COURSE BOOK M.TECH(CSE) II YEAR

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CURRICULUM STRUCTURE & SYLLABUS

Effective from the Session: 2025-26

M.Tech (CSE) 3rd Sem

S No.	Course Category (AICTE)	Course Category (UGC)	BOS	Course Code	Course Name	Type	Academic Learning (AL)			Continuous Internal Examination (CIE)			End Sem Examination (ESE)	Total Marks	Total Credits
							L	T	P	MSE	CA	TOTAL		CIE+ ESE	
1	PC	Major (Core)	CSE	CS522L	Advanced Computer Architecture	L	4	0	0	80	20	100	100	200	4
2	PC	Major (Core)	CSE	-	Elective 3	L	3	0	0	60	15	75	75	150	3
3	PC	Major (Core)	CSE	-	Elective 4	L	3	0	0	60	15	75	75	150	3
Lab/Practical															
4	PW	Major (Core)	CSE	CS523P	Seminar	P	0	0	20	-	500	500	-	500	10
5	PW	Major (Core)	CSE	CS524P	Dissertation	P	0	0	10	-	250	250	-	250	5
Total Hours : 40 hrs.							**10**	**0**	**30**					**1250**	**25**

Elective 3:
CS509E: Deep Learning
CS514E: IoT
CS519E: Network Security and Cryptography

Elective 4:
CS510E: Pattern Recognition
CS515E: Embedded Systems
CS520E: Wireless Sensor Networks

M.Tech (CSE) 4th Sem

S No.	Course Category (AICTE)	Course Category (UGC)	BOS	Course Code	Course Name	Type	Academic Learning (AL)			Continuous Internal Examination (CIE)			End Sem Examination (ESE)	Total Marks	Total Credits
							L	T	P	MSE	CA	TOTAL		CIE+ ESE	
1	PW	Major (Core)	CSE	CS525P	Dissertation	P	0	0	30	-	375	375	375	750	15
Total Hours : 30 hrs.							**0**	**0**	**30**					**750**	**15**

Theory Courses Detail Syllabus

Course Code : CS522L	Course Name: Advanced Computer Architecture	L	T	P	C
		4	0	0	4

Pre-requisite: Fundamentals of computer organization and basic computer architecture

Course Objectives

1. Understand parallel architectures and parallel computing environment.
2. Study the concepts of Parallel programming constructs to make the parallel computing environment.
3. Analyze the parallel programming problems and their solutions.

Course Outcome: After completion of the course, the student will be able to

1. Gain the knowledge of Parallel computing and parallel architectures.
2. Identify and apply the concept of parallel programming to make the parallel programming environment.
3. Learn about Parallel programming constructs and gain knowledge of various Threading API's.
4. Understand and apply Parallel programming algorithms.
5. Identify various Common parallel programming problems and analyze their solutions.

CO-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO – PO Mapping	PO1	PO2	PO3	PSO1	PSO2
CO1	2	-	1	2	2
CO2	1	1	3	2	2
CO3	2	-	3	2	2
CO4	2	1	3	2	2
CO5	3	1	3	2	2

Unit	Title	Hours
Unit 1	**Fundamentals of Parallel Computing and Architecture**	**12 hours**
Parallel Computing, Parallel Computer Model, Program and Network Properties, Parallel Architectural Classification Schemes, Flynn's & Feng's Classification, Performance. Metrics and Measures, Speedup Performance Laws, Multiprocessor System and Interconnection Networks.		
Unit 2	**Parallel Computer Architectures**	**12 hours**
Introduction to MIMD Architecture, Multithreaded Architectures, Distributed Memory MIMD Architectures, Shared Memory MIMD Architecture, Clustering, Instruction Level Data Parallel Architecture, SIMD Architecture, Fine Grained and Coarse Grained SIMD Architecture, Associative and Neural Architecture, Data Parallel Pipelined and Systolic Architectures, Vector Architectures.		
Unit 3	**Threading Constructs and Parallel Programming APIs**	**12 hours**
Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. Threading APIs : Threading APIs for Microsoft Windows, Win32/MFC Thread APls, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.		
Unit 4	**Parallel Algorithm Design Strategies**	**12 hours**
PRAM Algorithms: Parallel Reduction, Prefix Sums, Preorder Tree Traversal, Merging two Sorted lists; Matrix Multiplication: Row Column Oriented Algorithms, Block Oriented Algorithms; Parallel Quicksort, Hyper Quicksort; Solving Linear Systems: Gaussian Elimination, Jacobi Algorithm; Parallel Algorithm Design Strategies.		
Unit 5	**Handling Parallel Programming Issues and Performance Optimization**	**12 hours**
Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping- ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache- related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32,Data Organization for High Performance.		
	Total Lecture hours	**60 hours**

Textbook
1.Kai Hwang," Advance Computer Architecture", TMH
2. Dezso and Sima, "Advanced Computer Architecture", Pearson
3. Quinn, "Parallel Computing: Theory & Practice", TMH

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 40	MSE2 40	CA1 8	CA2 8	CA3 (ATT) 4		
80		20			100	200

Course Code: CS509E	Course Name: Deep Learning	L	T	P	C
		3	0	0	3

Pre-requisite: NA

Course Objectives

1. Gain foundational understanding and practical skills in deep learning techniques, including neural networks, CNNs, and RNNs.
2. Apply deep learning algorithms to real-world problems, such as image classification, object detection, and natural language processing.
3. Analyze, evaluate, and address challenges in deep learning models while exploring advanced topics like generative models and reinforcement learning.

Course Outcome:

1. Demonstrate a comprehensive understanding of deep learning fundamentals, including neural networks, backpropagation, activation functions, and optimization algorithms.
2. Apply deep learning techniques to solve real-world problems by implementing and training convolutional neural networks (CNNs) and recurrent neural networks (RNNs) for tasks such as image classification, object detection, and natural language processing.
3. Evaluate the performance of deep learning models using appropriate evaluation metrics, and address common issues such as overfitting and vanishing/exploding gradients.
4. Explore advanced topics in deep learning, such as generative models, reinforcement learning, and attention mechanisms, and understand their applications and implications.
5. Develop practical skills in deep learning frameworks (e.g., TensorFlow, PyTorch) and gain hands-on experience in preprocessing data, designing network architectures, and fine-tuning models for specific tasks.

CO-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	1	2	2
CO2	1	1	2	2	2
CO3	3	2	2	2	2
CO4	2	2	2	2	2
CO5	2	2	2	2	2

Unit 1	Introduction to Deep Learning	9 hours

Overview of machine learning and neural networks, Introduction to deep learning and its applications Neural network architectures: feedforward networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), Activation functions, loss functions, and optimization algorithms.

Unit 2	Deep Learning Fundamentals	9 hours

Backpropagation algorithm and gradient descent optimization, Regularization techniques: dropout, L1 and L2 regularization, Hyperparameter tuning and model selection, Evaluation metrics for deep learning models, Introduction to deep learning frameworks (e.g., TensorFlow, PyTorch).

Unit 3	Convolutional Neural Networks (CNNs)	9 hours

Convolutional layers, pooling layers, and padding, CNN architectures: LeNet, AlexNet, VGG, ResNet, Transfer learning and fine-tuning pre-trained models, Object detection and localization with CNNs, Image segmentation and generative adversarial networks (GANs).

Unit 4	Recurrent Neural Networks (RNNs)	9 hours
Basics of sequential data and time series analysis, RNN architectures: vanilla RNNs, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), Sequence generation and language modelling, Neural machine translation and text generation, Handling long-term dependencies and gradient, vanishing/exploding.		
Unit 5	**Advanced Topics in Deep Learning**	**9 hours**
Generative models: Variational Autoencoders (VAEs) and Generative Adversarial Networks (GANs), Reinforcement learning and deep Q-learning, Attention mechanisms and Transformer architecture, Explainability and interpretability of deep learning models, Recent advances and research trends in deep learning.		
	Total Lecture hours	**45 hours**

Textbook

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, 2016, MIT Press
2. François Chollet, Deep Learning with Python, 2017, Manning Publications
3. Rajalingappaa Shanmugamani, Deep Learning for Computer Vision, 2020, Packt Publishing
4. Palash Goyal, Sumit Pandey, and Karan Jain, Deep Learning for Natural Language Processing, 2018, Apress
5. Pieter Abbeel and John Schulman, Deep Reinforcement Learning, 2020, MIT Press

Reference Books:

1. Josh Patterson and Adam Gibson, Deep Learning: A Practitioner's Approach, 2017, O'Reilly Media
2. Li Deng and Dong Yu, Deep Learning: Methods and Applications, 2014, Now Publishers Inc.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques for Building Intelligent Systems, 2019, O'Reilly Media

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE2 30	CA1 6	CA2 6	CA3(ATT) 3		
60		15			75	150

Course Code: CS514E	Course Name : Internet of Things	L	T	P	C
		3	0	0	3

Pre-requisite: NA

Course Objectives

1. Understand the fundamental concepts and principles of the Internet of Things (IoT).
2. Develop the necessary skills to design and implement IoT systems.
3. Explore the ethical and security considerations related to IoT deployments.

Course Outcome

1. Explain the architecture and components of IoT systems.
2. Design and implement IoT applications using appropriate hardware and software tools.
3. Analyze and evaluate the impact of IoT on various industries and sectors.
4. Apply security measures and protocols to ensure the integrity and privacy of IoT systems.
5. Demonstrate an understanding of ethical considerations and potential societal implications of IoT technology.

CO-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	1	2	2
CO2	2	1	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	2
CO5	2	2	2	2	2

Unit 1	Introduction to IoT	9 hours
Definition and key concepts of the Internet of Things (IoT), Evolution and history of IoT Architecture and components of IoT systems, IoT applications and use cases in various industries, Challenges and opportunities in IoT deployment, Ethical and societal considerations in IoT		
Unit 2	**IoT Hardware and Software**	**9 hours**

Sensors and actuators in IoT systems, Embedded systems and microcontrollers, Communication protocols for IoT (e.g., MQTT, CoAP, HTTP), IoT development platforms and frameworks, Data acquisition and processing in IoT, Integration of IoT devices with cloud platforms		
Unit 3	**IoT Communication Protocols**	**9 hours**
Wireless communication technologies for IoT (e.g., Wi-Fi, Bluetooth, Zigbee), IoT network architectures (e.g., star, mesh, cellular), IoT data transmission and routing protocols, MQTT (Message Queuing Telemetry Transport) protocol, IoT security considerations in communication, Edge computing in IoT		
Unit 4	**IoT Security and Privacy**	**9 hours**
Security challenges in IoT deployments, Threats and vulnerabilities in IoT systems, Authentication and access control in IoT, Cryptographic protocols for IoT security, Privacy concerns and data protection in IoT, Secure firmware and software updates for IoT devices		
Unit 5	**IoT Applications and Future Trends**	**9 hours**
Industrial IoT (IIoT) and smart manufacturing, Smart homes and home automation, Connected healthcare and telemedicine, Smart cities and urban infrastructure, IoT in agriculture and environmental monitoring, Emerging trends and future directions in IoT		
	Total Lecture hours	**45 hours**

Textbook

1. Hersent, O., Boswarthick, D., & Elloumi, O. (2011). *The internet of things: Key applications and protocols*. John Wiley & Sons.
2. Jose, J. (2018). *Internet of things*. Khanna Publishing House.
3. Miller, M. (2015). *The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world*. Pearson Education.
4. Kamal, R. (2017). *Internet of Things*. McGraw-Hill Education.
5. Bahga, A., & Madisetti, V. (2014). *Internet of Things: A hands-on approach*. Vpt.

Reference Books

1. McEwen, A., & Cassimally, H. (2013). *Designing the internet of things*. John Wiley & Sons.
2. Holler, Jan, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, and David Boyle. *Internet of things*. Academic Press, 2014.
3. Buyya, R., & Dastjerdi, A. V. (Eds.). (2016). *Internet of Things: Principles and paradigms*. Elsevier.

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE2 30	CA1 6	CA2 6	CA3(ATT) 3		
60		15			75	150

Course Code: CS519E	Course Name: Network Security and Cryptography	L	T	P	C
		3	0	0	3
Pre-requisite: NA					

Course Objectives

1. Familiarize students with the fundamental principles of information, network security and cryptosystem.
2. Provide an introduction to cryptographic techniques based on both public and private key systems, as well as cryptographic hash functions.
3. Develop an understanding of various authentication applications and security protocols used in the field of security.

Course Outcome

1. Student will be able to utilize symmetric and asymmetric encryption algorithms to prevent attacks on computer and computer security.
2. Student will be able to understand the concept of secret key and public key cryptosystem.
3. Student will be able to identify various cryptographic hash functions, their applications, and their role in ensuring data integrity and authenticity.
4. Student will be able to understand authentication applications and email security protocols.
5. Student will be able apply system security concepts to protect network from security breaches and attacks.

CO-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	1	2	2
CO2	3	1	2	2	2
CO3	2	2	2	2	2
CO4	1	2	2	2	2
CO5	1	2	2	2	2

Unit 1	**Introduction**	**9 hours**
Security Attacks, Security Goals, Computer criminals, Methods of defense, Security Services, Security Mechanisms, cryptanalysis, steganography, Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Other Cipher Properties- Shannon’s theory of confusion and diffusion, fiestal structure		
Unit 2	**Secret Key & Public Key Cryptography**	**9 hours**
Data Encryption Standard (DES), Strength of DES, Block Cipher Design Principles and Modes of Operations, Triple DES, International Data Encryption algorithm, Blowfish, CAST-128. Principles of Public Key Cryptosystems, RSA Algorithm, Diffie Hellman Key Exchange		
Unit 3	**Cryptographic Hash Functions**	**9 hours**
Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital signatures, Digital Signature Schemes, Authentication Protocols, Digital Signature Standards.		
Unit 4	**Authentication Applications**	**9 hours**
Kerberos, Key Management and Distribution, X.509 Directory Authentication service, Authentication Applications: Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME.		
Unit 5	**IP Security**	**9 hours**
Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, combining security associations, Introduction to Secure Socket Layer, Secure electronic, transaction (SET) System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls.		
	Total Lecture hours	**45 hours**

Textbook

1. William Stallings, “Cryptography and Network security”, 4th ed., Pearson Education, 2010

2. William Stallings “Network Security Essentials Applications and Standards”, 2nd ed., Pearson Education, 2009.

Reference Books

1. Cryptography and Network Security by Behrouz A. Forouzan, TMH
2. A Course in Number Theory and Cryptography by Neal Koblitz
3. Cryptanalysis: A Study of Ciphers and Their Solution Helen Fouche Gaines

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE2 30	CA1 6	CA2 6	CA3 (ATT) 3		
60		15			75	150

Course Code: CS510E	Course Name: Pattern Recognition	L	T	P	C
		3	0	0	3

Pre-requisite: NA

Course Objectives

1. Develop a solid foundation in pattern recognition by understanding basic fundamentals and gaining proficiency in the mathematical preliminaries, with knowledge of various feature extraction and selection techniques.
2. Gain a comprehensive understanding of supervised and unsupervised learning for pattern recognition, including Bayesian decision theory, parametric and nonparametric methods, and linear classifiers like perceptron, support vector machines (SVM), and linear discriminant analysis (LDA).
3. Gain an in-depth understanding of neural networks and deep learning techniques for pattern recognition, and also explore advanced topics such as ensemble learning, support vector machines (SVM) with kernel methods, pattern recognition in time series etc.

Course Outcome

1. Apply the principles of pattern recognition and mathematics including the architecture and activation functions used. 2. Discover supervised and unsupervised learning algorithms, such as support vector machines (SVM) and k-means clustering, to classify patterns and underlying structures
3. Compare the effectiveness of different feature extraction and selection techniques for pattern recognition tasks.
4. Contrast the performance and suitability of various advanced techniques, such as ensemble learning, kernel methods in SVM, and deep reinforcement learning, for specific pattern recognition applications
5. Develop a comprehensive pattern recognition system using a combination of feature extraction techniques, supervised learning algorithms, and neural network models.

CO-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PSO1	PSO2
CO1	3	1	1	2	2
CO2	2	1	2	2	2
CO3	3	2	2	2	2
CO4	3	2	2	2	2
CO5	3	2	2	2	2

Unit 1	**Introduction to Pattern Recognition**	**9 hours**

Introduction to Pattern Recognition: Definition, scope, and applications, Mathematical Preliminaries: Probability theory, linear algebra, and statistical concepts relevant to pattern recognition, Feature Extraction and Selection: Feature representation, feature engineering, feature extraction techniques (e.g., PCA, LDA), and feature selection methods.

Unit 2	**Supervised Learning for Pattern Recognition**	**9 hours**

Bayesian Decision Theory: Bayes' rule, discriminant functions, and decision boundaries, Parametric Methods: Maximum likelihood estimation, Gaussian distributions, and parameter estimation techniques (e.g., maximum likelihood estimation, maximum a posteriori estimation), Nonparametric Methods: k-nearest neighbors, Parzen windows, and kernel density estimation, Linear Classifiers: Perceptron, support vector machines (SVM), and linear discriminant analysis (LDA).

Unit 3	**Unsupervised Learning and Clustering**	**9 hours**

Unsupervised Learning: Introduction to unsupervised learning, clustering, and dimensionality reduction, Clustering Algorithms: kmeans clustering, hierarchical clustering, and density-based clustering (e.g., DBSCAN), Dimensionality Reduction: Principal Component Analysis (PCA), Independent Component Analysis (ICA), and t-distributed Stochastic Neighbor Embedding (t-SNE).

Unit 4	**Neural Networks and Deep Learning for Pattern Recognition**	**9 hours**

Introduction to Neural Networks: Perceptron, feedforward neural networks, activation functions, and backpropagation algorithm, Convolutional Neural Networks (CNN): Architecture, convolutional layers, pooling, and applications in image recognition, Recurrent Neural Networks (RNN): Architecture, LSTM (Long Short-Term Memory), and applications in sequence recognition and natural language processing, Deep Learning Techniques: Transfer learning, generative adversarial networks (GANs), and autoencoders.

Unit 5	**Advanced Topics in Pattern Recognition**	**9 hours**

Ensemble Learning: Bagging, boosting, random forests, and ensemble methods for pattern recognition, Support Vector Machines (SVM): Nonlinear SVM, kernel methods, and soft-margin SVM, Pattern Recognition in Time Series Data: Hidden Markov Models (HMM), Dynamic Time Warping (DTW), and applications in speech recognition and gesture recognition, Deep Reinforcement Learning: Introduction to reinforcement learning, Q-learning, and deep Q-networks (DQN).

Total Lecture hours | **45 hours**

Textbook

1. "Pattern Recognition and Machine Learning" by Christopher M. Bishop Latest Edition: 1st Edition (2006), Publisher: Springer
2. "Pattern Classification" by Richard O. Duda, Peter E. Hart, and David G. Stork Latest Edition: 3rd Edition (2012) Publisher: Wiley-Inderscience
3. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy Latest Edition: 1st Edition (2012) Publisher: The MIT Press
4. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville Latest Edition: 1st Edition (2016) Publisher: The MIT Press
5. "Pattern Recognition and Neural Networks" by Brian D. Ripley Latest Edition: 1st Edition (1996) Publisher: Cambridge University Press

Reference Books

1. "Kernel Methods for Pattern Analysis" by John Shawe-Taylor and Nello Cristianini Latest Edition: 1st Edition (2004) Publisher: Cambridge University Press
2. "Hidden Markov Models for Time Series: An Introduction Using R" by Walter Zucchini and Iain L. MacDonald Latest Edition: 2nd Edition (2017) Publisher: CRC Press
3. Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto Latest Edition: 2nd Edition (2018) Publisher: The MIT Press

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE2 30	CA1 6	CA2 6	CA3 (ATT) 3		
60		15			75	150

Course Code : CS515E	Course Name: Embedded Systems	L	T	P	C
		3	0	0	3

Pre-requisite: NA

Course Objectives

1. Understand the basics of embedded systems.
2. Study the core concepts of embedded systems.
3. Analyze design methodologies and techniques specific to embedded systems.

Course Outcome

1. Gain the knowledge of basic characteristics of embedded systems
2. Identify and apply the core concept of embedded system.
3. Learn about the functioning of embedded firmware.
4. Understand and apply real-time concepts of embedded systems
5. Understand and apply design methodologies for embedded systems.

CO-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PSO1	PSO2
CO1	3	2	2	1	1
CO2	3	2	3	2	1
CO3	2	2	2	2	1
CO4	3	2	3	2	1
CO5	3	3	3	3	2

Unit	Title	Hours
Unit 1	**Introduction**	**9 hours**
Overview of Embedded Systems: Characteristics of Embedded Systems. Comparison of Embedded Systems with general purpose processors. General architecture and functioning of micro controllers. PIC and 8051 micro controllers : Architecture, memory interfacing , interrupts, instructions, programming and peripherals .		
Unit 2	**Core Components**	**9 hours**
Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.		
Unit 3	**Firmware and System Support Circuits**	**9 hours**
Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.		
Unit 4	**Real-Time Operating Systems**	**9 hours**
RTOS : RT-Linux introduction, RTOS kernel, Real-Time Scheduling Bus structure: Time multiplexing, serial, parallel communication bus structure. Bus arbitration, DMA, PCI, AMBA, I2C and SPI Buses.		
Unit 5	**Task Communication, Synchronization, and RTOS Selection**	**9 hours**
Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.		

Total Lecture hours	**45 hours**

Textbook

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.
2. Embedded Systems - Raj Kamal, TMH.
3. An Embedded Software Primer - David E. Simon, Pearson Education.

Reference Books

1. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley
2. Embedded Systems – Lyla, Pearson, 2013

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	MSE2 30	CA1 6	CA2 6	CA3 (ATT) 3		
60		15			75	150

Course Code: CS520E	Course Name: Wireless Sensor Networks	L	T	P	C
		3	0	0	3

Pre-requisite: NA

Course Objectives

1. To understand the fundamentals of wireless sensor networks and its applications.
2. To study the various protocols at various layers and its differences with traditional protocols.
3. To understand the issues pertaining to sensor networks and the challenges involved in managing sensor network.

Course Outcome

1. Student will be able to understand the basic concepts of wireless communication.
2. Student will be able to understand the concept of wireless sensor networks.
3. Student will be able to identify various MAC protocols.
4. Student will be able to understand Routing protocols.
5. Student will be able to address the issues related to QOS and energy management.

CO-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PSO1	PSO2
CO1	1	1	1	2	2
CO2	3	1	2	2	2
CO3	2	2	2	2	2
CO4	1	2	2	2	2
CO5	2	2	2	2	2
Avg.	1.8	1.6	1.8	2	2

Unit 1	**Introduction**	**9 hours**

Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

Unit 2	**Introduction to sensor networks**	**9 hours**

Key definitions of sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

Unit 3	**MAC Protocols**	**9 hours**

Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

Unit 4	**Routing Protocols**	**9 hours**

Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

Unit 5	**QoS and Energy Management**	**9 hours**

Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.	
Total Lecture hours	**45 hours**

Textbook

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004
2. William Stallings “Wireless Communication and Networks”, Pearson-2004
Education, 2009.
3.Anna Ha´c, “Wireless Sensor Network Designs”, John Wiley & Sons Ltd

Reference Books

1. C. Siva Ram Murthy, and B.S.Manoj, “AdHoc Wireless networks”, Pearson Education-2008
2. Jochen Schiller, “Mobile Communication”, Pearson,2nd Edition-2003

Mode of Evaluation

MSE		CA			ESE	Total
MSE1 30	**MSE2 30**	**CA1 6**	**CA2 6**	**CA3 (ATT) 3**		
60		**15**			**75**	**150**