SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE701T	Compiler Construction	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended to ● Understand the fundamental theories behind compiler design ● Develop practical skills in implementing compiler phases using standard tools and languages ● Enhance compiler performance through systematic evaluation and optimization techniques	**Students will be able to** ● Understand how programs are translated and interpreted in software development ● Explore various phases of compiler for efficient programming. ● Discover how intermediate steps help simplify complex programming tasks ● Apply core computer science ideas like data structures and algorithms practically ● Acquire practical programming skills necessary for constructing a compiler

Unit I **[08 Hrs]**

Introduction to Compiling and Lexical Analysis: Definition, Analysis of the source program, Phases of a compiler, Grouping of phases, Compiler Construction tools, A simple one-pass compiler, The role of the Lexical analyzer, Input buffering, Specification of Tokens, A Language for Specifying Lexical Analyzers

Unit II **[12 Hrs]**

Syntax Analysis: Role of the parser, Grammars, Context-Free Grammars, Top Down parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up parsing, Shift Reduce Parsing, Operator Precedent Parsing, LR Parsers, SLR Parser, Canonical LR Parser, LALR Parser ,YACC

Unit III **[10 Hrs]**

Intermediate Code Generation: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

Unit IV **[08 Hrs]**

Code Generation: Issues in the Design of a Code Generator, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, Simple Code Generator, Register allocation and Assignment, DAG Representation of Basic Blocks, Generating Code from DAGs, Code-Generation Algorithm, Code-Generators.

Unit V **[06 Hrs]**

Code Optimization: Principal Sources of Optimization, Peep-hole optimization, Optimization of Basic Blocks, Global Data Flow Analysis, Efficient Data Flow Algorithm.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Compilers: Principles, Techniques, and Tools	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman	Second	Addison-Wesley
2	Engineering a Compiler	Keith D. Cooper	Second	Morgan Kaufmann

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Compiler Writing	Paul G. Sorenson	-	McGraw-Hill Publication
2	Theory and Practice of Compiler Writing	Jean Paul Tremblay, Paul Gordon Sorenson	-	BS Publications
3	Writing Compilers and Interpreters: A Software Engineering Approach	Ronald Mak	Third	Wiley Publication

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE701P	Compiler Construction Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended to ● Understand the fundamental theories behind compiler design ● Develop practical skills in implementing compiler phases using standard tools and languages ● Enhance compiler performance through systematic evaluation and optimization techniques	**Students will be able to** ● Design simple lexical analyzers ● Implement predictive parsing techniques and parsing tables ● Apply LEX and YACC tools ● Perform semantic analysis and generate intermediate representations ● Analyze and apply various code optimization techniques

Experiment No	Title of the Experiment
1	Validation of language character set
2	Tokenizing a file using C - programs to recognize various strings given in the form of regular expression
3	Lexical Analyzer for a given Language (Lex Tool)
4	Implement functions to find FIRST and FOLLOW of all the variables
5	Implement predictive parsing algorithms
6	Syntax Analyzer for a given Language.(YACC Tool)

Text Books

S.N	Title	Authors	Edition	Publisher
1	Compilers: Principles, Techniques, and Tools	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman	Second	Addison-Wesley
2	Lex and Yacc	John R Levine, Tony Mason, Doug Brown	Second	O'Reilly

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE702T(i)	Professional Elective – IV IOT & Its Applications	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended ● To study architecture of IoT. ● To learn the concept of Machine to Machine to IoT. ● To understand the concept of IoT Connectivity technologies.	**Students will be able to** ● Understand the concept of Internet of things with architecture ● Remember the application of Internet of things. ● Differentiate the connectivity technologies. ● Explain IoT processing technologies with Data formats. ● Analyze the Precursor Technologies for different application.

Unit I **[9 Hrs]**

Internet of Things – Precedence of IoT-Wireless Sensor Network, Machine-2-Machine. Evolution of IoT-IoT vs M2M, IoT vs WoT. IoT networking Components, Addressing Strategies in IoT -Address management class, Addressing During Node mobility. OSI Model.

Unit II **[9 Hrs]**

Introduction to Internet of Things (IoT): Definition, Characteristic of IoT, Architecture, Vision, Trend in Adaptation of IoT, Technical Building block. Physical Design of IoT: Interoperability of IoT Devices, Sensor and Actuators, Need of analog/ Digital Conversion. Logical Design of IoT: IoT functional block, Iot Enabling technologies, IoT level and Development template, Application in IoT.

Unit III **[9 Hrs]**

Machine-to-machine to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit IV **[9 Hrs]**

IoT Processing Technologies: Data Format – Structured data, Unstructured Data, Importance of Processing in IoT, Processing Topologies-On-site, Off-site. IoT Device Design and Selection Consideration. IoT Connectivity Technologies- IEEE 802.15.4, Zigbee, LoRa, Wi-Fi, Bluetooth. IOT Data and BigData, Challenges of IOT analytics applications, cloud based IOT platform, IaaS, PaaS and SaaS paradigms, Requirements of IOT BigData Analytics, Function.

Unit V **[9 Hrs]**

IoT Communication Technologies- Constrained nodes, Constrained networks, Types of Constrained Devices, Low Power and lossy networks. Infrastructure Protocol – Ipv7, LOADng, RPL, QUIC, NanoP, CCN. Data Protocol – MQTT, MQTT-SN, CoAP. Agricultural IoT, Vehicular IoT and Healthcare IoT.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to IOT	Sudip Misra, Anandarup, Arjit Roy		Cambridge University Press
2	Building blocks for IOT Analytics	John Soldatos		River Publishers

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Getting Started with the Internet of Things	Cuno Pfister	1st	Shroff
2	Internet of Things	Jeeva Jose	1st	Khanna Book Publishing
3	Internet of Things	Shriram K Vasudevan, Abhishek S Nagarajan,RMD Sundaram	2nd	Wiley

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE702T(ii)	Professional Elective-IV Fundamentals of Virtual and Augmented Reality	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended to ● Learn the fundamental Computer Vision, Computer Graphics and Human-Computer interaction Techniques related to VR/AR ● Review the Virtual Environment ● Use of various types of Hardware and Software in Virtual Reality systems ● Simulate and Apply Virtual/Augmented Reality to varieties of Applications	**Students will be able to** ● Understand Fundamental of Computer Vision, Computer Graphics Techniques and applications of VR/AR. ● Understand Geometric Modeling Techniques ● Understand The Virtual Environment ● Analyze And Evaluate VR/AR Technologies ● Apply Various Types Of Hardware And Software In Virtual Reality Systes

Unit I **[9 Hrs]**

Introduction to Virtual Reality (VR): Virtual Reality and Virtual Environment, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark

Unit II **[10 Hrs]**

Computer Graphics and Geometric Modelling: The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms, Geometrical Transformations: Introduction, Frames of reference. Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.

Unit III **[10 Hrs]**

Input/Output Devices: Input (Tracker, Sensor, Digital Gloves, Movement Capture, Video based Input, 3D Menus & 3D Scanner, etc.), Output (Visual/Auditory/Haptic Devices**)**

Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems, Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system

Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft

Unit IV **[7 Hrs]**

Augmented Reality (AR): Taxonomy, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, enhancing interactivity in AR Environments, Evaluating AR systems

Unit V **[9 Hrs]**

Development Tools and Frameworks: **Human factors**: Introduction, the eye, the ear, the somatic senses **Hardware**: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems **Software**: Introduction, Modelling virtual world, Physical simulation, VR toolkits, VRML AR / VR Application

Text Books

S.N	Title	Authors	Edition	Publisher
1	Virtual Reality	Grigore Burdea and Philippe Coiffet	5th edition	Wiley-IEEE Press
2	Augmented Reality: Principles and Practices	Schmalstieg, D., Höllerer, T., (2016)	2nd edition	Pearson

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Designing Virtual Systems: The Structured Approach	Gerard Jounghyun Kim,	2005	Springer
2	Spatial Augmented Reality: Meging Real and Virtual Worlds	Oliver Bimber and Ramesh Raskar,	1st edition	A K Peters/CRC Press

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE702T(iii)	PE–IV Cryptography & Network Security	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended ● To develop the student's ability to understand the concept of security goals in the various applications. ● To provide the students with some fundamental cryptographic mathematics used in various symmetric and asymmetric key cryptography. ● To develop the student's ability to analyze the cryptographic algorithms. ● To familiarize the student with the need of security management in computer network related applications.	**Students will be able to** ● Acquire knowledge about security goals, background of cryptographic mathematics and identification of its application. ● Understand, analyze and implement the symmetric key algorithm. ● Acquire knowledge about the background of mathematics of asymmetric ● Analyze the concept of message integrity and the algorithms for checking the integrity of data. ● Understand various network security techniques to protect against the threats in the networks.

Unit I **[9 Hrs]**

Introduction, Terminology, Attacks, Security goals, Model for network security, Substitution & Transposition techniques, Mathematics for cryptography: Modular arithmetic, Euclidean, Extended Euclidean algorithm.

Unit II **[9 Hrs]**

Symmetric Key Cryptography: Introduction, Block Cipher principles, Data Encryption Standard (DES0, Triple DES, Attacks on DES, Blowfish, Advanced Encryption Standard (AES), Stream Cipher principles: RC4.

Unit III **[9 Hrs]**

Asymmetric Key Cryptography: Euler's Totient function, Fermat's & Euler's Theorem, Chinese Remainder Theorem (CRT), RSA, Elliptic Curve Cryptography (ECC), Digital Signature.

Unit IV **[9 Hrs]**

Key Management & Authentication: Introduction, Kerberos, Key Management Protocol: Diffie Hellman Key Exchange Algorithm, Digital Certificate: X.509 certificate, Hash Function: Introduction to SHA-1, SHA-256, MD5.

Unit V **[9 Hrs]**

Network Security: Firewalls & its principal design, Electronic Payment types: E-cash, chip card transaction & attacks, IDS, Software vulnerability: Phishing attack, Buffer overflow, Types of Intruders & its detection: virus, worms and trojan & its countermeasures.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Cryptography and Network Security: Principles and Standards	William Stallings	7th Edition	Prentice Hall India
2	Network Security and Cryptography	Bernard Menezes	1st Edition	Cengage Learning

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Network Security,The Complete Reference	Robert Bragge, Mark Rhodes, Heithstraggberg	1st Edition	McGraw-Hill
2	Cryptography and Network Security	Behrouz A. Forouzan	2nd Edition	McGraw-Hill
3	Applied Cryptography	Bruce Schneier	2nd Edition	John Wiley

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE702P(iii)	Professional Elective – IV Cryptography & Network Security lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended • To understand basics of Cryptography and Network Security. • To be able to secure a message over insecure channel by various means. • To learn about how to maintain the Confidentiality, Integrity and Availability of a data.	**Students will be able to** • Interpret security fundamentals and implement the cipher techniques. • Analyze and implement the key management and key distribution techniques. • Demonstrate the techniques to ensure data security and integrity.

Expt. No.	Title of the experiment
1	Implement Substitution Cipher techniques
2	Implement Transposition Cipher techniques
3	Implement Euclid's algorithm and Extended Euclid Algorithm
4	Implement the following regarding modern block cipher components: 1. WAP a program that splits an n-bit word into two words, each of n/2 bits. 2. WAP that combines two n/2 bits words into n-bit word. 3. WAP that swaps the left and right halves of an n- bit word. 4. WAP that circular- shifts an n-bit word k bits to the left or right based on the first parameter passed to the routine. 5. WAP to show the mapping for straight n x m P-box. 6. WAP to find the order of the permutation group and key size for n x m transposition and substitution block cipher method.
5	To explore Triple DES using virtual lab.
6	To perform round key transformation & Key Expansion process for AES-128 version symmetric key cryptography algorithm.
7	To understand the implementation of Asymmetric key cryptographic algorithm using RSA algorithm & Euler's Totient Function.
8	Implement Mathematical theorems related to Asymmetric Key Cryptography: Fermat's Little Theorem and Chinese Remainder Theorem.
9	Implementation of Cryptographic Hash function using SHA-1 hashing algorithm.
10	To understand the creation of session key using Diffie-Hellman Key Exchange algorithm.

Text Books

S. No	Title	Authors	Edition	Publisher
1	Cryptography and Network Security: Principles and Standards	William Stallings	7th Edition	Prentice Hall India
2	Network Security and Cryptography	Bernard Menezes	1st Edition	Cengage Learning

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CEM701T	Big Data Analytics	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended • Understand the Big Data Platform and its Use cases • Provide an overview of Apache Hadoop • Provide HDFS Concepts and Interfacing with HDFS • Understand Map Reduce Jobs	**Students will be able to** ● Identify Big Data and its Business Implications. ● List the components of Hadoop and Hadoop Eco-System ● Access and Process Data on Distributed File System ● Manage Job Execution in Hadoop Environment ● Develop Big Data Solutions using Hadoop Eco System

Unit I	**[10 Hrs]**
Introduction to Big Data-why Big Data, where did come from, Big Data 3Vs, challenges and applications, Characteristic of Big Data. Comparison between Hadoop 1.0 and 2.0.	
Unit II	**[9 Hrs]**
Big Data enabling Technology – Apache Hadoop Architecture and Ecosystem -MapReduce, HDFS, Zookeeper, Hive & Pig, Giraph, Spark, Storm, Flink, Cassandra, MongoDB, HBase.	
Unit III	**[10 Hrs]**
Hadoop stack for Big Data – Moving computation to data, Hadoop technologies, opportunity, Challenges, Hadoop stack, application, and technologies associated to Big data. HDFS ecosystem, MapReduce Architecture.	
Unit IV	**[10 Hrs]**
HDFS (Hadoop Distributed File System) -The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures	
Unit V	**[9 Hrs]**
Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Big Data & Hadoop	V.K.Jain	Second	Khanna Book
2	Big Data Analytics: Introduction to Hadoop, Spark, and Machine-Learning	John Soldatos	First	McGraw Hill Education

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization	DT Editorial Services	1st	Dreamtech Press

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE703T(i)	Professional Elective – V Ad Hoc and Sensor Networks	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended ● To comprehensively understand the Infrastructure less networks and importance in the future directions for wireless communications	**Students will be able to** ● Classify wireless Networks and Identify issues in MAC layer Protocols. ● Evaluate Routing Protocols for Ad Hoc Networks ● Interpret Challenges and Issues in Ad Hoc Network over traditional Networks ● Examine Ad Hoc Networks Applications ● Gain a comprehensive understanding of Quality of Service (QoS) principles in ad hoc networks, including the challenges and issues involved in providing QoS.

Unit I **[8Hrs]**

Introduction – Fundamentals of Wireless Networks, Wireless Internet, What Are Ad Hoc Networks?, MAC Layer Protocols for Ad Hoc Wireless Networks – Introduction, Important Issues and the Need for Medium Access Control, Classification of MAC Protocols

Unit II **[8Hrs]**

Routing Protocols for Ad Hoc Wireless Networks – Introduction, Design Issues of Routing Protocols for Ad Hoc Networks, Classification of Routing Protocols, Proactive Routing Protocols, Reactive Routing Protocols, Hybrid Routing Protocols.

Unit III **[9Hrs]**

Multicast Routing Protocols for Mobile Ad Hoc Networks – Introduction, Issues in Designing a Multicast Routing Protocol, Classification of Multicast Routing Protocols, Multicast Ad Hoc On-Demand Distance Vector (MAODV), Mesh-Based Routing Protocols, Source Routing-Based Multicast Protocol (SRMP), Multicasting with Quality-of-Service (QoS) Guarantees, Energy-Efficient Multicast Routing Protocols, Application Dependent Multicast Routing

Unit IV **[10Hrs]**

Transport Protocols for Ad Hoc Networks – Introduction, Transmission Control Protocol's (TCP's) Challenges and Design Issues in Ad Hoc Networks, TCP Performance over that of Mobile Ad Hoc Networks (MANETs), Ad Hoc Transport Protocols, Application Controlled Transport Protocol (ACTP)

Unit V **[10Hrs]**

Quality of Services (QoS) in Ad Hoc Networks – Introduction to QoS, Issues and Challenges involved in Providing QoS, Energy Management System in Ad Hoc Wireless Networks – Introduction, Energy Efficient Routing Protocols, Transmission Power Management Schemes, Transmission Power Control, Applications and Recent Developments in Ad Hoc Networks – Introduction, Typical Application, Application Opportunities, Challenges, Highlights of the Most Recent Development in the field

Text Books

S.N	Title	Authors	Edition	Publisher
1	Ad Hoc Mobile Wireless Networks, Principles, Protocols, and Applications	Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa	Special Indian Edition	Auerbach Publications

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Mobile Communication	Jochen Schiller	4th Edition	Pearson Educationn
2	Ad Hoc And Sensor Networks: Theory And Applications	Carlos De Morais Cordeiro, Dharma Prakash Agrawal	2nd Edition	World Scientific

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE703T(ii)	PE–V Deep Learning	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended ● To Learn the foundations of Deep Learning and its applications in real world ● To Learn how to implement, train and evaluate deep neural networks ● To Learn various deep neural networks architectures such as CNNs, RNNs, LSTM, and their applications	**Students will be able to** ● Understand basics of deep learning. ● Analysis neural networks for different technique. ● Apply appropriate deep learning algorithm to realize various learning problems. ● Apply the Convolution Neural Network and Recurrent Neural networks in context with real world problem solving. ● Understand deep learning algorithms to solve real world problems.

Unit I **[9 Hrs]**

Basics of Deep Learning - Human Brain and Fundamentals of Biological Neural Network, Model of an artificial Neuron, Basic concepts of Neural Networks, Evolution of Neural Networks, Characteristics of Neural Networks, Learning Methods–Supervised, unsupervised and reinforcement, Taxonomy of Neural Network Architectures, Terminologies – weights, bias, threshold, learning rate, Activation Functions-Liner, Sigmoidal, Signum, Tanh, ReLu, SoftMax, Applications of Neural Networks.

Unit II **[9 Hrs]**

Training of feed forward Neural Network - Hebb Network theory and training algorithm, Perceptron Networks architecture and training algorithm, Delta Learning Rule, Backpropagation Network architecture and training algorithm, Associative Memory Network architecture and training algorithm, Adaptive Resonance Theory Network architecture and training algorithm,

Unit III **[9 Hrs]**

Convolution Neural Network (CNN) - Convolution neural networks (CNNs): Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, PlacesNet, training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing.

Unit IV **[9 Hrs]**

Recurrent Neural Network (RNN) - Recurrent neural networks (RNNs): Sequence modeling using RNNs, Back propagation through time, Long Short-Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture.

Unit V **[8 Hrs]**

Applications: Case studies on applications of Deep Learning in Predictions and Classification applications, Computer vision, speech recognition and natural language processing.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Deep Learning	Ian Goodfellow, Yoshua Bengio and Aaron Courville	2016	MIT Press
2	Neural Networks and Deep Learning	Charu C. Aggarwal	2018	Springer
3	Deep Learning	M. Gopal	2022	Pearson education

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Deep Learning- From Logical Calculus to AI	Sandro Skansi	2018	Springer
2	Artificial Neural Networks	Yegnanarayana, B.	2009	PHI Learning Pvt. Ltd
3	Deep Learning	A.Das,S.Goswami,P. Mitra,A, Chakrabarti	2022	Pearson education
4	Introduction of Artificial neural networks.	Jecek Zurada	1992	PHI

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE703T(iii)	Professional Elective – V Real time Operating System	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended ● Understanding Real-Time Operating Systems (RTOS) Concepts and Performance Evaluation ● Applying Features of Real-Time Operating Systems (RTOS) and Embedded Software Architectures: ● Optimizing Task Scheduling and Implementing Fault Tolerance Techniques	**Students will be able to** ● Understand the fundamentals and characteristics of real-time operating systems and evaluate their performance measures. ● Analyze and apply features of real-time operating systems in practical scenarios through case studies and hands-on exercises. ● Design and apply embedded software architectures, and select appropriate scheduling algorithms for real-time systems ● Gain knowledge of real-time databases to manage transaction priorities, concurrency control, and disk scheduling efficiently. ● Develop strategies for fault detection, containment, and redundancy to enhance the reliability and resilience of real-time systems

Unit I **[10Hrs]**

Introduction to Real time systems: Introduction to Real Time operating Systems, component of Types of Real Time Operating Systems. Issues in real time computing Structure of real time system. Need for RTOS Task classes**. Performance measures for real time system**: Properties, traditional performance measures, performability, cost functions and hard deadlines, and Estimating program run times.

Unit II **[9 Hrs]**

Features of Real Time Operating System: Messages queues mailboxes pipes timer function events memory management Interrupt basic system design using an RT (OS design principles, interrupt routines, task structures and priority.) Current research in RTOS. Case Studies: Vx Works and Micro OS-II.

Unit III **[9 Hrs]**

Embedded software and Task Scheduling: Examples of embedded system their characteristics and their typical hardware components embedded software architectures Scheduling algorithms: round robin, round robin with interrupts, function queue scheduling real time operating system selection, CPU scheduling algorithms: Rate monotonic, EDF, MLF. ,Priority Scheduling, Priority Ceiling and Priority inheritance

Real time operating system: Tasks and task states, shared data and reentrancy semaphores and shared data, use of semaphores Protecting shared data.

Unit IV **[9 Hrs]**

Real Time Databases: Real time v/s general purpose databases main memory databases transaction priorities transaction aborts concurrency control issues: pessimistic concurrency control and optimistic concurrency control Disk scheduling algorithms

Unit V **[8 Hrs]**

Fault Tolerance Techniques: Causes of failure Fault types Fault detection Fault and error containment **Redundancy:** hardware redundancy software redundancy Time redundancy information redundancy Data diversity Integrated failure handling.

Text Books

S.N	Title	Authors	Edition	Publisher
1	An Embedded Software Primer	David E. Simon		Pearson
2	Embedded system: Architecture Programming and Design	Raj kamal		TMH

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Real Time Systems	C.M. Krishna and Kang G. Shin		TMH

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
21CE761O	OE–III Cyber Security and Ethics	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended • To know about Cyber Security. • To familiarize various types of cyber-attacks and cyber-crimes • To give an overview of the cyber laws • To study the defensive techniques against these attacks • To study cyber security challenges and implications.	**Students will be able to** • Understand basic concepts of Cyber Security. • Understand Cyber laws • Identify the attacks in Cyber Crimes • Specify the Organizational Implications • Identify the Types of Intellectual Property and Ethical Issues

Unit I **[9 Hrs]**

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management

Unit II **[9 Hrs]**

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

Unit III **[9 Hrs]**

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era.

Unit IV **[9 Hrs]**

Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Unit V **[9Hrs]**

Intellectual Property and Ethical Issues: Types of Intellectual Property, Intellectual Property Relevant to Network and Computer Security, Ethics and the Information Systems (IS) Professions, Ethical Issues Related to Computers and Information Systems, Security tools, The Information Technology ACT, 2008.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Cyber Security Essentials	James Graham, Richard Howard and Ryan Otson	1st Edition	CRC Press
2	Introduction to Cyber Security	Chwan-Hwa(john) Wu,J. David Irwin	1st Edition	CRC Press T&F Group

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Cyber Security - Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Nina Godbole, Sunit Belapure	1st Edition	WILEY INDIA
2	Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives	B. B. Gupta, D. P. Agrawal, Haoxiang Wang	1st Edition	CRC Press