tagging - HMM Part-of-Speech Tagging - Evaluation of Named Entity Recognition

UNIT III SYNTACTIC ANALYSIS 9

Context-Free Grammars, Treebanks, Grammar Equivalence and Normal Form – Ambiguity - CKY parsing – Span-Based Neural Constituency Parsing - Evaluating Parsers - Dependency Relations - Transition-Based Dependency Parsing - Graph-Based Dependency Parsing – Evaluation

UNIT IV SEMANTICS AND PRAGMATICS 9

Word Senses - Relations between Senses – WordNet - Word Sense Disambiguation (WSD) – WSD algorithms and Tasks - Thesauruses to Improve Embedding's - Word Sense Induction - Semantic Roles - The Proposition Bank – FrameNet - Semantic Role Labeling - Selectional Restrictions

UNIT V DISCOURSE ANALYSIS AND RESOURCES 9

Coherence Relations - Discourse Structure Parsing - Centering and Entity-Based Coherence - Representation learning models for local coherence - Global Coherence -

Resources: Porter Stemmer – Lemmatizer - Penn Treebank - Brill's Tagger – WordNet – PropBank – FrameNet - Brown Corpus - British National Corpus (BNC).

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain the fundamental concepts of Natural Language Processing

CO2: Illustrate the algorithms used in word level analysis

CO3: Demonstrate the use of CFG in syntactic analysis

CO4: Outline the need for semantics and pragmatics

CO5: Interpret the context of the discourse using coherence and various resources

TEXT BOOK

1. Daniel Jurafsky and James H Martin, 2023, *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*, 3rd Ed, Pearson Publication.

REFERENCE BOOKS

1. Tanveer Siddiqui & Tiwary US, 2023, *Natural Language Processing and Information Retrieval*, Oxford University Press Reprint.
2. Richard M Reese, 2015, *Natural Language Processing with Java*, O'Reilly Media.
3. Nitin Indurkhya & Fred J Damerau, 2010, *Handbook of Natural Language Processing*, 2nd ed, Chapman and Hall/CRC Press.
4. Steven Bird, Ewan Klein & Edward Loper, 2009, *Natural Language Processing with Python*, 1st ed, OReilly Media.
5. Breck Baldwin, 2015, *Language Processing with Java and LingPipe Cookbook*, Atlantic Publisher.

CS1734 PRINCIPLES OF CYBER SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basics of cyber security
- Know the security aspects in OS and networks
- Familiarize with security countermeasures
- Understand the privacy aspects in cyber space
- Familiarize with various cyber laws in force

UNIT I INTRODUCTION TO CYBER SECURITY 9

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authenticate Access Control and Cryptography - Web User Side - Browser Attacks - Web Attack Targeting Users - Obtaining User or Website Data - Email Attacks.

UNIT II SECURITY IN OPERATING SYSTEM & NETWORKS 9

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

UNIT III DEFENCES: SECURITY COUNTERMEASURES 9

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity -SQL Injection Attacks – case study of data breaches.

UNIT IV PRIVACY IN CYBERSPACE 9

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining -Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies - Where the Field Is Headed.

UNIT V MANAGEMENT AND INCIDENTS 9

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain the fundamentals of cyber security

CO2: Describe the various security aspects in OS and networks

CO3: Summarize various security measures to safeguard resources

CO4: Outline the privacy aspects in cyber space

CO5: Explain the cyber laws in force

TEXT BOOKS

1. Charles P Pfleeger, Shari Lawrence Pfleeger & Jonathan Margulies, 2018, *Security in Computing*, 5th ed, Pearson Education.
2. George K Kostopoulous, 2017, *Cyber Space and Cyber Security*, 2nd ed, CRC Press.

REFERENCE BOOKS

1. Martti Lehto & Pekka Neittaanmäki, 2015, *Cyber Security: Analytics, Technology and Automation edited,* Springer International Publishing Switzerland.
2. Nelson Philips & Enfinger Steuart, 2009, *Computer Forensics and Investigations*, Cengage Learning, New Delhi.

CS1735 **RANDOMIZED ALGORITHMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the mathematical foundations needed for understanding and designing randomized algorithms
- Appreciate the need for randomized algorithms
- Get exposure on probabilistic methods
- Understand the concept of random walk
- Get exposure to different types of applications of randomized algorithms

UNIT I INTRODUCTION TO RANDOMIZED ALGORITHMS 9

Introduction to Randomized Algorithms - Min-cut – Elementary Probability Theory – Models of Randomized Algorithms – Classification of Randomized Algorithms – Paradigms of the Design of Randomized Algorithms - Game Theoretic Techniques – Game Tree Evaluation – Minimax Principle – Randomness and Non-Uniformity.

UNIT II PROBABILISTIC METHODS 9

Moments and Deviations – occupancy Problems – Markov and Chebyshev Inequalities – Randomized Selection – Two Point Sampling – The Stable Marriage Problem – The Probabilistic Method – Maximum Satisfiability – Expanding Graphs – Method of Conditional Probabilities – Markov Chains and Random Walks – 2-SAT Example – Random Walks on Graphs – Random Connectivity.

UNIT III ALGEBRAIC TECHNIQUES AND APPLICATIONS 9

Fingerprinting Techniques – Verifying Polynomial Identities – Perfect Matching in Graphs – Pattern Matching – Verification of Matrix Multiplication - Data Structuring Problems – Random Treaps – Skip Lists – Hash Tables.

UNIT IV GEOMETRIC AND GRAPH ALGORITHMS 9

Randomized Incremental Construction – Convex Hulls – Duality – Trapezoidal Decompositions – Linear Programming – Graph Algorithms – Min-cut – Minimum Spanning Trees.

UNIT V HASHING AND ONLINE ALGORITHMS 9

Hashing – Universal Hashing - Online Algorithms – Randomized Online Algorithms - Online Paging – Adversary Models – Relating the Adversaries – The k-server Problem.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Identify the need for randomized algorithms

CO2: Discuss the classification of randomized algorithms

CO3: Describe the various paradigms for designing randomized algorithms

CO4: Discuss the different probabilistic methods used for designing randomized algorithms

CO5: Apply the techniques studied to design algorithms for different applications like matrix multiplication, hashing, linear programming

TEXT BOOK

1. Rajeev Motwani and Prabhakar Raghavan, 2013, *Randomized Algorithms*, Cambridge University Press.

REFERENCE BOOKS

1. Juraj Hromkovic, 2005, *Design and Analysis of Randomized Algorithms*, Springer.
2. Michael Mitzenmacher and Eli Upfal, 2017, *Probability and Computing: Randomization and Probabilistic Techniques in Algorithms and Data Analysis*, 2nd Ed, Cambridge University Press.

CS1736 RISK MODELING AND ASSESSMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the fundamentals of risk modeling and assessment
- Identify the risks through hierarchical holographic modeling and its derivatives
- Understand the objectives of risk modeling, assessment and management.
- Explore the concepts of multi objective risk impact analysis
- Learn the principles and guidelines of project risk management.

UNIT I FUNDAMENTALS OF RISK MODELING AND ASSESSMENT 9

Introduction- Systems Engineering - Risk Assessment and Management, The Role of Modeling in the Definition and Quantification of the Risk Function: -Introduction - The Risk Assessment and Management Process: Historical Perspectives- Information, Intelligence, and Models- The Building Blocks of Mathematical Models - On the Complex Definition of Risk, Vulnerability, and Resilience: a Systems Based Approach - On the Definition of Vulnerabilities in Measuring Risks to Systems-On the Definition of Resilience in Measuring Risk to Systems-On the Complex Quantification of Risk to Systems

UNIT II IDENTIFYING RISK AND RISK FILTERING 9

Identifying Risk through Hierarchical Holographic Modeling and its Derivatives: Hierarchical Aspects -Hierarchical Overlapping Coordination -HHM - HHM and the Theory of Scenario Structuring - Adaptive Multiplayer HHM Game - Water Resources System -Sustainable Development- HHM in a System Acquisition Project -Software Acquisition - Hardening the Water Supply Infrastructure- Risk Assessment and Management for Support of Operations other than War Automated Highway System – Food Poisoning Scenarios Risk Filtering, Ranking, and Management: Introduction - Past Efforts in Risk Filtering and Ranking - RFRM: A Methodological Framework - Case Study: An OOTW 220.

UNIT III ADVANCES IN RISK MODELING, ASSESSMENT AND MANAGEMENT - I 9

Risk of Extreme Events and the Fallacy of the Expected Value: Introduction - Risk of Extreme Events- The Fallacy of the Expected Value -The PMRM -General Formulation of the PMRM -Summary of the PMRM- Illustrative Example-Analysis of Dam Failure and Extreme Flood through the PMRM – Example Problems - Multiobjective Decision Tree Analysis: Introduction -Methodological Approach- Differences between SODT and MODT- Example Problems.

UNIT IV **ADVANCES IN RISK MODELING, ASSESSMENT AND MANAGEMENT - II** **9**

Multiobjective Risk Impact Analysis Method: Introduction - Impact Analysis- The Multiobjective, Multistage Impact Analysis Method: An Overview - Combining the PMRM and the MMIAM - Relating Multiobjective Decision Trees to the MRIAM - Example Problems -Statistics of Extremes: Extension of the PMRM **:** A Review of the Partitioned Multiobjective Risk Method - Statistics of Extremes -Incorporating the Statistics of Extremes into the PMRM- Sensitivity Analysis of the Approximation of f4(·) - Generalized Quantification of Risk of Extreme Events.

UNIT V **PRINCIPLES AND GUIDELINES FOR PROJECT RISK MANAGEMENT** **9**

Introduction -Definitions and Principles of Project Risk Management- Project Risk Management Methods - Aircraft Development Example-Quantitative Risk Assessment and Management of Software Acquisition- Critical Factors That Affect Software Nontechnical Risk -Basis for Variances in Cost Estimation-Discrete Dynamic Modeling.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain about Risk modeling principles and its assessment.

CO2: Summarize the activities for risk identification and filtering.

CO3: Interpret risk modeling and assessment.

CO4: Demonstrate multi objective risk impact analysis.

CO5: Summarize the activities for project risk management.

TEXT BOOK

1. Yacov Y Haimes, *Risk Modelling, Assessment and Management,* 4th ed, Wiley Publishers.

REFERENCE BOOK

1. Charles Yoe, *Principles of Risk Analysis: Decision Making Under Uncertainty,* 2nd ed, CRC Press.

AD1633 ROBOTICS AND INTELLIGENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Learn the concepts of Intelligent systems.
- Explain the various methods of solving problems using Intelligent systems.
- Explain the concepts of Expert Systems and machine learning.
- Learn about planning and reasoning of intelligent agent.
- Learn the risk in Robots intelligent systems.

UNIT I INTRODUCTION 10

History, state of the art, Need for AI in Robotics. Problem Solving: Solving problems by searching –Informed search and exploration–Constraint satisfaction problems– Adversarial search, knowledge and reasoning– knowledge representation – first order logic.

UNIT II PLANNING 9

Planning with forward and backward State space search – Partial order planning – Planning graphs– Planning with propositional logic – Planning and acting in real world.

UNIT III REASONING 9

Uncertainty – Probabilistic reasoning–Filtering and prediction–Hidden Markov models–Kalman filters–Dynamic Bayesian Networks, Speech recognition, making decisions.

UNIT IV LEARNING 9

Forms of learning – Knowledge in learning – Statistical learning methods – reinforcement learning, Communication, perceiving and acting, Probabilistic language processing, perception.

UNIT V AI IN ROBOTICS 8

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Explain the basic concepts of intelligent systems

CO2: Show appropriate by intelligent methods to solve a given problem

CO3: Demonstrate a given problem in the language/framework of different intelligent systems methods

CO4: Illustrate basic intelligent algorithms

CO5: Identify out an empirical evaluation of different algorithms on a problem

TEXT BOOKS

1. Russell, S & Norvig, P, 2020, *Artificial Intelligence: A Modern Approach*, 4th ed, Prentice Hall.
2. Negnevitsky, M, 2011, *Artificial Intelligence: A guide to Intelligent Systems*, 3rd ed, Harlow: Addison-Wesley.

REFERENCE BOOK

1. David Jefferis, 1992, *Artificial Intelligence: Robotics and Machine Evolution,* Crabtree Publishing Company.

OCS171 SOFTWARE ENGINEERING FUNDAMENTALS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Explore the fundamental concepts of software life cycle models
- Understand the various estimation techniques
- Learn the various types of requirements and structured system analysis
- Learn scheduling and management techniques
- Identify the basic ideas of different testing strategies.

UNIT I SOFTWARE PROCESS 10

Nature of software-software engineering –software process-Generic process model-Prescriptive process models-–Specialized process models –Agile Process- Extreme Programming.

UNIT II ESTIMATION FOR SOFTWARE PROJECTS 9

Observations on Estimation-The Project Planning Process-Software Scope and feasibility-Resources-Software Project Estimation-Decomposition Techniques-Empirical Estimation Models-Estimation for Object-Oriented Projects - Specialized Estimation Techniques -The Make/Buy Decision.

UNIT III SOFTWARE REQUIREMENTS 9

Functional and non-functional requirements- The software requirements document-Requirements specification-Requirements engineering processes-Requirements elicitation and analysis-Requirements validation-Requirements management-Structured systems Analysis.

UNIT IV SCHEDULING AND MANAGEMENT 9

Project Scheduling - Project Management concepts: The management Spectrum-People-The Product-The process- The Project-Project Scheduling-Risk Management – risk management.

UNIT V TESTING 8

Software Testing Strategies: Strategic issues-Test strategies for conventional software:-Unit Testing-Integration Testing-Validation Testing-System Testing-The art of debugging-Testing Conventional Applications: Taxonomy of software testing –

Software Testing Fundamentals-Internal and External Views of Testing-White-Box Testing: Basis Path Testing-Control Structure Testing-Black Box Testing: Equivalence Partitioning-Boundary Value Analysis.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Illustrate the life cycle models for software development

CO2: Calculate the estimation for software projects

CO3: Interpret the requirements and structured system analysis

CO4: Explain the various scheduling and management techniques

CO5: Summarize the various testing strategies

TEXT BOOKS

1. Roger S Pressman, 2014, *Software Engineering: A practitioner's Approach*, 7th ed, McGraw-Hill International Edition.
2. Ian Sommerville, 2012, *Software engineering*, 9th ed, Pearson Education Asia.

REFERENCE BOOKS

1. Stephen R Schach, 2007, *Software Engineering*, Tata McGraw-Hill.
2. Kelkar, SA, 2007, *Software Engineering*, Prentice Hall of India.