Professional Elective Courses

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
Semester : **Fifth**			Course Category Code: **PEC**				Semester Exam Type:**TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSY01	**Graphics and Image Processing**		3	-	-	3	40	60	100
Prerequisite	**Nil**								
Course Outcome	**CO1**	Understand the components of graphics and image processing applications.							
	CO2	Develop design and implement 2D graphical structures.							
	CO3	Understand the intricacies of graphics and image processing							
	CO4	Convert verbal descriptions to graphical images and vice versa for various applications							
	CO5	Develop algorithms for various graphics and image processing applications							
UNIT-I	**Graphics Systems and Graphical User Interface**					**Periods: 9**			
Pixel – Resolution– Types of Video Display Devices – Graphical Input Devices – Graphical Output Devices – Hard Copy Devices – Direct Screen Interaction – Logical Input Function – GKS User Dialogue – Interactive Picture Construction Techniques.									**CO1 CO3**
UNIT-II	**Display Primitives and Transformations**					**Periods: 9**			
Geometric Display Primitives and Attributes: Geometric Display Primitives – Points– Lines and Polygons – Point Display Method – Line Drawing Methods – Circle Methods. 2D Transformations and Viewing**:** Types of Transformations – Matrix Representation – Concatenation – Scaling– Rotation – Translation– Shearing – Mirroring– Homogeneous Coordinates Transformations. Window to View Port Transformations: Windowing And Clipping: Point – Lines– Polygons – Boundary Intersection Methods.									**CO2 CO4**
UNIT-III	**Digital Image Fundamentals**					**Periods: 9**			
Nature of Image Processing and Its Applications – Image Representations – Image Types – Image Processing Operations – Image Acquisition – Image Sampling and Quantization – Image Quality – Image Storage and File Formats – Image Processing Operations – Need for Image Transforms – Fourier Transforms and Its Properties – Haar Transforms and Its Applications.									**CO1 CO3**
UNIT-IV	**Image Enhancement and Restoration**					**Periods: 9**			
Need for Enhancements – Point operations – Histogram Techniques – Spatial filtering concepts – Frequency Domain Filtering – Image Smoothening – Image Sharpening - Image degradation and Noise Models – Introduction to Restoration Techniques.									**CO5**
UNIT-V	**Image Processing Activities**					**Periods: 9**			
Image Compression: Compression Models and Measures – Coding Types – Types of Redundancy – Lossless Compression Algorithms – Lossy Compression Algorithms – Introduction to Compression Standards. Image Segmentation**:** Detection of Discontinuities – Edge Detection – Thresholding – Region Based Segmentation – Introduction to Color Image Processing – Introduction to Morphological Operations and Image Processing Framework**.**									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**				**Total Periods: 45**		
Reference Books									
1. Donald D. Hearn, M. Pauline Baker, Computer Graphics C version, Pearson Education, 2014. 2. S. Sridhar, Digital Image Processing, First Edition, Oxford Press, 2011.									

Department : **Computer Science and Engineering**			Programme: **B.Tech. (CS)**						
SEMESTER : **Fifth**			Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CA	SE	TM
CSY02	**Software Design and Testing**		3	-	-	3	40	60	100
Prerequisite	**Software Engineering**								
Course Outcome	**CO1**	Understand the object oriented approach and UML models							
	CO2	Understand the relationship between class diagram and design class and state diagram							
	CO3	Develop activity diagrams for and to apply the implementation diagrams to develop architecture							
	CO4	Understand testing principles and apply basic testing techniques for a given programme							
	CO5	Understand the use software tools and apply testing techniques to object oriented programs							
UNIT-I	**Unified Modeling Languages and Models**					**Periods: 9**			
Rational Unified Process-Unified Modeling Languages -UML models – Introduction to the case study - Requirements for the Wheels case study system –Requirements engineering - Requirements elicitation - List of requirements for the Wheels system-Use cases- Use case diagram – Use case descriptions – Actor and actor descriptions - Use case relationship : communication association, include and extend - Boundary - Using the use case model in system development.									**CO1**
UNIT-II	**Class and State Diagrams**					**Periods: 9**			
Basics – Object – classes - Relationships between classes - The class diagram- Stages in building a class diagram - Packages - Using the class diagram in system development. State Diagrams - States and events -Constructing a state diagram - Using state diagrams in system development.									**CO2**
UNIT-III	**Activity and Implementation Diagrams**					**Periods: 9**			
Activity Diagrams Introduction - Modeling a sequence of activities - Modeling alternative courses of action - modeling iteration of activities - Modeling activities that are carried out in parallel – Swimlanes – Design - Architecture - Implementation diagrams The user interface Dealing with persistent data.									**CO3**
UNIT-IV	**Principles of Testing and Testing Strategies**					**Periods: 9**			
Principles of Testing: Context of Testing in Producing Software- The Incomplete Car- Dijkstra's Doctrine -A Test in Time- Example - Test the Tests First-The Pesticide Paradox - Example Convoy, Rags, The Policemen, Pendualm, Men in Black - Automation Syndrome – White box testing: Static Testing - Static Analysis Tools-Structural Testing -Challenges in White Box Testing black box testing: When to do Black Box Testing- How to do Black Box Testing – Integration testing: Integration Testing as a Type of Testing -Integration Testing as a Phase of Testing - Scenario Testing - Defect Bash System and acceptance testing – The need-- Functional and Non-Functional Testing - Acceptance Testing.									**CO4**
UNIT-V	**Non-Functional Testing Techniques**					**Periods: 9**			
Performance testing: Factors -Methodology -Tools for Performance Testing-Process - Challenges – Internationalization testing: Primer- Language -Character Set- Phases Enabling Testing - Locale – Validation- Fake Language and Language Testing – Localization. Object oriented testing- OO systems-Primer-Differences. Software test automation: Skills-Scope-Design and Architecture for Automation - Generic Requirements for Test Tool/Framework -Process Model- Process Model for Automation - Selecting a Test Tool.									**CO5**
Lecture Periods: 45	**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**			

Reference Books

1. Carol Britton and Jill Doake, Student Guide to Object - Oriented Development, Elsevier, 2007.
2. Srinivasan Desikan and Gopalaswamy Ramesh, Software testing –Principles and Practices, First Edition, Pearson Education, 2009.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Fifth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY03	**Python Programming**	3	-	-	3	40	60	100
Prerequisite	**Nil**							

Course Outcome		
	CO1	Select the basic and advanced features of core language built-ins
	CO2	Apply core and standard python programming features for problem solving
	CO3	Select standard libraries to control and handle system / OS level features
	CO4	Develop socket and internet programming using client and server side scripts
	CO5	Design and develop basic applications with database connectivity

UNIT-I	**Core Python: Basics**	**Periods: 9**
Introduction to Python, Python Interpreter and its working, Syntax and Semantics, Data Types, operators, loops, Assignments and Expressions, Control Flow Statements. Illustrative problems: exchange the values of two variables, circulate the values of n variables, distance between two points, Guess an integer number in a range, Towers of Hanoi.		**CO1**
UNIT-II	**Core Python: Advanced Features**	**Periods: 9**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing. Functions and lambda expressions. Iterations and Comprehensions, Handling text files Modules, reading and writing files, Classes and OOP Exception Handling, Strings and Regular Expression. Packages. Illustrative programs: square root, gcd, exponentiation, sum of array values, linear search, binary search, selection sort, insertion sort, merge sort, histogram, word count, copy file.		**CO1** **CO2**
UNIT-III	**System Programming**	**Periods: 9**
System tools: OS and System modules, Directory Traversal tools, Parallel System tools threading and queue, Program Exits.		**CO2** **CO3**
UNIT-IV	**Network and Web Programming**	**Periods: 9**
Socket Programming: Handling Multiple Connections, Client Server Programming, Client Side Scripting, urlib, Server Side Scripting: CGI Scripts with User Interaction, Passing Parameters. Sending Mail: SMTP protocol – Sending Email using Python.		**CO4**
UNIT-V	**GUI Programming and Database Connectivity**	**Periods: 9**
Introduction to tkinter, Top Level Windows, Dialogs, Message and Entry Event Handling, Menus, Listboxes and Scrollbars, Text. Database – SQLDB – Database connection – Python code for Insert, Update, Delete operations, Database Transactions.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Mark Lutz, Learning Python, O Reily, Fifth Edition, 2013.
2. Eric Matthes, Python Crash Course, Second Edition, No Starch Press, 2016.
3. Tim Hall and J-P Stacey, Python 3 for Absolute Beginners, 2009.
4. Magnus Lie Hetland, Beginning Python: From Novice to Professional", Second Edition, 2009.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Sixth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY04	**Data Mining and Data Warehousing**	3	-	-	3	40	60	100
Prerequisite	**Database management systems**							
Course Outcome	**CO1**	Describe the basic concepts, issues and applications of data mining						
	CO2	Comprehend association and correlation analysis from single dimension to high dimensional data						
	CO3	Explain classification and prediction using various methods						
	CO4	Understand cluster analysis and detection of outliers						
	CO5	Develop data warehousing and online analytical processing using Cube						

UNIT-I	**Introduction to Data Mining**	**Periods: 9**
Data Mining, Kinds, Patterns, Technologies, Application, Issues, Data Objects and Attributes Types, Basic Statistical Description of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Pre-processing: An Overview, Data Cleaning, Data Integration, Reduction, Data Transformation and Data Discretization.		**CO1**
UNIT-II	**Association and Correlation Analysis**	**Periods: 9**
Basic Concepts and Methods, Frequent Itemset Mining Methods, Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining, Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequency Pattern Mining, Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Approximate Pattern, Pattern Exploration and Application.		**CO2**
UNIT-III	**Classification and Prediction**	**Periods: 9**
Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule- Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy. Classification Advanced Methods: Beyesian Belief Networks, Classification by Back propagation, Classification using Frequent Patterns, and Other Classification Methods.		**CO3**
UNIT-IV	**Cluster Analysis Basic Concepts and Methods**	**Periods: 9**
Cluster Analysis, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, and Evaluation of Clustering. Advanced Cluster Analysis: Probabilistic Model-Based Analysis. Clustering High-Dimensional Data, Clustering Graph and Network Data, Clustering with Constraints. Outlier Detection: Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Clustering-Based Approaches, Classification-Based Approaches, Outlier Detection in High-Dimensional Data.		**CO4**
UNIT-V	**Data Warehousing and Online Analytical Processing**	**Periods: 9**
Data Warehouse: Basic Concepts. Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation. Data Cube Technology: Data Cube Computation Concepts, Data Cube Computation Methods, Processing Advanced Kinds of Queues, Multidimensional Data Analysis in Cube Space.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, Third Edition, Morgan Kauffman Publishers, 2012.
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining and OLAP, Tata McGraw-Hill, 2004. Reprint 2014.
3. Pangning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining, Pearson India Education Services, 2016.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Sixth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY05	**Internet of Things**	3	-	-	3	40	60	100
Prerequisite	**Computer networks**							

Course Outcome	**CO1**	Understand the basic terminologies, evolution and contemporary technologies.
	CO2	Learn the characteristics of sensors and actuators as Things, get a technical insight into the media access layer protocol standards
	CO3	Identify the key challenges in designing transport layer protocols and understand the existing standard protocols for IoT applications
	CO4	Apply the knowledge of embedded system design to design and develop IoT applications using state of the art platforms and tools
	CO5	Able to relate the usescases among the ocean of emerging IoT applications

UNIT – I	**IoT – Introduction, Evolution and Applications**	**Periods: 9**
Emergence of IoT – Impact of IoT – Architectures: oneM2M, IoTWF, OpenIoT standards, SOA based – API oriented - Core IoT Functional Stack –IoT and Cloud – Fog and Edge Computing – IoT Applications – Industry IoT – Cognitive IoT – Social and Semantic IoT.		**CO1**
UNIT-II	**Enabling Technologies and Standards for IoT**	**Periods: 9**
Smart Objects – Sensors – Actuators – MEMS – WSNs – Communication Criteria – IEEE 802.15.4 a/g/e standards – IEEE 1901.2 and IEEE 802.11 ah standards – LoRAWAN – NB-IoT – LTE-M.		**CO2**
UNIT-III	**IoT Network and Application Layer Protocols**	**Periods: 9**
Optimization of IP for IoT – 6LoWPAN – 6Lo – 6TiSCH – Authentication and Encryption on Constrained nodes – TinyTO- IP for Smart Objects – IoT Application Layer Protocols: CoAP, MQTT.		**CO3**
UNIT-IV	**Design and Development of IoT**	**Periods: 9**
IoT design methodology – Case Study: Weather monitoring – IoT devices – Raspberry Pi –Intel's Auduino - interfaces – programming – WAMP – Xively cloud – RESTful web API – Amazon web services: EC2, SQS, DynamoDB – Hadoop Ecosystem – Netflow analytics.		**CO4**
UNIT-V	**Use Cases and Advanced Topics**	**Periods: 9**
Industrial Automation Control Protocols: Ethernet/IP and CIP, PROFINET, MRP, Modbus/TCP. – Smart and Connected Cities: Connected Street Lighting – Smart Traffic Control – Smart Parking usecases – IoT architecture for Transportation.		**CO1 CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, First Edition, Pearson Education, 2017.
2. Arshdeep Bagha and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press (India), 2017.
3. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things– Principles and Paradigms, Morgan Kauffman, 2016.
4. Pethuru Raj, Anupama C. Raman, The Internet of Things – Enabling Technologies, Platforms and Use Cases, CRC Press, 2017.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Sixth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY06	**Mobile Application Development**	3	-	-	3	40	60	100
Prerequisite	**Nil**							
Course Outcome	**CO1**	Adapt unique features of Android in application development						
	CO2	Model android applications using fragments and controls						
	CO3	Demonstrate knowledge of different services of android						
	CO4	Design applications with the technology of android storage						
	CO5	Develop and test real time applications with android						
UNIT-I	**Basics of Building Android Application**				**Periods: 9**			
Features, Android Development Environment Android Architecture: Android Software Stack, Linux Kernel, Android Runtime - Dalvik Virtual Machine, Gradle, Building blocks, Intent, Activity, Activity Lifecycle and Android Layout Managers.								**CO1**
UNIT-II	**Fragments and Controls**				**Periods: 9**			
Fragments- passing data, Interfragment communication, Custom Styles & Themes, Animation, Retrieving Data from Users - controls - common-Text- Button- Widgets, Alert Dialog, Toast, Menus, Event Handling.								**CO2**
UNIT-III	**Services and Broadcasting**				**Periods: 9**			
Android Manifest XML, Services, Android Broadcast Intent and Broadcast Receiver, Basics of networking in Android -Asynctask- HttpUrlConnection, Threading and handlers - Multithreading, Background Services, Android Job Scheduling Task, Notifications.								**CO1 CO3**
UNIT-IV	**Content Providers**				**Periods: 9**			
Access files in Assets, Access Resources, Saving or Loading data and files, SQLite Databases, Content Providers, Shared Preferences, Internal Storage, and External Storage.								**CO4**
UNIT-V	**Building Applications**				**Periods: 9**			
Telephony Services, SMS Messages, Sending Email, Introduction to Location-Based Service, **Multimedia:** Playing Audio- Video and Media player, Gaming, Android Security and Testing.								**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 45**			
Reference Books								
1. Neil Smyth, Android Studio 3.0 Development Essentials – Android 8 Edition, 2017. 2. Barry Burd, Android Application Development All-in-One for Dummies, 2012. 3. Reto Meier and Ian Lake, Professional Android, Fourth Edition, John Wiley and Sons, 2018.								

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Sixth**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY07	**Mobile Communication and Computing**	3	-	-	3	40	60	100
Prerequisite	**Computer networks**							

Course Outcome		
	CO1	Learn and understand the wireless and mobile communication fundamentals
	CO2	Extend the concepts of wired LANS to wireless and learn the criteria for classifying the types of wireless LAN standards
	CO3	Recall the layered perspectives of computer networks and appraise the specific challenges in the design of routing and transport layer protocols
	CO4	Identify the specific challenges in building databases in mobile computing environment
	CO5	Illustrate the design challenges of mobile devices and m-commerce platforms

UNIT – I	**Mobile Communication Fundamentals**	**Periods: 9**
Wireless Communications – evolution – applications – reference model – frequencies for radio transmission – Signal propagation – multiplexing – modulation – spread spectrum –Medium Access – SDMA, TDMA, FDMA and CDMA.		**CO1**
UNIT-II	**Wireless LAN and PAN**	**Periods: 9**
Infrastructure Vs. Ad-hoc Network – Hidden and Exposed Node problems - IEEE 802.11 a/b/g standards – Bluetooth – Layered architecture – Service Discovery – Profiles – IEEE 802.15 Zigbee – 6LoWPAN.		**CO2**
UNIT-III	**Wireless Routing and Transport Layer**	**Periods: 9**
Mobile IP – Motivation – Tunneling – Encapsulation – DHCP – MANETs – DSDV – DSR – ZRP – AODV - LAR – Mobile TCP – STCP – Indirect TCP – Transaction-Oriented TCP.		**CO3**
UNIT-IV	**Mobile Computing – Database Perspectives**	**Periods: 9**
Mobile Databases – Issues in transaction processing – Data Dissemination – Atomicity and Consistency Relaxation – Isolation and Durability relaxation – Data Replication – Mobile transaction models – Rollback process – Two-Phase Commit – Query Processing and Optimization.		**CO4**
UNIT-V	**Mobile computing Platforms and Security**	**Periods: 9**
Mobile Devices and Web Clients – WAP – J2ME – Android Application Development – Mobile Commerce – B2C – B2B – Mobile Payment Systems – Security Issues.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Jochen Schiller, Mobile Communications, Second Edition, Addison Wesley, 2012
2. Prasanth Kumar Patnaik and Rajib Mall, Fundamentals of Mobile Computing, Second Edition, Prentice Hall (India), 2016
3. M. Bala Krishna, Jaime Lloret Mauri, Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks, First Edition, CRC Press, 2016
4. Mazliza Othman, Principles of Mobile Computing and Communications, First Edition, Auerbach Publications, 2007

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Seventh**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY08	**Embedded Systems**	3	-	-	3	40	60	100
Prerequisite	**Microprocessors and Microcontrollers, Operating Systems**							
Course Outcome	**CO1**	Understand the concepts of embedded processors						
	CO2	Learn the programming details of embedded systems						
	CO3	Develop embedded systems for real world applications using ARM processors						
	CO4	Understand the real time operating system concepts.						
	CO5	Design and development of basic embedded system using Intel Arduino						

UNIT-I	**Introduction to Embedded Systems**	**Periods: 9**
Processor in Embedded System – Other Hardware Units in the Embedded System – Software Embedded into a System - ARM Architecture: ARM Design Philosophy - Registers - Program Status Register - Instruction Pipeline - Interrupts and Vector Table - Architecture Revision - ARM Processor Families.		**CO1**
UNIT-II	**ARM Assembly Programming**	**Periods: 9**
Instruction Set - Data Processing Instructions - Addressing Modes - Branch, Load, Store Instructions - PSR Instructions - Conditional Instructions. Thumb Instruction Set - Register Usage - Other BranchInstructions - Data Processing Instructions - Single-Register and Multi Register Load-Store Instructions- Stack - Software Interrupt Instructions.		**CO2**
UNIT-III	**ARM Programming using C**	**Periods: 9**
Optimizing Assembly Code - Profiling and Cycle Counting – Instruction Scheduling – Register Allocation – Conditional Execution – Looping Constructs – Bit Manipulation – Efficient Switches – Optimized Primitives. Simple C Programs using Function Calls – Pointers – Structures.		**CO2 CO3**
UNIT-IV	**Real Time Operating Systems**	**Periods: 9**
Fundamental Components, Simple Little Operating System, Cache Memory - Cache Architecture - Cache Policy -Coprocessor and Caches-Flushing and Cleaning Cache Memory -Cache Lockdown - Caches and Software Performance. Memory Protection Units-Protected Regions-Initializing the MPU, Caches, and Write Buffer -Demonstration of an MPU system. Memory Management - A Small Virtual Memory System.		**CO4**
UNIT-V	**Basic Embedded System Developments**	**Periods: 9**
Intel Arduino features – Architecture – Instruction set – Arduino IDE –Programming using C – Introduction to Intel Galileo- Features. Programs for linking an LED without using thedelay() function, Controlling the Stepper Motor and Dimming a LED.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Andrew N Sloss, D. Symes and C. Wright, ARM System Developers Guide, Morgan Kaufmann/Elsevier, 2006.
2. Qing Li, Real Time Concepts for Embedded Systems –Elsevier, 2011.
3. Julien Bayle, C Programming for Arduino, Packt Publishing Ltd, 2013.
4. Wayne Wolf, Computer as Components: Principles of Embedded Computer System Design, Elsevier, 2006.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Seventh**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY09	**Cloud Computing**	3	-	-	3	40	60	100
Prerequisite	**NIL**							
Course Outcome	**CO1**	Describe the basic concept and characteristics of cloud computing						
	CO2	Understand the concept of virtualization and data center automation						
	CO3	Discuss the architectural design of computer						
	CO4	Analyze the different cloud software utility architecture						
	CO5	Discuss various cloud security models						

UNIT-I	**Cloud Computing Architecture and Model**	**Periods: 9**
Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models: Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public Vs Private Cloud – Cloud Solutions - Cloud Ecosystem – Service Management – Computing on Demand.		**CO1**
UNIT-II	**Virtual Machine**	**Periods: 9**
Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures- Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management–Virtualization for Data-center Automation.		**CO2**
UNIT-III	**Cloud Infrastructure**	**Periods: 9**
Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.		**CO3**
UNIT-IV	**Software Utility Application**	**Periods: 9**
Software Utility Application Architecture – Characteristics of SaaS – Software Utility Application – Cost Versus Value – Software Application Framework – Common Enablers – Conceptual view to Reality – Business Profits – Implementing Database System for Multitenant Architecture.		**CO4**
UNIT-V	**Cloud Security**	**Periods: 9**
Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security –Virtual Machine Security - Identity Management and Access Control – Autonomic Security.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Kai Hwang, Geoffrey C Fox and Jack G Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2016.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing Principles and Paradigms, Wiley Publications, 2017.
3. Alfredo Mendoza, Utility Computing Technologies, Standard, and Strategies Artech House INC, 2017.
4. Arshdeep Bahga, Vijay Madisetti, Cloud Computing, University Press, 2016.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Seventh**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY10	**Machine Learning**	3	-	-	3	40	60	100
Prerequisite	**NIL**							
Course Outcome	**CO1**	Demonstrate understanding of different types of learning algorithms						
	CO2	Discuss decision making under uncertainty and estimate probabilities						
	CO3	Analyze learning from multiple inputs and feature selection methods						
	CO4	Evaluate learning from mixture of distributions and hierarchical data structure						
	CO5	Understand artificial neural network structure, training algorithms and usage of Markov models to model input sequences						

UNIT-I	**Introduction to Machine Learning**	**Periods: 9**
Introduction to Machine Learning – Applications – Learning Associations – Classification – Regression – Unsupervised Learning – Reinforcement Learning – Supervised Learning – Vapnik-Chervonenkis (VC) Dimension – Probably Approximately Correct (PAC) Learning – Noise – Learning multiple classes – Model selection and Generalization.		**CO1**
UNIT-II	**Bayesian Decision Theory and Parametric Methods**	**Periods: 9**
Bayesian Decision Theory – Classification – Losses and Risks – Discriminant Functions –Parametric methods – Maximum Likelihood estimation – Bernoulli Density – Multinomial Density – Gaussian Density – Evaluating an Estimator: Bias and Variance – Tuning Model complexity: Bias/Variance Dilemma – Model selection procedures.		**CO2**
UNIT-III	**Multivariate Methods and Dimensionality Reduction**	**Periods: 9**
Multivariate methods – Parameter estimation – Multivariate Normal Distribution – Tuning Complexity – Discrete Features – Multivariate regression – Dimensionality reduction – Subset selection – Principal component analysis – Factor analysis – Multidimensional scaling – Linear discriminant analysis.		**CO3**
UNIT-IV	**Clustering and Decision Trees**	**Periods: 9**
Clustering – Mixture densities – k-Means clustering – Expectation-Maximization algorithm – Hierarchical clustering – Non-parametric methods – Histogram estimator – Kernel estimator – k-Nearest neighbor estimator – Decision trees – Univariate trees – Pruning – Rule extraction from trees – Learning rules from data – Multivariate trees.		**CO4**
UNIT-V	**Multilayer Perceptrons and Hidden Markov Models**	**Periods: 9**
Introduction- The perceptron – Training a perceptron – Back propagation algorithm – Local models – Competitive learning – Radial basis functions – Mixture of experts – Hidden Markov models – Discrete Markov processes – Evaluation problem – Finding the State sequence – Learning model parameters – Model selection in HMMs.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. Ethem Alpaydin, Introduction to Machine Learning, Third Edition, MIT Press, 2014.
2. Tom M. Mitchell, Machine Learning, McGraw Hill Education (India) Edition, 2013.

Department : **Computer Science and Engineering**		Programme: **B.Tech. (CS)**						
Semester : **Seventh**		Course Category Code: **PEC**				Semester Exam Type: **TY**		
Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
CSY11	**Business Intelligence**	3	-	-	3	40	60	100
Prerequisite	**NIL**							

Course Outcome		
	CO1	Demonstrate understanding of business intelligence
	CO2	Ability to develop decision support systems
	CO3	Select appropriate dm tools and methods to manipulate
	CO4	Study and analysis the time series data in business intelligence
	CO5	Understand the operation procedures of bi projects in an organization

UNIT-I	**Introduction to Business Intelligence**	**Periods: 9**
Effective and Timely Decisions, Data, Information and Knowledge, Role of Mathematical Models, Business Intelligence Architectures, Cycle of a Business Intelligence Analysis, Enabling Factors in Business Intelligence Projects, Development of a Business Intelligence System, Ethics and Business Intelligence.		**CO1**
UNIT-II	**Decision Support Systems**	**Periods: 9**
Definition of System, Representation of the Decision-Making Process, Rationality and Problem Solving, Decision-Making Process, Types of Decisions, Approaches to the Decision-Making Process, Evolution of Information Systems, Definition of Decision Support System, Development of a Decision Support System.		**CO2**
UNIT-III	**Mathematical Models for Decision Making**	**Periods: 9**
Mathematical Models for Decision Making- Data Mining- Definition of Data Mining - Representation of Input Data - Data Mining Process - Analysis Methodologies -Data Preparation- Data Validation - Data Transformation – Data Reduction –Data Exploration- Univariate Analysis- Bivariate Analysis- Multivariate Analysis - Regression – Structure of Regression Models- Simple Linear Regression- Multiple Linear Regression- Validation of Regression Models - Selection of Predictive Variables.		**CO3**
UNIT-IV	**Time Series Data in Business Intelligence**	**Periods: 9**
Definition of Time Series - Evaluating Time Series Models- Analysis of the Components of Time Series - Exponential Smoothing Models- Autoregressive Models- Combination of Predictive Models- The Forecasting Process.		**CO4**
UNIT-V	**Business Intelligence Applications**	**Periods: 9**
Marketing Models -Relational Marketing, Motivations and Objectives, Environment for Relational Marketing Analysis, Lifetime Value, Effect of Latency in Predictive Models, Acquisition, Retention, Cross-Selling and Upselling, Market Basket Analysis, Web Mining, Sales Force Management, Decision Processes in Sales Force Management, Models for Sales Force Management, Response Functions, Sales Territory Design, Calls and Product Presentations Planning, Business Case Studies.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Reference Books

1. John Wiley & sons and Carlo Vercellis, Business Intelligence, 2009.
2. Elizabeth Vitt, Michael Luckevich, Business Intelligence: Making Better Decision, Microsoft Press, 2002.
3. Larissa, T. Moss and ShakuAtre, Business Intelligence Roadmap: The Complete Project Life cycle for Decision Support systems, Addison – Wesley, 2008.
4. Turban, E. Sharda, R., and Delen, D., Decision Support and Business Intelligence Systems, Ninth Edition, Pearson, 2011.