B.E. COMPUTER SCIENCE & ENGG. SEM. VII & VIII

Syllabus of B.E. Sem. VII (Computer Science & Engineering)

7KS01 / 7KE01 SOCIAL SCIENCES AND ENGINEERING ECONOMICS

Course Objectives:

The phenomenal progress of technology in the twentieth century has brought dramatic changes in human lifestyles from the social and economic point of view. This subject helps students to get an understanding of market trends, economic transformations, changes in the laws and equip them to have a better understanding of the market.

Course objectives are:

1. To help students to understand the importance of economics to engineers
2. To let them know about the Indian Parliament
3. To enhance their knowledge about culture and civilization
4. To help students to get an understanding of Market Trends, Economic Transformations, Changes in the Laws & equip them to have a better understanding of Market
5. To critically examine the market trends.

Course Outcomes:

At the end of the course, students will have-

1. An ability to understand the importance of social science and economics in professional life.
2. An ability to utilize high-level interpersonal skills to negotiate with stakeholders and maintain cordial relationships with them reflecting the professional ethics and responsibilities.
3. Understanding of professional responsibility with socioeconomic constraints and norms
4. An ability to understand the need of society and design the system to fulfil it with deep analysis.
5. An ability to understand the social science and engage in a lifelong learning process performing better in the group as well as individually.

SECTION - A

Unit I : Study of Social Science : Importance to Engineer, salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State Policy. (8)

Unit II : Indian Parliament : Composition and powers, President of India : Election and Powers. Council of Ministers and Prime Minister (8)

Unit III : Impact of Science and Technology on culture and Civilization. Human Society: Community Groups. Marriage and Family: Functions, Types and problems. (8)

SECTION – B

Unit IV: Production : Factors of production, Laws of return, Forms of Business Organization. (8)

Unit V: Banking : Functions of Central and Commercial Banks. Introduction to GST, Market : Forms, perfect, imperfect competition and monopoly. (8)

Unit VI: Nature and scope of Economics : Special significance of Economics to Engineers. Economics of Development : Meaning, Characteristics of under development, obstacles to Economic growth and vicious circle of poverty. (8)

Books Recommended :

1. Pylee M.V. : Constitutional Govt. in India, S.Chand and Co.
2. C N Shankar Rao: Sociology, S.Chand and Co.
3. Dewett and Varma J.D. : Elementary Economic Theory, S.Chand and Co.

4. A.N.Agrawal : Indian Economy, Problem of Development and Planning (Wiley Eastern Ltd), New Delhi.
5. S.K.Mishra : Indian Economy, Its Development Experience. Himalaya Pub.House, Bombay.
6. E.Kuper : Economics of W.R. Development, McGraw Hill Co.,
7. Brij Kishore Sharma. : The Constitution of India, PHI.
8. Mahajan : The Constitution of India, S.Chand, New Delhi.
9. Maclaver and Page : Principle of Sociology.
10. Davis K. : Human Society
11. Datt R.K. : Indian Economy, S.Chand and Comp. New Delhi P.M.Sundharam
12. Dhingra I.C. : Indian Economy
13. Jemes L.E., R.R.Lee : Economics of W.R.Planning, McGraw Hill Co.

7KS02 COMPUTER GRAPHICS (L-3, T-0, C-3)

Course Prerequisite: Data Structures and algorithms, Basic Mathematics, Geometry, linear algebra, vectors andmatrices.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Graphics by being able to do each of the following:

- To acquaint the learner with the basic concepts of Computer Graphics.
- To learn the various algorithms for generating and rendering graphical figures.
- To get familiar with mathematics behind the graphical transformations.
- To understand various methods and techniques regarding projections, animation, shading, illumination andlighting

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe the basic concepts of Computer Graphics.
2. Demonstrate various algorithms for basic graphics primitives.
3. Apply 2-D geometric transformations on graphical objects.
4. Use various Clipping algorithms on graphical objects
5. Explore 3-D geometric transformations, curve representation techniques and projections methods
6. Explain visible surface detection techniques and Animation.

Unit I: Introduction and Overview of Graphics System **Hours: 7**

Definition and Representative uses of computer graphics, Overview of coordinate system, Definition of scan conversion, rasterization and rendering. Raster scan & random scan displays, Architecture of raster graphics systemwith display processor, Architecture of random scan systems.

Unit II: Output Primitives **Hours: 7**

Scan conversions of point, line, circle and ellipse: DDA algorithm and Bresenham algorithm for line drawing, midpoint algorithm for circle, midpoint algorithm for ellipse drawing (Mathematical derivation for above algorithmsis expected); Aliasing, Antialiasing techniques like Pre and post filtering, super sampling, and pixel phasing).; Filled Area Primitive: Scan line Polygon Fill algorithm, inside outside tests, Boundary Fill and Flood fill algorithm

Unit III: Two Dimensional Geometric Transformations **Hours: 7**

Basic transformations: Translation, Scaling, Rotation , Matrix representation and Homogeneous Coordinates Composite transformation Other transformations: Reflection and Shear

Unit IV: Two-Dimensional Viewing and Clipping **Hours: 7**

Viewing transformation pipeline and Window to Viewport coordinate transformation , Clipping operations: Point clipping, Line clipping algorithms: Cohen-Sutherland, Liang: Barsky, Polygon Clipping Algorithms: Sutherland- Hodgeman, Weiler-Atherton.

Unit V: Three Dimensional Geometric Transformations, Curves and Fractal Generation **Hours: 7**

3D Transformations: Translation, Rotation, Scaling and Reflection, Composite transformations: Rotation about an arbitrary axis, Projections – Parallel, Perspective. (Matrix Representation), Bezier Curve, B-Spline Curve, Fractal- Geometry: Fractal Dimension, Koch Curve.

Unit VI: Visible Surface Detection and Animation **Hours: 7**

Visible Surface Detection: Classification of Visible Surface Detection algorithm, Back Surface detection method, Depth Buffer method, Area Subdivision method

Animation: Introduction, Design of animation sequences, Animation languages, Keyframe, Morphing, Motion specification.

Text Book: Hearn, Baker, "Computer Graphics (C version)" – Pearson Education.

1. J. Foley, V. Dam, S. Feiner, J. Hughes, ―Computer Graphics Principles and Practice‖, 2nd Edition,Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
2. D. Rogers, J. Adams, ―Mathematical Elements for Computer Graphics‖, 2nd Edition, TataMcGrawHill Publication, 2002, ISBN 0 – 07 – 048677 – 8.
3. Mario Zechner, Robert Green, ―Beginning Android 4 Games Development‖, Apress, ISBN: 978-81- 322-0575-3.

7KS03 CLOUD COMPUTING (L-4, T-0, C-4)

Course Prerequisite: Data Communication and Networks

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Cloud Computing by being able to do each of the following:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a foundation of Cloud Computing, Cloud Computing services and tools in real life scenarios.
- To enable student to explore some important Cloud Computing driven commercial systems and applications.
- To provide students with essentials of Cloud Computing architecture, Virtualization, Storage and Network concepts.

Course Outcomes (Expected Outcomes): On completion of the course, the students will be able to:

1. Describe the fundamental concept, architecture and applications of Cloud Computing.
2. Discuss the problems related to cloud deployment model.
3. Examine the concept of virtualization.
4. Identify the role of network connectivity in the cloud.
5. Assess different Cloud service providers.
6. Inspect the security issues in cloud service models.

Unit I: Cloud Computing Fundamental, Architecture and Management: Hours: 8

Computing Paradigm and various computing types, Cloud Computing Fundamentals: Motivation for Cloud Computing, The need for Cloud Computing, Defining Cloud Computing, Principles of Cloud Computing, Requirements of Cloud Services, Cloud Applications, Benefits and Drawbacks. Cloud Computing Architecture and Management: Introduction, Cloud Architecture, Network connectivity in Cloud Computing, Applications on the cloud, Managing Cloud, Migrating Application to cloud.

Unit II: Cloud Deployment and Service Models: Hours: 8

Cloud Deployment Models: Introduction, Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud. Cloud Service Models: Introduction, Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models.

Unit III: Operating System and Virtualization: Hours: 8

Types of Operating Systems, Role of OS in Cloud Computing, Features of Cloud OS. Application Environment: Need for Effective ADE, Application Development Methodologies, Cloud Application Development Platforms and Cloud Computing API's. Virtualization: Introduction, Virtualization Opportunities, Approaches to Virtualization, Hypervisors, Virtualization to Cloud Computing.

Unit IV: Software Development in Cloud and Networking for Cloud Computing: Hours: 8

Introduction, Different Perspectives on SaaS Development, New Challenges, Cloud-Aware Software Development Using PaaS Technology. Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Networking Issues in Data Centers, Transport Layer Issues in DCNs.

Unit V: Cloud Service Providers: Hours: 8

Introduction, EMC: IT, and captive cloud toolkit, Google: Platform, Storage, Cloud connects, Cloud Print and App Engine, Amazon Web Services: Elastic Compute Cloud, Simple storage, Simple Queue Service, Microsoft: Windows Azure, IBM Cloud models and IBM Smart Cloud, SAP Labs: SAP HANA Cloud Platform, Virtualization Services Salesforce: Sales Cloud and Service Cloud, Rackspace and VMware.

Unit VI: Open-Source Support for Cloud and Security in Cloud Computing : Hours: 8

Open-Source Support for Cloud: Introduction, Open Source Tools for IaaS, Open Source Tools for PaaS, Open Source Tools for SaaS, Open Source Tools for Research, Distributed Computing Tools for Management of Distributed Systems. Security in Cloud Computing: Introduction, Security Aspects: Data, Virtualization and Network Security, Platform-Related Security: Security issues in Cloud Service Models, SaaS, PaaS, IaaS security issues, Audit and Compliance: Disaster Recovery, Privacy and Integrity.

Text Book: K. Chandrasekaran: Essentials of Cloud Computing, Edition, CRC Press Taylor & Francis Group.

Reference Books:

1. A. Shrinivasan, J. Suresh: Cloud computing a practical approach for learning and implementation, Pearson publication.
2. M. N. Rao: Cloud Computing, PHI Learning Pvt. Ltd, 2015.
3. Dr. Kumar Saurabh: Cloud computing, 2nd Edition, Wiley India 2012.
4. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski: Cloud Computing: Principles and Paradigms, John Wiley & Sons, Inc. 2011.
5. Anthony T. Velte , Toby J. Velte and Robert Elsenpeter, Cloud computing a practical approach, Tata McGraw- Hill , New Delhi – 2010.
6. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, “Cloud computing for dummies” Wiley Publishing, Inc, 2010.

7KS04 ROBOTICS (L-3, T-0, C-3)

Course Prerequisite: Mathematics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Robotics by being able to do each of the following:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Describe basic concept of robotics.
2. Explain Components of a Robot System & Mechanical Systems
3. Illustrate Control of Actuators in Robotic Mechanisms
4. Compare and contrast Robotic Sensory Devices
5. Recommend Robotics Hardware & Software Considerations in Computer Vision
6. Design Robotic system by taking real time considerations.

Unit I: Introduction to Robotics: Objectives, Motivation, Historical Perspective of Robots, Classification of Robots, Classification by Control Method, Continuous-path servo-controlled robots, Major Components of a Robot, Fixed versus Flexible Automation. (**Hours: 7)**

Unit II: Components of a Robot System & Mechanical Systems: Basic Components of a Robot System, Functions of a Robot System Specifications of Robot Systems, Kinematic Chains the Manipulator End Effectors, Resolution, Forces Encountered in Moving Coordinate Systems Lagrangian Analysis of a Manipulator. (**Hours: 7)**

Unit III: Control of Actuators in Robotic Mechanisms: Closed-Loop Control in a Position Servo, the Effect of Friction and Gravity, Frequency-Domain Considerations, Control of a Robotic Joint Brushless DC Motors, Direct-Drive Actuator, Hydraulic Actuators. (**Hours: 7)**

Unit IV: Robotic Sensory Devices: Non-Optical-Position Sensors, Optical Position Sensors, Robot Calibration Using an Optical Incremental Encoder, Instability Resulting from Using an Incremental Encoder, Velocity Sensors, Accelerometers. **(Hours: 7)**

Unit V: Computer Vision for Robotics Systems: A Functional Approach: Imaging Components, Image Representation, Hardware Considerations, Picture Coding, Object Recognition and Categorization, Software Considerations, Need for Vision Training and Adaptations. **(Hours: 7)**

Unit VI: Computer Considerations for Robotic Systems: Architectural Considerations, Hardware Considerations, Computational Elements in Robotic Applications Real-Time Considerations, Robot Programming, Path Planning, The Robot's Computer System. **(Hours: 7)**

Text Books:

1. Richard D.Klafter Thomas , Achmielewski and Michael Negin Robotic Engineering- An Integrated Approach Prentice Hall India – New Delhi.
2. Saeed B Nikku Introduction to Robotics , analysis control and applications Wiley-India 2nd Edition-2011

Reference Books:

1. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
2. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.
3. David Jefferis, "Artificial Intelligence: Robotics and Machine Evolution", Crabtree Publishing Company, 1992.
4. Robin Murphy, Robin R. Murphy, Ronald C. Arkin, "Introduction to AI Robotics", MIT Press, 2000.
5. Francis.X.Govers, "Artificial Intelligence for Robotics", Packt Publishing, 2018.
6. Huimin Lu, Xing Lu, "Artificial Intelligence and Robotics", Springer, 2017.

7. Lentin Joseph, "Robot Operating Systems (ROS) for Absolute Beginners, Apress, 2018
8. Aaron Martinez, Enrique Fernández, "Learning ROS for Robotics Programming", Packt Publishing Ltd, 2013.
9. Wyatt Newman, "A Systematic Approach to learning Robot Programming with ROS", CRC Press, 2017.
10. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
11. K. K.AppuKuttan, Robotics, I K International, 2007.
12. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
13. Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin - Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 2009.
14. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
15. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012
16. Deb. S. R. "Robotics technology and flexible automation", Tata McGraw Hill publishing company.

7KS04 DATA WAREHOUSE AND MINING (L-3, T-0, C-3)

Course Prerequisite: Basic knowledge of Database management system

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Data Warehouse and Mining by being able to do each of the following:

1. Introduce the basics of data mining, data types, similarity and dissimilarity measures
2. Explain association rules and algorithms
3. Be familiar with mathematical foundations of data mining tools.
4. To identify the scope and essentiality of Data Warehousing and Mining
5. Demonstrate the appropriate data mining techniques for decision making.
6. To develop research interest towards advances in data mining.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain the basics of data mining techniques.
2. Identify the similarity and dissimilarity between the data sets.
3. Apply Data Preprocessing to techniques.
4. Describe Data Warehouse fundamentals, Data Mining Principles.
5. Illustrate Multidimensional Data Analysis in Cube Space
6. Assess Mining Frequent Patterns, Associations, and Correlations

Unit I: Introduction: Why Data Mining?, What Is Data Mining? , What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? , Which Kinds of Applications Are Targeted? , Major Issues in Data Mining. **(Hours: 7)**

Unit II: Getting to Know Your Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. **(Hours: 7)**

Unit III: Data Preprocessing: Data Preprocessing: An Overview , Data Cleaning , Data Integration , Data Reduction , Data Transformation and Data Discretization. **(Hours: 7)**

Unit IV: Data Warehousing and Online Analytical Processing:
Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction. **(Hours: 7)**

Unit V: Data Cube Technology
Data Cube Computation: Preliminary Concepts, Data Cube Computation Methods, Processing Advanced Kinds of Queries by Exploring Cube Technology, Multidimensional Data Analysis in Cube Space. **(Hours: 7)**

Unit VI: Mining Frequent Patterns, Associations, and Correlations :
Basic Concepts and Methods: Basic Concepts , Frequent Itemset Mining Methods , Which Patterns Are Interesting?-Pattern Evaluation Methods . **(Hours: 7)**

Text Book:
Data Mining – Concepts and Techniques, Jiawei Han & Micheline Kamber, Morgan Kaufmann(MK) Publishers, Elsevier, 3rd Edition, 2006.

Reference Books:

1. Data Mining Techniques, Arun K Pujari, 3rd edition, Orient Blackswan/Universities Press, 2013.
2. Data Warehousing Fundamentals, PaulrajPonnaiah, John Wiley & Sons, 2001.
3. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education, 2007
4. Insight into Data mining Theory and Practice, K.P. Soman, Shyam Diwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, Prentice Hall of India, 2006.

7KS04 EMBEDDED SYSTEM (L-3, T-0, C-3)

Course Pre-requisite: Microprocessor and Assembly Language Programming, Computer Architecture and Organization

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Embedded System by being able to do each of the following:

1. Introduce the fundamentals and building blocks of Embedded System.
2. Impart the knowledge of basic embedded programming in various languages as well as data structures.
3. Introduce hardware units, bus communication in processors and input/output interfacing.
4. Impart knowledge of real-time operating system and various task scheduling algorithms.
5. Introduce basics of real-time operating system and case study example to elaborate importance of real-time operating system.

Course Outcomes (Expected Outcomes): On completion of the course, the students will be able to:

1. Describe the basics of embedded systems and structural core units as well as memory organization for embedded system.
2. Explain components of embedded system, characteristics and quality attributes of embedded systems.
3. Discuss role of 8051 microcontroller and its architecture in design of embedded systems
4. Examine the different Addressing modes and Instruction Set of 8051 microcontrollers.
5. Use knowledge of C programming to do embedded programming.
6. Assess the Real-Time Operating System concepts with VxWorks RTOS.

UNIT I: Introduction to Embedded System: What is Embedded System, Embedded Systems Vs General Computing Systems, History, classification, major application areas and purpose of Embedded Systems, Wearable Devices. The Typical Embedded System: Core of the Embedded System, Memory. **(Hours: 7)**

UNIT II: The Typical Embedded System: Sensors & Actuators, Communication Interface, Embedded Firmware, Other System Components, PCB and Passive Components. Characteristics of an Embedded System, Quality Attributes of Embedded Systems. Embedded Systems Application and Domain Specific Examples: Washing machine, Automotive. **(Hours: 7)**

UNIT III: Designing Embedded Systems with 8-bit Microcontroller - 8051: Factors to be considered in Selecting a Controller. Why 8051 Microcontroller. Designing with 8051 Microcontroller: 8051 Architecture, 8051 Memory Organization, Registers, Oscillator Unit, Ports, 8051 Interrupt System, Timer units, the Serial Port, 8051 Power Saving Modes. **(Hours: 7)**

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UNIT IV: Programming the 8051 Microcontroller: Different Addressing modes supported by 8051. The 8051 Instruction Set: Data transfer instructions, Arithmetic instructions, Logical instructions, Boolean instructions, and Program Control Transfer instructions. Embedded Firmware Design Approaches, Assembly Language based Embedded Firmware development. **(Hours: 7)**

UNIT V:

Programming in Embedded C: Review of various constructs in C. Constant declarations, 'volatile' type qualifier, Delay generation and Infinite loops in Embedded C. Coding Interrupt Service Routines, Recursive and Re-entrant Functions, Dynamic memory allocation. **(Hours: 7)**

UNIT VI:

VxWorks Real Time Operating System (RTOS): How to choose an RTOS, Characteristics, Real Time Kernel, Hard/Soft Real time. VxWorks Task Creation, Management and Task Scheduling, Kernel Services, Inter Task Communication, VxWorks Task Synchronization and Mutual Exclusion, Interrupt Handling, Watchdog for task Execution monitoring, Timing and Reference in VxWorks.
The Embedded Product Development Life Cycle (EDLC): What is EDLC, Why EDLC, Objectives of EDLC, Different Phases of EDLC, EDLC approaches. **(Hours: 7)**

Text Book: Shibu K V "Introduction to Embedded Systems", Second Edition, McGraw-Hill.

References:

1. Rajkamal, "Embedded Systems, Architecture, Programming & Design", Third Edition, TMH.
2. Tammy Noergaard, "Embedded Systems Architecture" Elsevier Newness Publication.
3. Vahid and Givargis, "Embedded System Design" John Wiley & Sons P Ltd.
4. Peter Marwedel, "Embedded Systems Design" Springer, Netherland.
5. Jane W. S. Liu, "Real Time Systems", Pearson Education.
6. Mohammad Ali Mazidi, "The 8051 Microcontroller and Embedded System using Assembly and C" Pearson.

7KS04 DIGITAL FORENSICS (L-3, T-0, C-3)

Course Prerequisite: Data Communication & Networking, Introduction to Cyber Security, Cryptography

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Digital Forensics by being able to do each of the following:

- To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- To understand how to examine digital evidences such as the data acquisition, identification analysis.
- To understand the basics of mobile phone forensics.
- To understand the network based cyber security intrusion detection.
- To know the various forensics tool.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Digital Forensics and its related preparation
2. Outline Data Acquisition tools
3. Use knowledgeto improve crime investigations.
4. Examine Digital Forensic and its validation
5. Assess role of email and social media in investigations
6. Discuss Cloud Forensics.

Unit I: **Hours: 7**

Introduction: An Overview of Digital Forensics, Preparing for Digital Investigations, Preparing A Digital Forensics Investigations, Procedure for Private Sector High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

Unit II: **Hours: 7**

Data Acquisition: Understanding storage formats for digital evidence, determining the best acquisition method, Contingency planning for Image acquisition, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

Unit III: **Hours: 7**

Processing Crime and Incident Scenes: Identifying Digital Evidence, Collection Evidence in Private Sector Scenes, Processing Law Enforcement Crime Scenes, Preparing for a search, Securing a Digital Incident or Crime Scene, Seizing Digital Evidence at the scene, Storing a Digital Evidence, Obtaining a Digital Hash,

Unit IV: **Hours: 7**

Digital Forensic Analysis and Validation: Data to collect and analyze, Validating Forensic data, Addressing data hiding techniques, Virtual Machine Forensics, Live Acquisition and Network Forensics

Unit V: **Hours:7**

Email and Social Media Investigations: Role of Email in investigations, Roles of Client and server in Email, Investigating Emails Crimes and Violations, Email Servers, Specialize Email Forensic Tools, Digital Forensics to Social Media Communications. Mobile Device Forensics and Internet of Anything: Mobile Device Forensics, Acquisitions procedure for Mobile Devices, Forensics in Internet of Anything.

Unit VI: **Hours: 7**

Cloud Forensics: Cloud Computing, Legal Challenges in Cloud Forensics, Technical Challenges in Cloud Forensics, Acquisitions in the cloud, Conducting a cloud investigation, Tools for Cloud Forensics. Digital Forensics Tools: Evaluating Digital Forensics Tools Needs, Software and Hardware Tools, Validating and Testing Software.

Text Book: Nelson, B, Phillips, A, Stuart, C., “Guide to Computer Forensics and Investigations”, 6th Ed., Cengage Learning.

Reference Books:

1. Warren G. Kruse II and Jay G. Heiser, “Computer Forensics: Incident Response Essentials”, Addison Wesley, 2002.
2. Davidoff, S. and Ham, J., Network Forensics Tracking Hackers through Cyberspace, Prentice Hall, 2012.
3. Michael G. Solomon, K Rudolph, Ed Tittel, Broom N., and Barrett D., Computer Forensics Jump Start, Willey Publishing, Inc., 2011.
4. Marcella, Albert J., Cyber forensics: A field manual for collecting, examining and preserving evidence of computer crimes, New York, Auerbach publications, 2008.
5. Davidoff, Sherri, Network forensics: Tracking hackers through cyberspace, Pearson education India private limited, 2017.
6. John Sammons, The Basics of Digital Forensics, Elsevier, 1st Edition, 2015.

7KS05 Blockchain Fundamentals (L-3, T-0, C-3)

Course Prerequisite:Basic Knowledge of Distributed systems and Networking, Basic knowledge of Data Structure

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of blockchain fundamental by being able to do each of the following:

1. A comprehensive understanding of how blockchain systems (mainly Bitcoin and Ethereum) work,
2. To securely interact with them
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from blockchain technology into applications

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Understand the concept of decentralization of the block chain with different layers of blockchain
2. Apply basic cryptographic primitives with encryption standards.
3. Analyze & Design Consensus Algorithms.
4. Examine fundamentals of Bitcoin, how Bitcoin transactions are constructed and used with Bitcoin addresses, accounts, and mining
5. Understand foundation, architecture, and use of the Ethereum blockchain.
6. Execute & build block chain application/ transaction

Unit I: Blockchain Fundamentals **Hours: 7**

Introduction to Blockchain, History, Centralised versus Decentralised systems, Layers of blockchain, Importance of blockchain, Blockchain uses and use cases.

Unit II: Blockchain Working with Cryptography **Hours: 7**

Laying the Blockchain Foundation, Cryptography, Symmetric Key Cryptography, DES cryptography, Advanced Encryption Standard, Cryptographic Hash Functions, MAC and HMAC, Asymmetric Key Cryptography, Diffie-Hellman Key Exchange, Symmetric vs. Asymmetric Key Cryptography

Unit III: Consensus Algorithms **Hours: 6**

Introducing the consensus problem, Analysis and design, Classification, Algorithms: CFT algorithms, BFT algorithms, Choosing an algorithm

Unit IV: Bitcoin & Its Working **Hours: 7**

The History of Money, Dawn of Bitcoin: What Is Bitcoin, Working with Bitcoins. The Bitcoin Blockchain: Block Structure, The Genesis Block. The Bitcoin Network: Network Discovery for a New Node Bitcoin Transactions, Bitcoin Wallets

Unit V: Ethereum **Hours: 7**

From Bitcoin to Ethereum, Ethereum as a Next-Gen Blockchain Design Philosophy of Ethereum Enter the Ethereum Blockchain Ethereum Blockchain Ethereum Accounts Trie Usage Merkle Patricia Tree RLP Encoding Ethereum Transaction and Message Structure. Ethereum Smart Contracts Contract Creation

Unit VI: Blockchain Application Development **Hours: 6**

Decentralized Applications, Blockchain Application Development, interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum, Sending Transactions

Text Books:

[1] Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda Apress 2018

[2] Mastering Blockchain, Imran Bashir: Packt- Birmingham-Mumbai Third Edition A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, crypto currencies, Ethereum, and more

Reference Books:

[1] Blockchain – Blueprint for new Economy Melanie Swan - O'reilly

[2] Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.

[3] Sainul Abideen, Blockchain-ebook,Cybrosys Private Limited

7KS05 IMAGE PROCESSING (L-3, T-0, C-3)

Course Prerequisite: Calculus, Linear Algebra, Differential Equation

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Image Processing by being able to do each of the following:

- To introduce and discuss the fundamental concepts and applications of Digital Image Processing.
- To discuss various basic operations in Digital Image Processing.
- To know various transform domains

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to

1. Explain fundamental steps in Image Processing
2. Compare different methods for image transform with its properties
3. Illustrate Image Enhancement in spatial domain
4. Examine Image Enhancement in Frequency Domain
5. Apply various methods for segmenting image and identifying image components
6. Investigate morphological operations to improve the quality of image.

Unit I: Introduction to Image processing: Hours: 7

Fundamental steps in image processing, Components of image processing system, Pixels, coordinate conventions, Imaging Geometry, Spatial Domain, Frequency Domain, sampling and quantization, Basic relationship between pixels, Applications of Image Processing.

Unit II : Image transforms and its properties: Hours: 7

Unitary transform, Discrete Fourier Transform, Discrete Cosine Transform, Walsh Transform, Hadamard Transform.

Unit III: Image Enhancement in spatial domain: Hours: 7

Basic Gray Level Transformation functions – Image Negatives, Log Transformations, Power- Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching, Gray Level Slicing, Bit Plane Slicing, Histogram Processing–Equalization, Specification. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters, Ordered Statistic Filters, Sharpening: Laplacian, Unsharp Masking and High Boost Filtering.

Unit IV: Image Enhancement in Frequency Domain: Hours: 7

Basics of Filtering in Frequency Domain, Filters -Smoothing Frequency Domain Filters : Ideal Low Pass Filter, Gaussian Low Pass Filter, Butterworth Low Pass Filter, Sharpening Frequency Domain Filters: Ideal High Pass Filter, Gaussian High Pass Filter, Butterworth High Pass Filter, Homomorphic Filtering.

Unit V: Image Segmentation: Hours: 7

Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method, Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators, Line Detection, Corner Detection.

Unit VI: Morphological Operations: Hours: 7

Basics of Set Theory, Dilation and Erosion - Dilation, Erosion, Structuring Element, Opening and Closing, Hit or Miss Transformation. Representation and Description Representation - Boundary, Chain codes, Polygonal approximation approaches, Boundary segments.

Text Books:

1. A K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (English) 3rd Edition, Pearson India, 2013.

Reference Books:

1. Al Bovik, The Essential Guide to Image Processing, Academic Press, 2009.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, 2008.
3. S Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Procesing, McGraw Hill Education , 2009.

7KS05 OPTIMIZATION TECHNIQUES (L-3, T-0, C-3)

Course Prerequisite: Mathematics III

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Optimization Technique by being able to do each of the following:

- To familiarize with optimization techniques using both linear and non-linear programming.
- To study convex optimization though some techniques
- To gain understanding of linear algebra and probability theory

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe statement of an optimization problem
2. Examine linear programming procedures to solve optimization problems.
3. Compare different nonlinear programming methods of optimization
4. Discuss Geometric Programming with different constraint
5. Identify the appropriate optimization technique for the given problem
6. Synthesize algorithms to solve real time optimization problems.

Unit I: **Hours: 7**

Introduction to Optimization: Introduction, Historical Development, Engineering Applications of Optimization, Statement of an Optimization Problem, Classification of Optimization Problems, Classification Based on the Existence of Constraints.

Classical Optimization Techniques: Introduction, Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints, Multivariable Optimization with Inequality Constraints.

Unit II: **Hours: 7**

Linear Programming I: Simplex Method Introduction, Applications of Linear Programming, Standard Form of a Linear Programming Problem, Geometry of Linear Programming Problems, Definitions and Theorems, Solution of a System of Linear Simultaneous Equations, Pivotal Reduction of a General System of Equations, Motivation of the Simplex Method, Simplex Algorithm, Two Phases of the Simplex Method, Revised Simplex Method, Duality in Linear Programming, Decomposition Principle Sensitivity or Post optimality Analysis, Transportation Problem.

Unit III: **Hours: 7**

Nonlinear Programming: One-Dimensional Minimization Methods Unimodal Function, ELIMINATION METHODS: Unrestricted Search, Search with Fixed Step Size, Search with Accelerated Step Size, Exhaustive Search, Dichotomous Search, Interval Halving Method, Fibonacci Method, Golden Section Method, Comparison of Elimination Methods, INTERPOLATION METHODS, Quadratic Interpolation Method, Cubic Interpolation Method, Direct Root Methods, Newton Method, Quasi-Newton Method , Secant Method.

Unit IV: **Hours: 7**

Nonlinear Programming: Unconstrained Optimization Techniques Introduction, Classification of Unconstrained Minimization Methods, General Approach, Rate of Convergence, Scaling of Design Variables, DIRECT SEARCH METHODS Random Search Methods, Random Jumping Method, Random Walk Method, Random Walk Method with Direction Exploitation, Advantages of Random Search Methods, Grid Search Method, Univariate Method ,Pattern Directions, Powell's Method, Simplex Method, INDIRECT SEARCH (DESCENT) METHODS Gradient of a Function, Steepest Descent (Cauchy) Method, Conjugate Gradient (Fletcher–Reeves) Method, Newton's Method, Marquardt Method, Quasi-Newton Methods, Davidon–Fletcher–Powell Method, Broyden–Fletcher–Goldfarb–Shanno Method

Unit V: **Hours: 7**

Nonlinear Programming: Constrained Optimization Techniques Introduction, Characteristics of a Constrained Problem, DIRECT METHODS Random Search Methods, Complex Method, Sequential Linear Programming , Basic Approach in the Methods of Feasible Directions, Zoutendijk's Method of Feasible Directions, Rosen's Gradient Projection Method, Generalized Reduced Gradient Method, Sequential Quadratic Programming, INDIRECT METHODS Transformation Techniques, Basic Approach of the Penalty Function Method, Interior Penalty Function Method, Convex Programming Problem, Exterior Penalty Function Method, Extrapolation Techniques in the Interior Penalty Function Method, Extended Interior Penalty Function Methods

Unit VI: **Hours: 7**

Dynamic Programming Introduction, Multistage Decision Processes, Concept of Sub optimization and Principle of Optimality, Computational Procedure in Dynamic Programming, Conversion of a Final Value Problem into an Initial Value Problem, Linear Programming as a Case of Dynamic Programming, Continuous Dynamic Programming Stochastic Programming Introduction, Basic Concepts of Probability Theory, Stochastic Linear Programming, Stochastic Nonlinear Programming, Stochastic Geometric Programming.

Text Book: Engineering Optimization: Theory and Practice, Fourth Edition Singiresu S. Rao Copyright © 2009 by John Wiley & Sons, Inc.

Reference Books:

1. Mokhtar S. Bazaaraa, Hanif D. Shirali and M.C.Shetty, “Nonlinear Programming, Theory and Algorithms”, John Wiley & Sons, New York (2004).
2. Kwang Y. Lee, Mohamed A. El-Sharkawi, “Modern heuristic optimization techniques: theory and applications”, Kluwer (2008).
3. Hamdy A. Taha, “Operations Research: An Introduction”, 8th Edition, Pearson Education (2008).
4. G. V. Reklaitis, A. Ravindran, K. M. Ragsdell, “Engineering Optimization: Methods and Applications”, Wiley (2006).
5. Michael C. Bartholomew-Biggs, “Nonlinear optimization with engineering applications”, Springer (2008).

7KS06 COMPUTER GRAPHICS – LAB. (P-2, C-1)

Course Prerequisite: Knowledge of C or C++ Programming

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Computer Graphics Lab by being able to do each of the following:

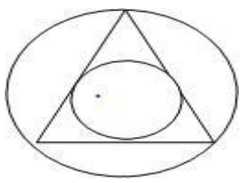
- To acquaint the learner with the basic concepts of Computer Graphics.
- To learn the various algorithms for generating and rendering graphical figures.
- To get familiar with mathematics behind the graphical transformations.
- To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting
- To prepare the student for advance areas like Image Processing or Computer Vision or Virtual Reality and professional avenues in the field of Computer Graphics.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe the basic concepts of Computer Graphics.
2. Demonstrate various algorithms for basic graphics primitives.
3. Apply 2-D geometric transformations on graphical objects.
4. Use various Clipping algorithms on graphical objects
5. Explore 3-D geometric transformations, curve representation techniques and projections methods
6. Explain visible surface detection techniques and Animation.

List of Experiments: This is the sample list of Experiments; **minimum 12 experiments** are to be performed covering the entire syllabus. At least two experiments should be beyond syllabi based on learning of syllabi (Apply)

1. Write a program to draw line using DDA algorithm.
2. Write a program to draw line using Bresenham‘s algorithm
3. Write a program to draw circle using Bresenham‘s algorithm
4. Write a program for 2-D transformations, a) Scaling b) Translation c) Rotation
5. Write a program for 3-D transformations, a) Scaling b) Translation c) Rotation
6. Write program to fill polygon using scan line algorithm
7. Write a program to draw the polygons by using the mouse. Choose colors by clicking on the designed color pane. Use window port to draw. Use DDA algorithm for line drawing.
8. Write a program to clip line using following algorithm : Cohen-Sutherland algorithm
9. Write a program to draw following type of curve-Hilbert’s Curve
10. Write a program to draw following type of curve-Koch curve, Bezier curves
11. Write a program to draw inscribed and Circumscribed circles in the triangle as shown as an example below. (Use any Circle drawing and Line drawing algorithms)



12. Write a program to move circle to forward direction.
13. Write a program to draw a cube using in build library function and perform 3D transformations
14. Write a program to fill color in rectangle
15. Write a program to generate Bouncing ball animation using Direct3D/Maya/Blender
16. Write a program to generate snowflake using concept of fractals.
17. Write a program to implement translation, sheer, rotation and scaling transformations on equilateral triangle and rhombus
18. Write program to draw any object such as flower, waves using any curve generation technique
19. Write a program of man walking in rain
20. Write a program to draw a house
21. Write a program for moving a cycle
22. Write a graphics program analog clock
23. Write a program to draw 3-D cube and perform following transformations on it using OpenGL.

7KS07 EMERGING TECHNOLOGY LAB III (P-2, C-1)

7KS07 Emerging Technology Lab III is based on 7KS04 Professional Elective-III. Tentative FOSS Tools & Technology for Practical's are as follows:

AI : ROS, YARP, MRPT, Gazebo, OROCOS.
DS :RapidMiner, Weka, Scrapy, Pandas
IoT :ThingsBoard, Kinoma, SiteWhere
Cyber Security: Security Onion, LastPass,KeePAss.

7KS08 EMERGING TECHNOLOGY LAB IV(P-2, C-1)

7KS08 Emerging Technology Lab IV is based on 7KS05 Professional Elective-IV. Tentative FOSS Tools & Technology for Practical's are as follows:

Blockchain: Ethereum,Bigchain DB, Corda
Image Processing:Open CV, SimpleCV, Keras, Caffe
Optimization :Open Eaagles, Repast, Open Simulator.

7KS09 PROJECT AND SEMINAR (P-8, C-4)

Seminar shall bebased on the advanced topic in thefield. It may be related to domain of the project. The seminar should be conducted in seventh semester andevaluated. Each candidate shall submit a seminar report, deliver the seminarand face the viva-voce. The distribution of internal 50 marks shall be asfollows.

1. Seminar report preparation and submission :- 10 marks
2. Seminar delivery/ presentation:- 20 marks
3. Seminar viva-voce:- 10 marks
4. Attendance in all seminar sessions:- 10 marks.

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SEMESTER EIGHTH

8KS01 OBJECT ORIENTED ANALYSIS AND DESIGN (L-3, T-0, C-3)

Course Prerequisite: Data Structures and algorithms, Basic Mathematics, Geometry, linear algebra, vectors and matrices

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Object-Oriented Analysis and Design by being able to do each of the following:

- To learn the basic concepts of Object-Oriented Analysis and Design, UML, Software Development Processes and Design pattern.
- To study requirement analysis in the Inception phase of software development and relate
- To present Object Oriented Analysis and Design through case studies.
- To introduce design patterns that can be used for development of object-oriented software systems.
- To study UML notation and frequently used UML diagrams for designing Object Oriented software.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Object Oriented principles, for performing object-oriented analysis and design.
2. Explain the basic concepts of UML, Software Development Processes and Design pattern.
3. Illustrate requirements for developing a software.
4. Create initial domain model & system sequence diagram for use case scenario.
5. Design static and dynamic objects for modeling.
6. Construct UML and Design Patterns for developing object-oriented software.

Unit I: **Hours: 07**

Introduction to Object Oriented Analysis and Design: Analysis and Design, Object-Oriented Analysis and Design; UML, Iterative, Evolutionary and Agile: UP, Iterative and Evolutionary Development, Waterfall Lifecycle, Iterative and Evolutionary Analysis and Design, Risk-Driven and Client-Driven Iterative Planning, Agile Methods and Attitudes, Agile Modeling, Agile UP, UP Phases, UP Disciplines.

Unit II: **Hours:07**

Defining Inception: Inception, Artifacts Start in Inception, Evolutionary requirements: Requirements, Evolutionary vs. Waterfall Requirements, Types and Categories of Requirements, Requirements Organized in UP Artifacts
Use cases: Actors, Scenarios and Use Case, Use Cases and the Use-Case Model, Importance of Use Cases, Three Kinds of Actors, Three Common Use Case Format, Sections Mean, Take an Actor and Actor- goal perspective, Use Case Diagrams, Activity Diagrams

Unit III: **Hours:07**

Domain Models: Domain Model, Need of Create a Domain Model, create a Domain Model, Conceptual Classes, Sketching a Class Diagram, Common Mistake with Attributes vs. Classes, Associations, Attributes.
System Sequence Diagrams: System Sequence Diagrams, Need of SSD, Relationship between SSDs and Use Cases, Naming System Events and Operations, Model SSDs Involving Other External Systems, Process: Iterative and Evolutionary SSDs, Operation Contracts

Unit IV: **Hours:07**

Logical Architecture and UML Package Diagrams: Logical Architecture, Layers, Software Architecture, UML Package Diagrams, Design with Layers, Benefits of Using Layers
On to Object Design: Designing Objects: Static and Dynamic Modeling, The Importance of Object Design Skill over UML Notation Skill
UML Interaction Diagrams: Sequence and Communication Diagrams, Common UML Interaction Diagram Notation, Basic Sequence Diagram Notation, Basic Communication Diagram Notation.
UML Class Diagram: Common Class Diagram Notation, Design Class Diagram, Attribute Text and Association Lines, Notes, Comments, Constrains and Method Bodies, Operations and Methods, Keywords, Stereotypes, Profiles and Tags

Unit V: **Hours:07**

GRASP: Designing Objects with Responsibilities: Object Design: Example Inputs, Activities and Outputs, Responsibilities and Responsibility-Driven Design, GRASP: A Methodological Approach to Basic OO Design, the Connection between Responsibilities, GRASP and UML Diagrams, Patterns, A Short Example of Object Design with GRASP Designing for Visibility: Visibility between Objects Mapping Designs to Code: Creating Class Definitions from DCDs, Creating Methods from Interaction Diagrams, Collection Classes in Code

Unit VI: **Hours:07**

Applying GoF Design Patterns: Adapter(GoF), Factory, Singleton(GoF), Strategy (GoF), Composite (GoF) and Other Design Principles, Façade (GoF), Observer (GoF).

UML State Machine Diagrams and Modeling: Event, State and Transition, Apply State Machine Diagrams, More UML State Machine Diagram Notation, State Machine Diagrams in UP.

Relating Use Cases: The include Relationship, The extend Relationship, The Generalize Relationship, Use Case Diagrams.

Text Books:

1. Craig Larman: ”Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development, Third Edition, Addison Wesley Professional.
2. Erich Gamma et al., Design Patterns, Elements of Reusable OO Software, Addison-Wesley.

Reference Books:

1. Blaha, Rumbaugh: “Object Oriented Modeling and Design with UML” (2/e) Pearson Education.
2. Arlow, Jim, “UML and the Unified Process”, Pearson Education.
3. Dathan, Ramnath: “Object Oriented Analysis, Design & Implementation, ”OUP.
4. McRobb& Farmer: “Object Oriented System Analysis & Design” Mc Graw Hill.
5. Booch, Rumbaugh & Jacobson: “ The UML User guide” Pearson Education.
6. Whitten & Bentley: “System Analysis & Design Methods” Tata McGraw Hill.
7. Booch: “Object Oriented Analysis & Design with Applications”, Pearson Education.

8KS02 PROFESSIONAL ETHICS AND MANAGEMENT (L-3, T-0, C-3)

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Professional Ethics and Management by being able to do each of the following:

- To enable the students to create an awareness of engineering and professional ethics
- To instill moral, social values and appreciate the rights of others
- To regulate the student's behavior in a professional environment
- To conscious about the impact of non-ethical engineering decisions
- To comprehend 'mind and desire control' needs for being ethical

Course Outcomes (Expected Outcomes): On completion of the course, the students will be able to:

1. Relate ethical and non-ethical situations
2. Outline ethics in the society & environment
3. Examine the moral judgment & correlate the concepts in addressing the ethical dilemmas
4. Identify risk and safety measures in various engineering fields
5. Justify ethical issues related to engineering responsibilities and rights
6. Synthesize cognitive skills in solving social problems

Unit I: Introduction to Ethics **Hours: 07**

Senses of Engineering and professional ethics, Engineering profession & its view, Ethical issues for engineers, distinction between ethics, morals and laws, opinions vs. judgments, Ethical theories: utilitarianism, duty, right, virtue; Cost-benefit analysis in engineering, McCuen's ethical dimensions, IEEE: Code of conducts & Code of ethics

Unit II: Professional Practices in Engineering **Hours: 07**

Professional attributes, Difference in engineering and other professions; Ethical dilemma: right-wrong or better-worse; Code of ethics for engineers in India: need and its roles; abuse of codes, ethical relativism, well-being and profession, Ethics as Design - Doing Justice to Moral Problems, Kohlberg's theory – Gilligan's theory.

Unit III: Central Professional Responsibilities of Engineers **Hours: 07**

Confidentiality and Proprietary Information, Conflict of interest, Competitive bidding, rights of Engineers: fundamental, professional conscience, conscientious refusal, professional recognition, employee, privacy; types of conflict of interest, avoiding conflict of interest, competitive bidding, situations for conflict of interest, ethical corporate climate & its features.

Unit IV: Intellectual Property Rights and Ethics **Hours: 07**

Patent: IP chain of activities, IP as intangible property, protection offered by patent, right of patent owner; Trademarks (TM): purpose, what can be registered under trademark, categories of TM, industrial design, geographical indications; Copyright & related rights: advances in technology and copyright, benefits, World IP organization, TRIPS & WTO.

Unit V: Computers, Software and Digital Information **Hours: 07**

Emergence of Computer ethics, issues in Computer ethics: distribution of power issues, property issues, issues of privacy, professional issues, Computer crimes, Computer Software and Digital Information: Characteristics of digital information, s/w as IP, and challenges in information age, IEEE code of conduct and code of ethics.

Unit VI: Responsibilities and Management **Hours: 07**

Responsibility for the Environment, Engineering as Social Experimentation, Safety and Risk management, IT Professional relationship management with: Employers, Clients, Suppliers, IT Users, other professionals, and society at large.

Text Books:

1. Prof. Susmita Mukhopadhyay, 'Ethics in Engineering Practice' IIT Kharagpur
2. Mike Martin and Roland Schinzinger, 'Ethics in Engineering', Tata McGraw Hill, New York, 2005

Reference Books:

1. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, 'Engineering Ethics – Conceptsand Cases', Cengage Learning, 2009 & Thompson Learning, 2000
2. Govindarajan M., Natarajan,'Engineering Ethics', Prentice Hall of India, New Delhi, 2004
3. Stephen Byars, 'Business Ethics', USC Marshal School of Business Kurt Stanberry, University of Houston (https://openstax.org/details/books/business-ethics

8KS03 VIRTUAL AND AUGMENTED REALITY (L-3, T- 0, C-3)

Course Prerequisite: Basics of Computers & Multimedia

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Virtual and Augmented Reality by being able to do each of the following:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications
- To know the intricacies of these platform to develop PDA applications with better optimality

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe Virtual reality & its applications.
2. Discuss virtual reality world and types.
3. Examine geometry of virtual world and the physiology of human vision
4. Investigate Visual Perception, Motion and Tracking
5. Inspect Physics of Sound and the Physiology of Human Hearing.
6. Explain Augmented reality & examples based on Augmented reality

Unit I: **Hours: 07**

Introduction to Virtual Reality: Defining Virtual Reality, History ofVR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output-Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Unit II: **Hours: 07**

Representing the Virtual World: Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR

Unit III: **Hours: 07**

The Geometry of Virtual Worlds &The Physiology of Human Vision: Geometric Models, Changing Position and Orientation, Axis- Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.

Unit IV: **Hours: 07**

Visual Perception, Motion & Tracking: Visual Perception -Perception of Depth, Motion, & Color, Ray Motion in Real and Virtual Worlds- Velocities and Accelerations, Tracking 2D & 3D Orientation, Tracking Position and Orientation.

Unit V: **Hours:07**

Interaction & Audio: Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Unit VI: **Hours: 07**

Basics of Augmented Reality: Introduction to Augmented Reality , Examples based on Augmented reality , Mixed Reality Continuum ,Computer Vision for Augmented Reality , Confluence of Virtual Reality and Augmented Reality , Requirements of AR Authoring ,Taking AR Outdoors.

Text Books:

1. M. LaValle, “Virtual Reality, Steven”, Cambridge University Press, 2016.
2. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575

Reference Books:

1. William R Sherman and Alan B Craig, "Understanding Virtual Reality", Interface, Application and Design, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
2. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2004
3. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Inter science, India, 2008
4. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
5. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
6. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
7. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Merging Real and Virtual Worlds", 2005
8. Jason Jerald - The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan and Claypool, New York, NY, USA.
9. Dieter Schmalstieg and Tobias Hollerer - Augmented Reality: Principles and Practice (Usability), Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016.
    1. 8. Steve Aukstakalnis - Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability), Addison-Wesley Professional; 1st edition, 2016.
10. Robert Scoble and Shel Israel - The Fourth Transformation: How Augmented Reality and Artificial Intelligence Will Change Everything, Patrick Brewster Press; 1st edition, 2016.
11. Tony Parisi - Learning Virtual Reality: Developing Immersive Experiences and Applications forDesktop, Web, and Mobile, OReilly Media; 1st edition, 2015.
12. Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, OReilly Media; 1st edition, 2014.
13. John Vince - Virtual Reality Systems, Addison Wesley, 1995.
14. Howard Rheingold - Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society, Simon and Schuster, 1991.

Supplementary Resources:

1. http://lavalle.pl/vr/book.html

Mapped with MOOCS/other Courses:

1. https://nptel.ac.in/courses/106/106/106106138/
2. https://nptel.ac.in/courses/106105195/13
3. https://www.coursera.org/learn/introduction-virtual-reality.

8KS03 MACHINE LEARNING AND AI (L-3, T-0, C-3)

Course Prerequisite: Basic Mathematics, Linear algebra, Vectors and matrices, Data Science & Statistics

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Machine Learning and AI by being able to do each of the following:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques
- To understand neural network

1. Describe Machine learning and its types.
2. Discuss Bayesian Decision Theory and Parametric Methods
3. Illustrate Multivariate and Dimensionality Reduction methods.
4. Categorize Non-Parametric methods
5. Justify discrimination techniques in Machine learning
6. Synthesize Neural network using Multilayer Perceptron

Unit I: **Hours:07**

Introduction: What Is Machine Learning Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning

Supervised Learning: Learning a Class from Examples, Vapnik-Chervonenk is Dimension, Probably Approximately Correct Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm.

Unit II: **Hours:07**

Bayesian Decision Theory: Introduction, Classification, Losses and Risks, Discriminant Functions, Association Rules

Parametric Methods: Introduction, Maximum Likelihood Estimation, Bernoulli Density, Multinomial Density Gaussian (Normal) Density, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator , Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma, Model Selection Procedures

Unit III: **Hours:07**

Multivariate Methods: Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity, Discrete Features, Multivariate Regression Dimensionality Reduction: Introduction, Subset Selection, Principal Component Analysis, Feature Embedding, Factor Analysis, Singular Value Decomposition and Matrix Factorization, Multidimensional Scaling, Linear Discriminant Analysis, Canonical Correlation Analysis

Unit IV: **Hours:07**

Clustering: Introduction, Mixture Densities,k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Spectral Clustering, Hierarchical Clustering, Choosing the Number of Clusters

Nonparametric Methods: Introduction, Nonparametric Density Estimation, Histogram Estimator, Kernel Estimator, k-Nearest Neighbor Estimator, Generalization to Multivariate Data, Nonparametric Classification, Condensed Nearest Neighbor, Distance-Based Classification, Outlier Detection

Unit V: **Hours:07**

Decision Trees: Introduction, Univariate Trees, Classification Trees, Regression Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees.

Linear Discrimination: Introduction, Generalizing the Linear Model, Geometry of the Linear Discriminant: Two Classes, Multiple Classes; Pairwise Separation, Parametric Discrimination Revisited, Gradient Descent, Logistic Discrimination: Two Classes, Multiple Classes; Discrimination by Regression.

Unit VI: **Hours:07**

Multilayer Perceptrons : Introduction: Understanding the Brain, Neural Networks as a Paradigm for Parallel Processing; The Perceptron, Training a Perceptron, Learning Boolean Functions, Multilayer Perceptrons, MLP as a Universal Approximator, Back propagation Algorithm: Nonlinear Regression, Two-Class Discrimination, Multiclass Discrimination, Multiple Hidden Layers

Text Book:

EthemAlpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and MachineLearning Series), Third Edition, MIT Press, 2014

Reference Books:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013.
3. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data‖, First Edition, Cambridge University Press, 2012.

8KS03 WIRELESS SENSOR NETWORKS (L-3, T-0, C-3)

Course Prerequisite: Computer Networks, Internet of Things, Sensors and Actuators

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Wireless Sensor Network by being able to do each of the following:

- To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios.
- To study the various protocols at various layers and its differences with traditional protocols.
- To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

1. Describe Network of Wireless Sensor Nodes
2. Explain Node Architecture and Physical Layer.
3. Discuss Medium Access Control and its related properties.
4. Analyze the protocols and algorithms used at different network protocollayers in sensor systems.
5. Compare different power management techniques and clocks and the Synchronization problems.
6. Explain time synchronization and its problems.

Unit I: **Hours:07**

Network of Wireless Sensor Nodes- Definitions and Background, Sensing and Sensors, Wireless Sensor Networks, Challenges and Constraints, Energy, Self-Management, Wireless Networking, Decentralized Management, Design Constraints, Security, Other Challenges. Applications: Structural Health Monitoring, Traffic Control, Health Care, Pipeline Monitoring, Precision Agriculture, Active Volcano, Underground Mining.

Unit II: **Hours:07**

Node Architecture: The Sensing Subsystem, The Processor Subsystem, Communication Interfaces, Prototypes. Physical Layer: Basic Components, Source Encoding, Channel Encoding, Modulation, Signal Propagation.

Unit III: **Hours:07**

Medium Access Control: Contention-Free Medium Access, Contention-Based Medium Access, Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols.

Unit IV: **Hours:07**

Network Layer: Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols.

Unit V: **Hours:07**

Power Management: Local Power Management Aspects, Dynamic Power Management, Conceptual Architecture. Time Synchronization: Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization, Time Synchronization Protocols.

Unit VI: **Hours:07**

Localization: Ranging Techniques, Range-Based Localization, Range-Free Localization, Event-Driven Localization. Security: Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and Zig Bee Security.

Text Book:

Fundamentals of Wireless Sensor Networks: Theory and Practice / Waltenegus Dargie, Christian Poellabauer, 2010 John Wiley & Sons Ltd.

Reference Books:

1. .Wireless sensor networks: technology, protocols, and applications by Kazem Sohraby, Daniel Minoli, TaiebZnati, Copyright _ 2007 by John Wiley & Sons, Inc.
2. Wireless Sensor Network Designs by Anna Hac, John Wiley & Sons Ltd.
3. Wireless Sensor Networks by Ian F. Akyildiz, Mehmet Can Vuran, 2010 John Wiley & Sons Ltd.
4. Wireless Sensor Networks: An Information Processing Approach by Feng Zhao, Leonidas J. Guibas, The Morgan Kaufmann Series in Networking.

8KS03 SYSTEM & SOFTWARE SECURITY (L-3, T-0, C-3)

Course Prerequisite: Networking, Operating System, Basics of Cyber Security & Cryptography

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of System and Software Security by being able to do each of the following:

- To provide an in-depth study of concepts and threats in computer security.
- To provide knowledge of common vulnerabilities, attack mechanisms and methods against computer and information system
- To familiarize security issues at various levels such as operating systems and databases.
- To provide the study of vulnerability issues and its counter measures at advanced application such as networks and Clouds

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Relate malicious and non-malicious attacks.
2. Outline web common vulnerabilities, attack mechanisms and methods against computer and information systems.
3. Apply relevant methods for security modeling and analysis of Operating System.
4. Investigate a secure network by monitoring and analyzing the nature of attacks.
5. Explain cryptography, intrusion detection and firewall system
6. Implement different security solutions at various levels such as operating systems, databases and clouds.

Unit I: **Hours:07**

Programs and Programming: Unintentional (Non malicious) Programming: Buffer Overflow, Incomplete Mediation, Time-of-Check to Time-of Use, Undocumented Access Point, Off-by-One Error, Integer Overflow, Un-terminated Null-Terminated String, Parameter Length, Type and Number, Unsafe Utility Program, Race Condition. Malicious Code: Malware: Viruses, Trojan Horses, and Worms, Technical Details: Malicious Code. Countermeasures: Countermeasures for Users, Countermeasures for Developers, Countermeasure Specifically for Security, Countermeasures that Don't Work.

Unit II: **Hours:07**

The Web: Browser Attacks: Browser Attack Types, How Browser Attacks Succeed: Failed Identification and Authentication. Web Attacks Targeting Users: False or Misleading Content, Malicious Web Content, Protecting Against Malicious Web Pages. Obtaining User or Website Data: Code Within Data, Website Data: A User's Problem, Too Foiling Data Attacks. Email Attacks: Fake Email, Fake Email Messages as Spam, Fake (Inaccurate) Email Header Data, Phishing, Protecting Against Email Attacks.

Unit III: **Hours 7**

Operating System: Security in Operating Systems: Operating System Structure, Security Features of Ordinary Operating Systems, Protected Objects, Operating System Tools to Implement Security Functions. Security in the Design of Operating Systems: Simplicity of Design, Layered Design, Kernelized Design, Reference Monitor, Correctness and Completeness, Secure Design Principles, Trusted Systems, Trusted System Functions, The Results of Trusted Systems Research Rootkit: Phone Rootkit, Rootkit Evades Detection, Rootkit Operates Unchecked, Sony XCP Rootkit, TDSS Rootkits, Other Rootkits.

Unit IV: **Hours:07**

Networks: Network Concepts, Threats to Network Communications: Interception: Eavesdropping and Wiretapping, Modification, Fabrication: Data Corruption Interruption: Loss of Service, Port Scanning, Vulnerability. Wireless Network Security: Vulnerabilities in Wireless Networks, Failed Countermeasure: WEP (Wired Equivalent Privacy), Stronger Protocol Suite: WPA (Wi-Fi Protected Access) Denial of Service: Network Flooding Caused by Malicious Code, Network Flooding by Resource Exhaustion, Denial of Service by Addressing Failures, Traffic Redirection, DNS Attacks, Exploiting Known Vulnerabilities, Physical Disconnection. Distributed Denial-of-Service: Scripted Denial-of-Service Attacks, Bots, Botnets, Malicious Autonomous Mobile Agents, Autonomous Mobile Protective Agents.

Unit V: **Hours:7**

Cryptography in Network Security Browser Encryption, Onion Routing, IP Security Protocol Suite (IPsec), Virtual Private Networks, System Architecture. Firewalls: Firewall, Design of Firewalls, Types of Firewalls, Personal Firewalls Comparison of Firewall Types, Example Firewall Configurations. Intrusion Detection and Prevention Systems: Types of IDSs, Other Intrusion Detection Technology, Intrusion Prevention Systems, Intrusion Response, Goals for Intrusion Detection Systems, IDS Strengths and Limitations.

Unit VI: **Hours:07**

Database: Security Requirements of Databases: Integrity of the Database, Element Integrity, Auditability, Access Control, User Authentication, Availability, Integrity / Confidentiality/Availability. Reliability and Integrity: Protection Features from the Operating System, Two-Phase Update Redundancy/Internal Consistency, Recovery, Concurrency/Consistency. Database Disclosure: Sensitive Data, Types of Disclosures, Preventing Disclosure: Data Suppression and Modification, Security Versus Precision Data Mining and Big Data: Data Mining, Big Data. Cloud Computing: Cloud Computing Concepts: Service Models, Deployment Models. Risk Analysis: Cloud Provider Assessment, Switching Cloud Providers, Cloud as a Security Control. Cloud Security Tools and Techniques: Data Protection in the Cloud, Cloud Application Security, Logging and Incident Response. Cloud Identity Management: Security Assertion Markup Language OAuth: OAuth for Authentication. Securing IaaS: Public IaaS Versus Private Network Security

Text Book:

Security in Computing, Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Fifth Edition, Prentice Hall, 2015

Reference Books:

1. Computer Security: Principles and Practice, William Stallings and Lawrie Brown, Third Edition, Pearson Prentice Hall
2. Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing Achyut S. Godbole,Tata Mc Graw-Hill Education, 2013
3. Cryptography and Network Security Principles and Practices, William Stallings, Seventh Edition, Pearson
4. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

8KS04 DISTRIBUTED LEDGER TECHNOLOGY (L-3, T-0, C-3)

Course Prerequisite: Data structures and Algorithms, Design and Analysis of Algorithms, Discrete Mathematics and basic knowledge of Cryptography

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Distributed Ledger Technology by being able to do each of the following:

- To develop an understanding of the requirements for electronic payment systems
- To understand key cryptographic constructs, economic incentive mechanisms and distributed algorithms underpinning crypto currencies such as Bitcoin and Ethereum
- To develop a basic facility with programming smart contracts on one crypto currency platform.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe basic knowledge of Distributed Ledger Technologies
2. Outline Analytical Framework for Distributed ledger technology
3. Use Cryptographic method for ledgers.
4. Explain knowledge of Bitcoin
5. Inspect Bitcoin cryptocurrency mechanisms
6. Synthesize bitcoin mining process. **Hours:07**

Unit I:

Distributed ledger technology: Introduction, Background, Technical design elements, Institutional design elements: Operation of the arrangement, Access to the arrangement (unrestricted or restricted)

Unit II: **Hours:07**

Analytical framework: Understanding the arrangement, Potential implications for efficiency, Potential implications for safety, Potential broader financial market implications

Unit III: **Hours:07**

Introduction to Cryptography & Cryptocurrencies: Cryptographic Hash Functions, SHA-256, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency

Unit IV: **Hours:07**

Bitcoin: Centralization vs. Decentralization, Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work

Unit V: **Hours:07**

Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, Bitcoin network. How to Store and Use Bitcoins, Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets

Unit VI: **Hours:07**

Bitcoin Mining: The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies.

Text Book:

Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction: Andrew Miller, Arvind Narayanan, Edward Felten, Joseph Bonneau, and Steven Goldfeder. Princeton University.

Reference Books:

1. Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition
2. Distributed ledger technology in payment, clearing and settlement - An analytical framework
3. Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts.

8KS04 MULTIMEDIA COMPUTING (L-3, T-0, C-3)

Course Prerequisite: Computer Network, Image Processing

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Multimedia Computing by being able to do each of the following:

- To learn and understand technical aspect of Multimedia Computing.
- To understand the standards available for different audio video and text applications.
- To Design and develop various Multimedia Systems applicable in real time.
- To learn various multimedia compression algorithms.
- To understand various networking aspects used for multimedia applications.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe technical aspect of Multimedia Computing.
2. Compare various file formats for audio, video and text media.
3. Examine lossless data compression techniques in real time.
4. Illustrate lossy data compression techniques in real time scenario
5. Investigate video compression technique
6. Construct various networking protocols for multimedia applications.

Unit I: Introduction **Hours:07**

Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

Unit II : Video and Digital Audio **Hours:07**

Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

Unit III: Data Compression-I **Hours:07**

Multimedia data compression I: Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression.

Unit IV: Data Compression-II **Hours:07**

Multimedia data compression II: Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

Unit V: Video Compression **Hours:07**

Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.

Unit VI: Multimedia Networks **Hours:07**

Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand (MOD).

Text Book: 'Fundamentals of Multimedia' by Ze-Nian Li and Mark S. Drew Pearson Education.

Reference Books:

1. Digital Multimedia, Nigel chapman and jenny chapman, Wiley-Dreamtech
2. Macromedia Flash MX Professional 2004 Unleashed, Pearson.
3. Multimedia and communications Technology, Steve Heath, Elsevier (Focal Press).
4. Multimedia Applications, Steinmetz, Nahrstedt, Springer.
5. Multimedia Technology and Applications, David Hilman ,Galgotia.

8KS04 MODELLING & SIMULATION(L-3, T-0, C-3)

Course Prerequisite: Familiarity with Linear Algebra, Probability and Statistics, Discrete structures, graph theory, Object-oriented design and programming.

Course Objectives: Throughout the course, students will be expected to demonstrate their understanding of Modelling & Simulation by being able to do each of the following:

- To understand the basic concepts in modeling and simulation
- To introduce the simulation and modeling techniques
- To introduce basic simulation and modeling skills with respect to carrying out research projects using any simulation method on the computer.

Course Outcomes (Expected Outcome): On completion of the course, the students will be able to:

1. Describe System models & system modelling.
2. Explain continuous system methods of obtaining solutions.
3. Illustrate the need of simulation and mathematical modeling
4. Examine simulation of Queuing System and PERT network.
5. Inspect experimentation of Simulation.
6. List different special purpose languages use for continuous and discrete systems

Unit I: **Hours:7**

System Models and System studies: Basic concepts of systems and system modeling static and dynamic/physical and mathematical models-principles used in modeling-corporate models-analysis, design and postulation of system.

Unit II: **Hours:7**

Basic Concepts and continuous system: Techniques used - distributed lag models and cobweb models continuous system Model-Analytical equations &methods of obtaining solutions–analog and hybrid computers and simulations CSSLS examples of different continuous system.

Unit III: **Hours:7**

System dynamics, probability concepts and basic principles of discrete simulation Growth and decay models system dynamics diagrams examples - stochastic process-probability functions and their evaluation –random number generation-rejection method-comparison of Monte-Carlo method and stochastic simulation – examples

Unit IV: **Hours:7**

Simulation of Queuing system and PERT Network, Simulation of Queuing system: Rudiments of queuing theory, simulation of a single serve queue, simulation of a two-server queue, simulation of more general queues, Simulation of a PERT Network: Network model of a project, Analysis of an activity network, critical path.

Unit V: **Hours:7**

Simulation of Inventory Control & Forecasting Design and Evaluation of Simulation Experiments Inventory Control and Forecasting, Elements of inventory theory, more Complex inventory models simulation example= 1 Generation of Poisson and Erlanger variates, Simulation example-2 Forecasting and regression Analysis. Design and Evaluation of simulation Experiments: Length of Simulation runs, Variance reduction techniques, Experimental layout, Validation summary and conclusion.

Unit VI: **Hours:7**

Simulation of Languages and Introduction to GPSS, Different special purpose languages use for continuous and discrete systems and comparison, factors affecting the selection of discrete system simulation languages-comparison of GPSS sans SIMSCRIPT.A detailed study of GPSS with examples.

Text Books:

1. Geoffrey Gordon, System Simulation, PHI Learning/Pearson.
2. Narsingh Deo, System Simulation with Digital Computer, PHI Learning/Pearson.

Reference Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, P. Shahabudeen, Discrete-Event System Simulation, Fourth Edition, Pearson Publication.
2. Sheldon Ross, Simulation , Academic Press.
3. Law & Kelton, Simulation Modeling & Analysis, Tata McGraw Hill
4. Kai Velten, Mathematical Modeling and Simulation: Introduction for Scientists and Engineers, Wiley.
5. Shannon, R.E. Systems simulation, The art and science, Prentice Hall, 1975.
6. Thomas J. Schriber, Simulation using GPSS, John Wiley, 1991.

8KS05 EMERGING TECHNOLOGY LAB V (P-2, C-1)

8KS05 Emerging Technology Lab V is based on 8KS03 Professional Elective-V. Tentative FOSS Tools & Technology for Practical's are as follows:

AI :Google's ARCore, AR.js, ARToolKit, DroidAR, Brio, Adobe Aero
DS :R Studio, Orange, D3.js, Ggplot2, Jupyter Notebooks
IoT :DSA,Thinger,RIOT, OpenRemote,Anjay
Cyber Security: Wireshark, Burp Suit, Nessus.

8KS06 EMERGING TECHNOLOGY LAB VI (P-2, C-1)

8KS06 Emerging Technology Lab V is based on 8KS04 Professional Elective-VI. Tentative FOSS Tools & Technology for Practical's are as follows:

Blockchain: Hyperledger, HydraChain, MultiChain, Elements
Image Processing:Google Colab, GPUImage, Cuda, Aforge/Accord.NET
Optimization: OR-Tools, Locust.io, httperf, Apache JMeter, Siege.

8KS07 PROJECT & SEMINAR (P-12, C-6)

The student batch size for project may be preferably 04. The project shall be internally evaluated (for 75 Internal Marks) inthree phases based on theprogress of the project work. Each phase shallbe internally evaluated for 25 marks as follows:
Phase I: - Problem Definition and Design
Phase II: - Problem Implementation and Testing
Phase III: - Project Demonstration & Report submission.
The external evaluation of the project shall be based ondemonstration of the project and viva-voce.

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