Semester- VI (Third Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CO 321	Wireless Sensor Networks	3	0	30	70	3	PC
2	CO 322	Compiler Design	3	0	30	70	3	PC
3	CO 323	Industrial IoT	3	0	30	70	3	PC
4	CO 324	Professional Elective – II	3	0	30	70	3	PE
5	CO 325	Open/Job-Oriented Elective – II	3	0	30	70	3	OE
6	CO 361	Wireless Sensor Networks Lab	0	3	30	70	1.5	PC
7	CO 362	Industrial IoT Lab	0	3	30	70	1.5	PC
8	CO/CS/IT/CM 363	Term Paper / Seminar	0	3	100	-	1.5	PR
9	COSL4	Skill Oriented Course – IV	1	2	100	-	2	SC
		TOTA	**16**	**11**	**410**	**490**	**21.5**	

Internship minimum of 6 weeks is mandatory during summer vacation.
(Will be evaluated in Seventh Semester)

Category	CREDITS
Professional Core Courses	12
Professional Elective Course	3
Open Elective Course/Job Oriented Elective	3
Skill Advanced Course	2
Project/Term Paper	1.5
TOTAL CREDITS	**21.5**

R **V R & J C COLLEGE OF ENGINEERING (Autonomous), CHOWDAVARAM, GUNTUR-19**
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CO 321 **WIRELESS SENSOR NETWORKS** **L P C**
3 0 3

Course Objectives:

1. To understand the basic WSN technology and different applications in WSN.
2. To understand MAC and Routing protocols used in WSN.
3. To understand Design principles and architecture of a WSN.
4. Understand various operating systems used in WSN.

Course Outcomes:

After successful completion of the course, the students are able to

1. Describe the concepts of Wireless Sensor Networks with issues and challenges.
2. Illustrate the design principles of gateway, WSN communications and single node architecturewith hardware components and design constraints.
3. Interpret the MAC and Routing protocols for Wireless Sensor Networks.
4. Select operating systems used for WSN.

Course Content:

UNIT I **CO1[Text Book -1]** **12 Periods**

Wireless Sensor Networks - Introduction, Application examples, Types of applications, Challenges for WSNs, Mobile ad hoc networks and wireless sensor networks, Enabling technologies for wireless sensor networks, Single-node architecture - Hardware components.

UNIT II **CO2[Text Book -1]** **12 Periods**

Network Architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts - The need for gateways, WSN to Internet communication, Internet to WSN communication, WSN tunneling.

UNIT III **CO3 [Text Book-1]** **12 Periods**

MAC Protocols : Fundamentals of MAC protocols - Requirements and design constraints for wireless MAC protocols, Important classes of MAC protocols, MAC protocols for wireless sensor networks, Contention-based protocols "CSMA, PAMAS, The IEEE 802.15.4 MAC protocol. Routing Strategies in Wireless Sensor Networks - WSN Routing Techniques, Geographical Routing.

UNIT IV **CO4[Text Book-2]** **12 Periods**

Operating Systems for Wireless **Sensor Networks :** Introduction, Operating System Design Issues, Examples of Operating Systems "Tiny OS, Mate, Magnet OS, MANTIS, OSPM, EYES OS, Sen OS, EMERALDS, Pic OS, Performance and Traffic Management , Introduction, Background, WSN Design Issues, Performance Modeling of WSNs.

Text Books:

1. Holger Karl and Andreas Willig, â€oeProtocols and Architectures for Wireless SensorNetworks ,John Wiley & Sons, Ltd, 2005.
2. Kazem Sohrby, Daniel Minoli, Wireless Sensor Network Technology, Protocols and Applications,Wiley-Inter science.

REFERENCE BOOKS:

1. Waltenegus Dargie , Christian Poellabauer,Fundamentals Of Wireless Sensor Networks TheoryAnd Practice by John Wiley & Sons Publications ,2011.
2. Sabrie Soloman,Sensors Handbook by McGraw Hill publication. 2009.
3. Feng Zhao, Leonidas Guibas, Wireless Sensor Networks by Elsevier Publications,2004.
4. Philip Levis, And David Gay TinyOS Programming by Cambridge University Press 2009.

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CO 322 **COMPILER DESIGN** **L P C**
3 0 3

Course Objectives:

The main objectives of this course are:

1. Introduce the phases of compiler and lexical analyzer.
2. Discuss the parsing techniques and syntax direct translation schemes.
3. Illustrate run-Time storage allocations strategies and Symbol Table implementation.
4. Illustrate intermediate code forms and code generation.

Course Outcomes:

At the end of the course, the student will be able to

1. Explain the phases of compiler and Lexical analysis.
2. Construct Parsers and symbol table look-up schemes.
3. Develop various intermediate code forms for compiler construction.
4. Design code generator through optimized intermediate code forms, specify the various code optimization methods, and runtime allocation strategies.

Course Content:

UNIT I **CO1** **12 Periods**

Introduction to Compiling: Compilers - Analysis of the source program - Phases of a compiler - Cousins of the Compiler - Grouping of Phases - Compiler construction tools.

Lexical Analysis: Role of Lexical Analyzer - Input Buffering - Specification of Tokens-Recognition of tokens- a language for specifying lexical analyzers- Finite Automata-From Regular expressions to NFA- Design of a lexical analyzer generator.

Syntax Analysis: Role of the parser - Top Down parsing - Recursive Descent Parsing, Predictive Parsing, LL(1) Parser.

UNIT II **CO2** **13 Periods**

Syntax Analysis - Bottom-up parsing - Shift Reduce Parsing , Operator Precedent Parser – Operator precedence parsing, Operator Precedence functions, Error recovery in operator precedence parsing, LR Parsers - SLR Parser, Canonical LR Parser, and LALR Parser- Parser Generators.

Symbol Tables: Symbol table entries, Data structures for symbol table implementation, representing scope information.

UNIT III **CO3** **12 Periods**

Syntax Directed Translation: Syntax Directed definition- construction of syntax trees, Bottom-up evaluation of S-attribute Definitions-L-attribute Definitions.

Intermediate Code Generation: Intermediate languages – SDT scheme for Assignment Statements - SDT scheme for Case Statements-SDT scheme for Boolean Expressions, SDT scheme for Flow of control constructs - SDT scheme for Procedure calls.

UNIT IV **CO4** **12 Periods**

Code Generation: Issues in the design of code generator - The target machine - Runtime Storage management - Basic Blocks and Flow Graphs - Next-use Information - A simple Code generator - DAG representation of Basic Blocks.

Code Optimization: Introduction- Principal Sources of Optimization - Optimization of basic Blocks - Introduction to Global Data Flow Analysis- Peephole Optimization.

Run Time Environments: Source Language issues - Storage Organization - Storage Allocation strategies – Static allocation scheme, Stack allocation scheme, Heap allocation scheme- Access to non- local names - Parameter Passing methods- Call-by-Value, Call-by-Reference, Call-by-Name methods.

Text Book:

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools",Pearson Education Asia, 2007.

Reference Books:

1. Alfred V.Aho, Jeffrey D. Ullman, Principles of Compiler Design, Narosa publishing, 2002.
2. Lex & Yacc - John R. Levine, Tony Mason, Doug Brown, 2nd Edition, O'reilly
3. Engineering a Compiler - Keith Cooper & Linda Torezon, 2nd Edition Elsevier.

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CO 323 **INDUSTRIAL IoT** **L P C**

3 0 3

Course Objectives:

1. Learn and understand the Importance of IoT in industrial applications
2. Know how IoT has become a game changer in the new economy where the customers are looking for integrated value.
3. Apply the IoT concepts in building solutions to Industrial problems
4. Learn and understand the tools and techniques that enable IoT solution and Security aspects.

Course Outcomes:

At the end of this course the student will be able to:

1. Understand the elements of IoT to build a total control plane in an Industrial application
2. Apply M2M protocols for development of IoT Applications.
3. Learn and understand the concept of digitalization and data acquisition.
4. Build smart factory based on the concepts

Course Content:

UNIT I **CO1** **12 Periods**

INTRODUCTION: Introduction to IoT, IoT Vs. I IoT, History of I IoT, Components of I IoT -Sensors, Interface, Networks, People & Process, Hype cycle, IOT Market, Trends & future Real life examples, Key terms of IoT–IoT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of I IoT in Manufacturing Processes Use of I IoT in plant maintenance practices, Sustainability through Business excellence tools Challenges and Benefits in implementing I IoT.

UNIT II **CO2** **14 Periods**

ARCHITECTURES: Overview of IoT components: Various Architectures of IoT and I IoT, Advantages & disadvantages, Industrial Internet -Reference Architecture;

IoT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IoT.

SENSORS AND INTERFACING: Introduction to sensors, Transducers, Classification, Roles of sensors in I IoT, Various types of sensors, Design of sensors, sensor architecture, special requirements for I IoT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BAC net, Current, M2M etc.

UNIT III **CO3** **12 Periods**

PROTOCOLS AND CLOUD : Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, BAC net, BLE, Modbus, SPI, I2C, IIoT protocols –COAP, MQTT, 6LoWPAN, LWM2M, AMPQ IIoT cloud platforms: Overview of COTS cloud platforms, Predix, PTC Thing Worx, Microsoft Azure etc. Data analytics, cloud services, Business models: Saa S, Paa S, Iaa S.

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UNIT IV **CO4** **12 Periods**

SECURITY: Introduction to web security, Conventional web technology and relationship with IIoT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT, Network security techniques Management aspects of cyber security.
ANALYTICS: IoT Analytics: Role of Analytics in IoT, Data visualization Techniques.

Text Books:

1. Digital Twin Technologies and Smart Cities by Farsi, M., Daneshkhah, A., Hosseinian-Far, A., Jahankhani, H., Springer International Publishing, 2020.
2. Architecting the Internet of Things, by Michahelles, Springer, 2011

Reference Books:

1. The Internet of Things Connecting Objects to the Web" by Hakima Chaouchi,Willy Publications
2. The Internet of Things: Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi,2ndEdition, Willy Publications
3. Inside the Internet of Things (IoT), Deloitte University Press
4. Internet of Things-From Research and Innovation to Market Deployment; By Ovidiu& Peter; River Publishers Series
5. Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, by Daniel Minoli, BerndScholz-Reiter, Florian, Willy Publication

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Professional Elective-II Subjects		
CO 324		
1.	COEL05	Data Sciences for IoT
2.	COEL06	Cryptography & Network Security
3.	COEL07	Business Intelligence & Analytics
4.	COEL08	Natural Language Processing(LBD)

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CO 324 **COEL05: Data Sciences for IoT** **L P C**
3 0 3

Course Objectives:

This course will enable the students**:**

1. Demonstrate an understanding of statistics and machine learning concepts that are vital fordata science
2. Produce Python code to statistically analyze a dataset
3. Critically evaluate data visualizations based on their design and use for communicating stories from data
4. Able to understand Machine to machine web of things
5. Understanding the IOT problems in data science.

Course Outcomes:

1. Describe What Data Science Is and The Skill Sets Needed To Be A Data Scientist And The Significance of Exploratory Data Analysis (EDA) In Data Science
2. Able To Understand The Working Principle Of Wireless Networking Equipment's
3. Explore The IoT Protocols And Architecture
4. Ability To Learn The Security Aspects In IoT In Data Science.

Course Content:

UNIT I **CO1** **13 Periods**

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications. Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources

UNIT I **CO2** **12 Periods**

Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of Wireless Networking equipment's – Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

UNIT III **CO3** **12 Periods**

M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, Remote Controlling, and Performance Analysis. The Architecture the Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN Security aspects in IoT

UNIT IV **CO4** **13 Periods**

The IoT ecosystem, Unique considerations for the IoT ecosystem Addressing IoT problems in Data science time series data, enterprise IoT edge computing, real-time processing, cognitive computing, image processing, introduction to deep learning algorithms, geospatial analysis for IoT/managing massive geographic scale, strategies for integration with hardware, sensor fusion.

Learning Resources:

Text Books:

1. Cathy O'Neil And Rachel Schutt. Doing Data Science, Straight Talk From The Frontline.O'Reilly.
2. 6lowpan: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley
3. Internet Of Things: Converging Technologies For Smart Environments And Integrated Ecosystems, Dr. Ovidiuvermesan, Dr. Peter Friess, River Publishers

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CO 324 **COEL06: CRYPTOGRAPHY & NETWORK SECURITY** **L P C**

3 0 3

Course Objectives:

The Main objectives of This Course are to:

1. Introduce message encryption and decryption techniques for symmetric and Asymmetric cipher systems.
2. Impart knowledge on authentication and key distribution protocols.
3. Create awareness on protocols used to provide security at various layers of computer networks

Course Outcomes:

After successful completion of the course, students will be able to:

1. Discuss common network security vulnerabilities/ attacks
2. Explain classical symmetric encryption schemes.
3. Illustrate the concepts of public key encryption and key exchange protocols.
4. Explain MAC and Hashing techniques for message authentication.
5. Explain digital signatures, key management and distribution
6. Discuss the user authentication applications, web and E-Mail security mechanisms.

Course Content:

UNIT I **CO1** **13 Periods**

Introduction: Computer Security Concepts, The OS Is security architecture, Security Attacks, SecurityServices, Security Mechanisms, A model for Network Security.

Number Theory: Prime Numbers, Fermat's and Euler's theorem, testing for primality, The Chinese remainder theorem, Discrete logarithms.

Classical Encryption techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography.

UNIT I **CO2** **12 Periods**

Block Ciphers & Data Encryption Standard : Traditional Block Cipher Structure, Data EncryptionStandard, Strength of DES, Block Cipher Design Principles.

Advanced Encryption Standard(AES): AESstructure, AES Transformation functions AES key expansion.

Block Cipher operations:

Public key cryptography and RSA: Principles of public key crypto-systems , The RSA Algorithm. Other Public Key Crypto Systems: Diffie Hellman Key exchange, Elgamal Cryptographic System.

UNIT III **CO3** **12 Periods**

Crypto graphic Hash Functions: Applications of cryptographic hash functions, Hash function based on cipherblock chaining, SHA512, SHA-3.

Message Authentication codes: Message Authentication requirements, Message Authentication functions,MAC Based on Hash functions: HMAC

Digital signatures: Digital Signatures, ELGamal Digital Signature Scheme.

Key management and Distribution: Symmetric key distribution using Symmetric and asymmetric encryption , Distribution of public keys, X.509 Certificates.

UNIT IV **CO4** **12 Periods**

Userauthentication: Kerberos.

Transport Level Security: Web security Considerations, Transport Layer Security (TLS), Secure Shell (SSH)

E-Mail Security: S/MIME, Pretty Good Privacy(PGP)

IP Security: Overview, IP Security Policy, Encapsulating Security Payload.

Learning Resources:

Text Book:

1 Cryptography and Network Security Principles and Practice William Stallings, 7th Edition, Pearson Education.

Reference Books:

1 BehrouzA.Ferouzan,"Cryptography&NetworkSecurity",TataMcGrawHill,2007.
2 Man YoungRhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols",Wiley Publications, 2003.
3 Charles Pfleeger, "Security in Computing", 4thEdition, Prentice Hall of India, 2006.
4 Ulysess Black,"Internet Security Protocols", Pearson Education Asia,2000.

CO 324 **COEL07: Business Intelligence & Analytics** **L P C**
1 2 2

Course Objectives:

Data mining is the discovery of hidden information from historical data. With data mining, it is possibleto better manage product warranties, predict purchases of retail stock, unearth fraud, determine creditrisk, and define new products and services. This course introduces basic data mining technologies and their use for business intelligence.

Course Outcomes:

Upon completion of this course, learners should be able to:

1. Critically analyze advanced Business Intelligence and Business Analytics methodologies in order to access best practice guidance when applied to operational data of a business.
2. Investigate and evaluate key concepts and advanced Business Intelligence and Business Analytics techniques and assess how to apply which technique on complex datasets and practical problem domains.
3. Contextualize, research and utilize current data approaches, applications and technologies in order to develop Business and Business Analytics strategies to address the operational and analytical requirements of an organization.
4. Critically review and apply appropriate data mining research and assess research methods.

Course Content:

UNIT I **CO1** **13 Periods**

An Overview of Business Intelligence, Analytics and Decision Support A Framework for Business Intelligence (BI). Intelligence Creation Use and BI Governance. Transaction Processing Versus Analytic Processing. Successful BI Implementation. Analytics Overview. Brief introduction to Big Data Analytics Data Warehousing Process Overview. Data Warehousing Architectures. Data Integration and the Extraction, Transformation, and Load Processes. Data Warehouse Development. Data Warehousing Implementation Issues. Real-Time Data Warehousing. Data Warehouse Administration, Security Issues and Future Trends**[Chapter-1&2 Text book-1]**

UNIT II **CO2** **12 Periods**

Business Reporting Definitions and Concepts. Data and Information Visualization. Different Types of Charts and Graphs. The Emergence of Data Visualization and Visual Analytics. Performance Dashboards. Business Performance Management. Performance Measurement. Balanced Scorecards. Six Sigma as a Performance Measurement System

UNIT III **CO3** **12 Periods**

Data Mining Concepts and Applications. Data Mining Applications. Data Mining Process. Data Mining Methods. Data Mining Software Tools. Data Mining Myths and Blunders.

Text and Web Analytics.Text Analytics and Text Mining Overview. Natural Language Processing. Text Mining Applications. Text Mining Process. Sentiment Analysis. Web Mining Overview. Search Engines. Web Usage Mining (Web Analytics). Social Analytics **[Chapter-5 Text book-1]**

UNIT IV **CO4** **11 Periods**

Big Data and Analytics

Definition of Big Data. Fundamentals of Big Data Analytics. Big Data Technologies. Data Scientist. Big Data and Data Warehousing. Big Data Vendors. Big Data and Stream Analytics. Applications of Stream Analytics

Analytics: Emerging Trends and Future Impacts

Location-Based Analytics for Organizations. Analytics for Consumers. Recommendation Engines. The Web 2.0 Revolution and Online Social Networking. Cloud Computing and BI. Impacts of Analytics in Organizations: An Overview. Issues of Legality, Privacy, and Ethics. The Analytics Ecosystem

Learning Resources:

Text Books:

1. Business Intelligence: A Managerial Approach (2011) Turban, Sharda, Delen, King, Publisher: Prentice Hall, Edition: 2nd, ISBN: 13-978-0-136-
2. Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications by Larissa T. Moss

References

1. The Visual Display of Quantitative Information by Edward R. Tufte
2. Business Intelligence: Making Better Decisions Faster by Elizabeth Vitt , Michael Luckevich, Stacia Misner
3. Business Intelligence Competency Centers: A Team Approach to Maximizing Competitive Advantage (Hardcover)by Gloria J. Miller

CO 324 **COEL08: Natural Language Processing** **L P C**
3 0 3

Course Objectives:

The main objectives of this course are :

1. To understand the underlying concepts and techniques required f or natural language processing.
2. To create computational models for enabling effective and natural language processing

Course Outcomes:

After successful completion of the course, the students are able to:

1. Determine the structural components of sentences for a given Grammar.
2. Produce logical form that representscontext-independent meaning of a sentence.
3. Link logical forms with syntactic structures for semantic interpretation of the sentence.
4. Understand the ambiguity in natural language constructs and identify possible interpretations of a sentence.
5. Map the logical form to the Knowledge representation to generate contextual presentation.

Course Content:

UNIT I **CO 1** **12 Periods**

Introduction to Natural Language Understanding: Applications of Natural Language Understanding, Evaluating language Understanding Systems, The Different levels of Language Analysis.

Syntactic Processing: Grammars and Parsing, Grammars and Sentence Structure, Top- down parser, Bottom up chart parser, Transition network grammars, Top-down chart parsing, Finite state models and Morphological processing.

Features and Augmented Grammars: Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, A Simple Grammar Using Features, Parsing with Features, Augmented Transition Networks.

UNIT II **CO2** **12 Periods**

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling Questions in Context-Free Grammars.

Toward Efficient Parsing: Human preferences in parsing, Encoding Uncertainty-Shift- Reduce Parsers, A Deterministic Parser.

Ambiguity Resolution: Statistical Methods: Part of Speech tagging, Obtaining lexical probabilities, Probabilistic Context-Free Grammars, Best-First Parsing.

Semantic Interpretation: Semantics and logical Form: Semantics and Logical Form, Word Senses and Ambiguity, The Basic Logical Form Language, Encoding Ambiguity in the

UNIT III **CO3** **12 Periods**

Linking Syntax and Semantics: Semantic Interpretation and Compositionality, A Simple grammar and Lexicon with Semantic Interpretation, Prepositional Phrases and Verb Phrases.

Ambiguity Resolution: Selectional Restrictions, Semantic Filtering Using Selectional Restrictions, Statistical Word Sense Disambiguation.

Knowledge Representation and Reasoning: Knowledge representation, A Representation based on FOPC, Frames: representing Stereotypical Information, Handling Natural Language Quantification.

UNIT IV **CO4** **12 Periods**

Local discourse context and Reference: Defining Local Discourse Context and Discourse Entities, A Simple Model of Anaphora Based on History Lists, pronouns and Centering, Define Descriptions.

Using World Knowledge: Using world knowledge: Establishing Coherence, Matching against Expectations, Reference and Matching Expectations, Using Knowledge about Action and Casualty, Scripts: Understanding Stereotypical Situations

Discourse Structure: The Need for Discourse Structure, Segmentation and Cue Phrases, Discourse Structure and Reference, Relating Discourse Structure and Inference, Discourse Structure, Tense and Aspect, Managing the Attentional stack Logical Form,Verbs and States in Logical Form.

Learning Resources:

Text Book:

1. James Allen, Natural Language Understanding, Second Edition, Pearson Education.

Reference Books:

1. Daniel Jurafsky, James H.Martin, Speech and Language Processing.
2. Christopher Manning, Hinrich Schutze, Foundations of Statistical Natural Language Processing, MIT Press.
3. Elaine Rich and Kevin Knight, Artificial Intelligence, Second Edition, Tata Mc GrawHill.

Open/ Job Oriented Elective-II Subjects		
S.NO	**Subject Code**	**Name of the Subject**
CO 325		
1.	JOEL19	Embedded Systems
2.	JOEL22	Machine Learning

CO325 **JOEL19: EMBEDDED SYSTEMS** **L P C**
3 0 3

Course Objectives:

1. To understand the concept of an embedded system, to get the clarity of various design metrics for a system, understand the concept of improving productivity by presenting a unified view of software & hardware .
2. To understand general purpose processors and standard single purpose processors.
3. To grasp the advanced techniques for programming embedded systems including state machine models & concurrent process models.
4. To learn the details of task scheduling algorithms. Understand the commonalties and differences of the operating systems available off the shelf and to grasp the knowledge regarding various abstraction levels (syntheses) to be involved in the designing of an embeddedsystem.

Course Outcomes:

After successful completion of the course, the students are able to

1. Outline the knowledge on Processor, IC and Design Technologies, State machines and Models, communication interfaces and RTOs, Design process models.
2. Discover problems in optimization of custom single purpose processor and synchronizationamong processes and scheduling algorithms.
3. Distinguish Models, S.P.P and G.P.P, Priority Inversion and inheritance protocols, Embedded and real time and hand held operating systems.
4. Decide suitable hardware and software components of a system that work together to solve engineering problems to show a specific behavior.

Course Contents:

UNIT I **CO1** **10 Periods**

Introduction to embedded systems overview, design challenge, processor technology, IC technology, designtechnology, trade offs. Custom single-Purpose processors:

Hardware, Introduction: Combinational Logic, Sequential Logic, Custom Single-Purpose Processor Design, RT-Level Custom Single-Purpose Processor Design, Optimizing the Custom Single-purpose processors.

UNIT II **CO2** **10 Periods**

General purpose processors: Software, Introduction, Basic Architecture, Operation, programmers View. Development Environment, Application-Specific Instruction-Set Processors (ASIPs), Selecting a Microprocessor, General-Purpose Processor Design, Standard Single-Purpose Processors: Peripherals, **Introduction**: Timers, Counters and Watchdog Timers, UART, Pulse Width Modulators, LCD Controllers, Keypad Controllers, Steeper Motor Controllers, Analog-to-Digital Converters, Real-Time Clocks.

UNIT III **CO3** **10 Periods**

State machine and concurrent process models: Introduction, models vs languages, Text versus Graphics, An Introductory Example, FSM, FSMD, using state machines, HCFSM and the state charts language PSM, The role of an appropriate Model and Language concurrent process model, concurrent processes, communication and synchronization among processes, Implementation, data flow model and realtime systems.

UNIT IV **CO4** **10 Periods**

Embedded system and RTOS concepts: priority in version problem, priority in heritance protocol, embedded OS and real time OS, RT Linux, and Handheld OS. Design technology: Introduction, automation, synthesis, Verification: Hardware / Software Co-Simulation, Reuse: Intellectual Property Cores Design ProcessModels.

Learning Resources:

Text Books:

1. Frank Vahid, Tony D Givarg is - Embedded system design - A unified HW/ SW Introduction, John Wily & sons 2002.
2. KVKK Prasad - Embedded and real time systems, Dreem tech Press, 2005.

Reference Books:

1. Raj Kamal, Embedded system architecture, programming and design, TMH edition.
2. Jonathan W Valvano, Embedded Microcomputer Systems, Brooks/cole, Thompson Learning.
3. David E. Simon, An Embedded Software Primer, Pearson edition

Web Resources: http://nptel.iitm.ac.in/courses/

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CO 325 **JOEL22: MACHINE LEARNING** **L P C**

3 0 3

Course Objectives:

The main objectives of this course are to:

1. Basic concepts and applications of machine learning.
2. Supervised learning and its applications
3. unsupervised learning and its applications
4. multi layer perceptron's and kernel tricks

Course Outcomes:

After successful completion of the course, the students are able to:

1. apply the machine learning concepts in real life problems
2. design solutions for supervised learning problems
3. use rule sets and reinforcement learning to solve real world problems
4. discuss the issues in dimensionality reduction and unsupervised learning algorithms

Course Content:

Unit I **CO1** **12 periods**

Introduction: Well posed learning problems, Designing a Learning System, Perspectives and Issues in machine learning.

Concept Learning and general to specific ordering: concept learning Task , Concept learning as a search, Finding a Maximally Specific Hypothesis , Version Spaces and Candidate Elimination Algorithm, Remarks on Version space and candidate elimination.

Bayesian Learning: Bayes Theorem, Maximum Likelihood and Least Square Error Hypotheses, Bayes OptimalClassifier, Naïve-Bayes Classifier, Bayesian Belief Network.

Unit II **CO2** **12 periods**

Decision Tree Learning : Decision Tree Representation, appropriate problems for decision tree, the basicdecision tree Algorithm, Issues in decision tree learning.

Artificial Neural Networks: Introduction, Neural Network Representation, appropriate problems for neuralnetwork, Perceptron's, Multi layer Networks and the Back Propagation Algorithm.

Instance Based Learning: Introduction, KNN Learning, Locally Weighted Regression , Radial Bias Functions,Case-Based Reasoning.

Unit III **CO3** **12 periods**

Learning Sets of Rules: Sequential Covering Algorithm , Learning Rule Sets: summary , Learning First OrderRules, Learning set of first order rules :FOIL.

Reinforcement Learning: Introduction ,the Learning Task, Q Learning, Non Deterministic Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

Unit IV **CO4** **12 periods**

Dimensionality Reduction: Introduction, subset selection, Principal component analysis, Feature Embedding, Factor analysis, Singular Value Decomposition and Matrix factorization, Multi dimensional Scaling, Linear Discriminant analysis, Canonical correlation analysis.

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.

Learning Resources:

Text Books:

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. (UNITI, UNIT II, and UNIT III)
2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Prentice Hall of India, Third Edition 2014. (UNITIV).

Reference Books:

1. Stephen Marsland,—Machine learning: An Algorithmic Perspective‖, CRC Press, 2009
2. Machine Learning: A Probabilistic Perspective, Kevin P.Murphy, MIT Press, 2012
3. Foundations of Machine Learning, Mehryar Mohri, Afshin Rostamizade
4. Machine Learning-The Art and Science of Algorithms that Make Sense of Data, Peter. Flach, Cambridge.

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B.Tech., Computer Science & Engineering (IoT)

CO 361 **Wireless Sensor Networks Lab** **L P C**

0 3 1.5

Course Outcomes :

After successful completion of this course, students should be able to

1. Familiarize with protocol, design requirements, algorithms, and the cloud platform to meet the industrial requirement.
2. Establish the concept of addressing in WSN.
3. To design and connect, hardware platforms and software frameworks used to realize dynamic Wireless sensor network

1. **Wireless Sensor Networks (Any three practical's/ Programs on)**
   Network IP and basic network command and network configuration Commands, Routing Protocols,Simulation of Four Node Point to Point Network. Network simulators used for wireless Ad Hoc and Sensor Network
2. **Architecture of WSN's (Any three practical's/ Programs on)**
   Demonstrate one small network simulation script. Study various trace file formats of network simulators.
3. **Protocols for WSN's (Any three practical's/ Programs on)**
   To implement and compare various MAC layer protocols. To implement and compare AODV and DSRrouting algorithms in MANET. To implement DSDV routing algorithms in MANET
4. **Protocols Management for WSN's (Any three practical's/ Programs on)**
   To implement signal strength-based link management routing protocols. To calculate and compare average throughput for various TCP variants. To implement and compare various routing protocols for wireless sensor networks.
5. **Autonomic sensing and secure protocol design**
   Hands-on-experience on sensor network simulators (preferably: NS3 and QualNet).

Text Books:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

List of Experiments :

1. Introduction to network simulators used for wireless Ad Hoc and Sensor Networks.
2. Introduction to TCL scripting: demonstration of one small network simulation script.
3. To study various trace file formats of network simulators.
4. To implement and compare various MAC layer protocols.
5. To implement and compare AODV and DSR routing algorithms in MANET
6. To implement DSDV routing algorithms in MANET
7. To implement signal strength based link management routing protocols.
8. To calculate and compare average throughput for various TCP variants
9. To implement and compare various routing protocols for wireless sensor networks

CO362	**Industrial IoT Lab**	L	P	C
		0	3	1.5

Name of the Experiments:

1. To Interface Led with Arduino Uno and its Proteus Simulation.
2. To Interface Led and switch with Arduino Uno and its Proteus Simulation.
3. To Interface IR Sensor with Arduino Uno and its Proteus Simulation.
4. To Interface Rain Sensor with Arduino Uno and its Proteus Simulation.
5. To Interface Motor with Arduino Uno and its Proteus Simulation.
6. To Interface led and Relay with Arduino Uno and its Proteus Simulation.
7. Ladder Diagram for all the logic Gates in using Virtual Lab.
8. Ladder Diagram for given Expression using Virtual Lab.
9. To Interface Node MCU Connectivity with WIFI Network.
10. To Send field Data to Thing speak Server.
11. To Receive Data from Thing speak Server.

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SKILL Oriented Courses -4		
S.NO	**Subject Code**	**Name of the Subject**
COSL4		
1.	COSL4	Mobile App Development
2.	COSL4	Ethical Hacking

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COSL4 **Mobile App Development** **L P C**

1 2 2

Course Objectives:

The objectives of the course are:

1. Provide knowledge on tools required for Mobile Application Development using Android.
2. Discuss android User Interface using Views.
3. Impart Android User Interface for pictures and menus.
4. Introduce knowledge on android databases.

Course Outcomes:

After successful completion of the course, the students are able to

1. Install the required tools for android application development.
2. Design user interfaces for android applications.
3. Design user interfaces for menus using Views.
4. Develop android applications using android database.

Course Content:

UNIT I **CO1** **10 Periods**

Android Programming: What Is Android? Obtaining the Required Tools, Creating Your First Android Application.

Android studio for Application development: Exploring IDE, using code completion, debugging your Application, Generating a signed APK.

UNIT II **CO2** **10 Periods**

Activities, Fragments and Intents: Understanding Activities, Linking Activities Using Intents, Fragments, Displaying Notifications.

Android User Interface: Components of a Screen, Adapting To Display Orientation, Managing Changes to Screen Orientation, Utilizing the ActionBar, Creating the User Interface Programmatically.

UNIT III **CO3** **10 Periods**

User Interface with Views: Using Basic Views, Using Picker Views, Using List Views To Display Long Lists,Understanding Specialized Fragments.

Pictures and Menus with Views: Using Image Views to Display Pictures, Using Menus with Views.

UNIT IV **CO4** **10 Periods**

Using WebView Notifications-Creating and Displaying notifications, Displaying Toasts.

Data Persistence: Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases.

Learning Resources:

Text Books:

1. Beginning Android Programming with Android Studio, J.F.DiMarzio, Wiley India(Wrox),2017.

Reference Books:

1. Wei-MengLee, Beginning Android 4 Application Development, Wiley India(Wrox), 2012.
2. RetoMeier, Professional Android 4 Application Development, Wiley India(Wrox), 2012
3. James CSheusi, Android Application Development forJava Programmers, Cengage Learning, 2013

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COSL4 **ETHICAL HACKING** **L P C**
1 2 2

Course Objectives:

1. The aim of the course is to introduce the methodologies and framework of ethical hackingfor enhancing the security
2. The course includes-Impacts of Hacking; Types of Hackers; Information Security Models; Information Security Program; Business Perspective; Planning a Controlled Attack
3. Frame work of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration).

Course Outcomes:

1. Gain the knowledge of the use and availability of tools to support an ethical Hack
2. Gain the knowledge of interpreting the results of a controlled attack
3. Understand the role of politics, inherent and imposed limitations and metrics for planningof a test
4. Comprehend the dangers associated with penetration testing

Course Content:

UNIT I **CO1** **10 Periods**

Introduction: Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration Information

Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

UNIT II **CO2** **12 Periods**

The Business Perspective: Business Objectives, Security Policy, Previous Test Results and Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks.

Preparing for a Hack: Technical Preparation, Managing the Engagement Reconnaissance: Social Engineering, Physical Security, and Internet Reconnaissance

UNIT III **CO3** **9 Periods**

Enumeration: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase Exploitation: Intutive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, Root Kits, applications, Wardialing, Network, Services and Areas of Concern.

UNIT IV **CO4** **8 Periods**

Deliverable: The Deliverable, The Document, Overall Structure, Aligning Findings,

Presentation Integration: Integrating the Results, Integration Summary, Mitigation, DefensePlanning, Incident Management, Security Policy, Conclusion.

Text Book:

1. James S. Tiller, —The Ethical Hack: A Framework for Business Value Penetration Testing‖, Auerbach Publications, CRC Press

Reference Books:

1. EC-Council, —Ethical Hacking and Countermeasures Attack Phases‖, Cengage Learning
2. Michael Simpson, Kent Backman, James Corley, —Hands-On Ethical Hacking and Network Defense , Cengage Learning