POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING,
KALABURAGI.
Scheme of Teaching and Examination 2018-19
(Effective from the academic year 2018-19)

VII Semester

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self Study	Duration in hours	SEE Marks	CIE Marks	Total	
1.	PC	18IS71	Internet of Things	ISE	4	--	--		03	50	50	100	4
2.	PC	18IS72	Web Application Security	ISE	4	--	--		03	50	50	100	4
3.	PE	18IS73X	Elective - C	ISE	3	-	--		03	50	50	100	3
4.	PE	18IS74X	Elective – D	ISE	3	--	--		03	50	50	100	3
5	OE	18IS7OE	Open Elective	ISE	3	--	--		03	50	50	100	3
6	PC	18ISL71	Web Application security lab	ISE		-	1		03	50	50	100	1
7	PC	18ISS1	Seminar/Case study/ Group work	ISE		-	1		03	--	50	50	1
8	PROJ	18ISP1	Project work Phase – I	ISE			2		03	50	50	100	2
9	INT	18ISIN74	Internship	(TO be carried out during the intervening vacations of VI and VII semesters									
	Total				16	--	04	--	24	350	400	750	21
	Note:PC:Professional core, PE: Professional Elective, OE: Open Elective, MP: Mini-Project, INT: Internship.												
	Internship: All the student admitted to III year of BE/B.Tech have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and/or VII and VIII semesters.												

ELECTIVE - C		
Sl.No	Course	Course-ID
1	User interface design	18IS731
2	Software Architecture	18IS732
3	Storage Area Network	18IS733

ELECTIVE - D		
Sl.No	Course	Course-ID
1	Machine Learning	18IS741
2	Real time system	18IS742
3	Mobile Adhoc Network	18IS743

Open Elective		
Sl.No	Course	Course-ID

1	Data science	18IS7OE

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VIII Semester

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	Duration in hours	SEE Mark	CIE Mark	Total Marks	
1.	PC	18IS81	Big Data Analytics	ISE	4		--	03	50	50	100	4
2.	PE	18IS82X	Professional Elective E	ISE	3	2	--	03	50	50	100	3
3.	PE	18IS8OE	Open Elective	ISE	3	-	--	03	50	50	100	3
4	OE	18ISMC84	Certification Course (NPTEL/ MOOC)	ISE	--	2	--	--	50	50	100	1
5	PC	18ISP2	Project Work Phase- II	ISE		-	03	03	50	50	100	8
6	INT	18ISIM81	Internship	(Completed During the intervening vacations of VI and semesters and /or VII and VIII Semesters.)					50	50	100	2
	Total				09	04	03	12	200	200	400	21
	Note: PC: Professional core, PE: Professional Elective, OE: Open Elective, MP: Mini-Project, INT: Internship.											
	Internship: All the student admitted to III year of BE/B. Tech have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and/or VII and VIII semesters.											

Elective -E	Course ID
Virtual Augmented Reality	18IS821
Digital Image Processing	18IS822
Game Theory	18IS823

Open Elective		
Sl.No	Course	Course-ID
1	Web Technology And Applications	18IS8OE

Credit Compliance for The B.E/ B. Tech. Degree Curriculum			
Course category	**VTU**	**AICTE**	**PDACEK**
Humanities , Social Sciences and Management (HSMC)	10	12	09
Basic Science (BSC)	28	25	25
Engineering Science (ESC)	20	24	22
Professional Course (PCC)-Courses	64	48	76
Professional Course (PEC) Elective	20	18	19
Other Open Elective Courses(OEC)	08	18	09
Project Work (PROJ)/ Seminar /Internship	25	15	15
Total	175	160	175

PDA COLLEGE OF ENGINEERING, KALABU
Autonomous College under VTU SEVENTH SEMESTER

INTERNET OF THINGS		
Subject Code	**18IS71**	Credits:04
CIE:50	SEE:50	SEE: 03hours
Hours/Week:4hours(Theory)		Total Hours:52

Prerequisite: The students should have the thorough knowledge of hardware interfacing, IP networking , automation and UI/UX design.

Course Objectives:

To enable the students to obtain the knowledge of Internet Of Things in the following topics.

- To understand Vision and Introduction to IoT.
- To Understand IoT Market perspective.
- To know the Data and Knowledge Management and use of Devices in IoT Technology.
- To understand the real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Modules	**Teaching Hours**
Module-I **What is IoT:** Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	**10 Hours**

Module-II **Smart Objects:** The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	**11 Hours**
Module-III **IP as the IoT Network Layer:** The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	**10 Hours**
Module-IV **Data and Analytics for IoT:** An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	**11 Hours**
Module-V **IoT Physical Devices and Endpoints:** Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture.Smart City Security Architecture, Smart City Use-Case Examples	**10 Hours**
Question paper pattern: 1. The question paper will have TEN questions. 2. There will be TWO questions in each module, covering all the topics. 3. The student need to answer FIVE full questions, selecting ONE full question from each module.	

Text books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN:978-9386873743)

2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (AHands-on-Approach)",

1st Edition, VPT, 2014.(ISBN:978-8173719547)

2. Raj Kamal, "Internet of Things: Architecture and Design Principles",

1st Edition, McGraw Hill Education, 2017. (ISBN:978-9352605224)

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Demonstrate the impact and challenges posed by IoT networks leading to new architectural models.
	CO2	Analyze the IoT Sensors, Actuators and Smart Objects for IoT access technologies.
	CO3	Propose the role of IoT protocols for efficient network communication.
	CO4	Apply the data science, machine learning techniques and security principles in IoT
	CO5	Design and implement real life applications using sensor technologies and IoT devices.

Web Application Security		
Subject Code : **18IS72**	Credit : 04	CIE: 50
Number of Lecture Hours/Week	04	SEE: 50
Total Number of Lecture Hours	52	SEE Hours: 03
Prerequisites: Computer Networks, Information Security		

Course Objectives: To enable the students to understand Web Application Security in the following topics:

- The main objective is to understand the importance of Security.
- To discover and exploiting security flaws in web applications which are accessed using a web browser to communicate with a web server.
- To examine a wide variety of different technologies, such as databases, file systems, and web services, but only in the context in which these are employed by web applications.

MODULES	Teaching Hours
Module I **Web Application Insecurity And Defence Mechanism:** The Evolution of Web Applications, Web Application Security, Key Problem Factors, Handling User Access, Handling User Input, Handling Attackers **Web application technologies:** HTTP Protocol, Web Functionality, Encoding Schemes,	**11 hrs**
Module II **Mapping application :** Enumerating Content and functionality, Analyzing application, **Attacking Authentication:** Authentication technologies, design flaws in authentication, implementation flaws in authentication, securing authentication	**10 hrs**
Module III **Attacking Session Management:** The Need for state, Weaknesses in token generation, weaknesses in session token handling, securing session management. **Attacking Access Controls:** Common vulnerabilities, Attacking access controls, securing access controls.	**10 hrs**
Module IV **Attacking Data Stores:** Injecting into interpreted contexts ,injecting into SQL, Injecting into NoSQL, injecting into XPath, Injecting into LDAP. **Attacking Back-end components:** Injecting OS Commands ,Manipulating File Paths, Injecting into XML Interpreters, Injecting into Back-end HTTP Requests, Injecting into Mail Services	**11 hrs**

Module V	
Attacking Application Logic: The Nature of Logic Flaws , Real – World Logic Flaws, Ex.1 Fooling a password change function , Ex.2 Breaking the bank, Ex.3 Cheating on bulk discounts, Ex.4 Invalidating input validation, Ex.5 Racing against the login, avoiding logic flaws	**10 hrs**

TEXTBOOK:

1. Web Application Hacker's Handbook, DafyddStutarf, Marcus Pinto, Wiley, 2nd Edition

REFERENCE BOOKS:

1. Hacking Exposed Web Applications, by JeolScambray, Vincent Liu and Caleb Sima. 3rd edition,

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)	
	CO1	Describe web-based applications and Technologies and associated threats	
	CO2	**Analyze** the application and authentication technologies and design, implement flaws in authentication	
	CO3	Evaluate web application security vulnerabilities Develop a security strategy and solution for securing web-based applications	
	CO4	Understand the role of web-based applications in E-commerce transactions Describe social networking and evaluate associated risks Identify web application security controls and risk mitigation techniques	
	CO5	Assess web application security compliance requirements and objectives Design a web – application Vulnerability and Security Assessment Test Plan	

USER INTERFACE DESIGN		
Subject Code	**18IS731**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week:3hours(Theory)		Total Hours:42
Prerequisite: The students should have the knowledge the Software Engineering Fundamentals and Interface Building tools.		
Course Objectives: To enable the students to obtain the knowledge of User Interface Design in the following topics. • To analyze and model requirements and constraints for the purpose of designing and implementing user interfaces for software applications. • To participate in a small team to design and implement a user interface, based on modeling or requirements specification. • To apply software and paper prototyping tools to design user interfaces that take into account human capabilities and constraints, users' needs, usability goals and user experience goals. • To implement functional or wizard-of-oz user interface prototypes based on the design process and critically evaluate the usability of a small-to-medium-sized software application.		
Modules		**Teaching Hours**
Module I **Human Factors Of Interactive Software, Theories, Principles And Guidelines:** Introduction, Goals of Systems Engineering, Goals of Interface Design, Motivation for Human Factors in Design, Accommodation of Human Diversity, Goals for the Profession, High Level Theories, Object-Action Interface Model, Principle 1: Recognize the Diversity, Principle 2: Use the Eight Golden Rules of Interface Design, Principle 3: Prevent Errors, Guidelines for Date Display.		**8 Hours**

Module II **Management Issues:** Introduction, Organizational Design to Support Usability, The Three Pillars of Design, Development Methodologies, Ethnographic Observation, Participatory Design, Scenario Development, Social Impact Statement for Early Design Review, Legal Issues. Expert reviews, usability testing and laboratories, surveys, acceptance tests, evaluation during activeuse **Tools and Environments:** Introduction, Specification Methods, Interface-Building Tools, Evaluation and Critiquing Tools. Introduction, Examples of Direct-Manipulation Systems, Explanations of Direct Manipulation, Visual Thinking and Icons.	**9 Hours**
Module III Menus, Forms, Dialog Boxes And Commands: Task Related Organization, Item Presentation Sequence, Response Time and Display Rate, Fast Movement through Menus, Menu Layout, Form Fill-in, Dialog Boxes. Functionality to support Users Tasks, Command-Organization Strategies,. The benefits structure, naming and abbreviations, command menus, Natural language in computing.	**8 Hours**
Module IV **Interaction Devices And Response Time:** Interaction Devices, Introduction, Keyboards and Function Keys, Pointing Devices, Speech Recognition, Digitization, and Generation, Image and video displays, printers, **Presentation Styles, Manuals, Help, And Tutorials:** Error Messages, Non-anthropomorphic Design ,Display design, color reading from paper versus from displays.	**8 Hours**
Module V **Presentation Styles, Manuals, Help, And Tutorials Contd:** **Multiple-Window Strategies, Hypermedia And The World Wide Web :** Preparation of Printed Manuals, Multiple-Window Strategies: Introduction, Individual-Window Design, Multiple- window Design, Co-ordination by Tightly Coupled Windows, Image Browsing and Tightly Coupled Windows. **Multiple-Window Strategies, Hypermedia And The World Wide Web** contd.: Genres and Goals and Designers, Users and Their Tasks, Object-Action Interface Model for Web Site Design.	**9 Hours**

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. **Designing the User Interface-** Ben Shneiderman, 3rd Edition,Addison-Wesley, 1998.

Reference Books:

1. **Human-Computer Interaction -** Alan J Dix et. al., 2nd Edition,Prentice-Hall, India,1998
2. **User Interface Design –** Eberts, Prentice-Hall,1994.
3. **The Essential Guide to User Interface Design - An Introduction to GUI Design**– Wilber O Galitz, Principles and Techniques, Wiley-Dreamtech India Pvt. Ltd.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Describe the User interface design
	CO2	Identify the key aspects of Management
	CO3	Implement the Menus, Forms, Dialog Boxes
	CO4	Propose the Interactive devices to various applications.
	CO5	Apply the Presentation Styles, Manual, Multiple windows and World Wide Web in the user interface design

SOFTWARE ARCHITECUTRE		
Subject Code	**18IS732**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week: 3hours(Theory)		Total Hours:42

Prerequisite: The students should have the knowledge of software engineering and computer architecture.

Course Objectives: To enable the students to obtain the knowledge of Software Architecture and Design Patterns in the following topics.

- To perform the analyses necessary to formulate effective software architectures.
- To analyze Software engineering problems in terms of architectural thinking.
- To have a firm working grasp of the architectural concepts of platform, framework, pattern, Class Association Diagram and the use of 'objects in the N-Platform space'.

Modules	Teaching Hours
Module I **Introduction**: what is a design pattern? Describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern. What is object-oriented development? , key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm.	**9 Hours**
Module II Analysis a System: overview of the analysis phase, stage 1: gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation, discussions and further reading.	**8 Hours**

Module III Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, fly weight proxy.	**8 Hours**
Module IV Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analyzing a simple drawing program , designing the system, designing of the subsystems, getting into implementation, implementing undo operation , drawing incomplete items, adding a new feature , pattern based solutions.	**9 Hours**
Module V Designing with Distributed Objects: Client server system, java remote method invocation, implementing an object oriented system on the web (discussions and further reading) a note on input and output, selection statements, loops arrays.	**8 Hours**

Question paper pattern:

1. The question paper will have TEN questions.

2. There will be TWO questions in each module, covering all thetopics.

3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. Object-oriented analysis, design and implementation, brahma dathan, sarnathrammath, universitiespress,2013

2. Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides,PEARSON Publication,2013.

Reference Books:

1. Frank Bachmann, ReginеMeunier, Hans Rohnert “Pattern Oriented Software Architecture” – Volume1.
2. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wile..

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Identify and utilize design patterns.
	CO2	Analyze the functional requirements and defining conceptual classes and relationships
	CO3	Practice core design principles and be able to assess the quality.
	CO4	Analyze and design the principles to the object oriented systems
	CO5	Implementing range of design patterns and capable of comprehending a design and apply suitable patterns in specific contexts

STORAGE AREA NETWORKS		
Subject Code	**18IS733**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week:3hours(Theory)		Total Hours:42
Prerequisite: The students should have a basic knowledge of computer networks.		

Course Objectives: To enable the students to obtain the knowledge of Storage Area Networks in the following topics.

- To understand basics of storage area networks and network attached storage.
- To understand implementation of RAID, RAID impact on performance.
- To understand about direct attached storage (DAS) type benefits and limitations.
- To understand about content addressed storage (CAS) and storage virtualization.

Modules	Teaching Hours
Module I **INTRODUCTION:** Server Centric IT Architecture and its Limitations; Storage - Centric IT Architecture and its advantages; Case study: Replacing a server with Storage Networks; The Data Storage and Data Access problem; The Battle for size and access. INTELLIGENT DISK SUBSYSTEMS - 1: Architecture of Intelligent Disk Sub systems.	**9 Hours**
Module II Hard disks and Internal VO Channels, JBOD, Storage virtualization using RAID and different RAID levels; INTELLIGENT DISK SUBSYSTEMS - 1, I/O TECHNIQUES - 1: Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems; Availability of disk subsystems. The Physical VO path from the CPU to the Storage System; SCSI.	**8 Hours**
Module III **I/OTECHNIQUES-2,NETWORKATTACHEDSTORAGE**:FibreChannel Protocol Stack; Fibre Channel SAN; IP Storage. The NAS Architecture The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system	**8 Hours**
Module IV **FILE SYSTEM AND NAS**: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fiber Channel and NAS.	**8 Hours**
Module V **STORAGE VIRTUALIZATION:** Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.	**9 Hours**

Course outcomes:

On completion of the course, the student will have the ability to:

Question paper pattern:

1. The question paper will have TEN questions.

2. There will be TWO questions in each module, covering all the topics.

3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. **Storage Networks Explained** - Ulf Troppens, Rainer Erkens and Wolfgang Muller, Wiley India, 2003

2. **Storage Networks**, **The Complete Reference** - Robert Spalding, Tata McGraw Hill, 2003.

Reference Books:

Reference Books: 1. Storage Area Network Essentials A Complete Guide to Understanding and Implementing SANs - Richard Barker and Paul Massiglia, Wiley India, 2002.

2. **Storage Networking Fundamentals** - Marc Farley, Cisco Press, 2005.

Course Code	CO #	Course Outcome (CO)
	CO1	Demonstrate the architecture, limitations and data access techniques in SAN.
	CO2	Identify Intelligent Disk Subsystems, JBOD, Storage Virtualization using RAID & RAID Levels
	CO3	Demonstrate the working principles of NAS
	CO4	Illustrate File System and Network Attached Storage Systems
	CO5	Describe Storage Virtualization on Various levels of Storage Network

MACHINE LEARNING		
Subject Code	**18IS741**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week: 3 hours(Theory)		Total Hours:42

Prerequisite: Students should have basic knowledge of algebra, discrete math and statistics.

Course Objectives:

To enable the students to obtain the knowledge of Machine Learning in the following topics.

- To introduce students to the basic concepts and techniques of machine learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

Modules	**Teaching Hours**
Module-I Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias	**8 Hours**
Module-II Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning	**8 Hours**
Module-III Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Back propagation algorithm.	**8 Hours**
Module-IV Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm	**9 Hours**

Module-V Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning, Reinforcement Learning: Introduction, Learning Task, Q Learning	**9 Hours**

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1.Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.

Reference Books:

1. EthemAlpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd.,2013
.
2. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer;1st edition, 2001

Course out comes :On completion of the course, the student will have the ability to:

Course Code	**CO #**	**Course Outcome (CO)**
	CO1	Apply the learning techniques with this basic knowledge
	CO2	Apply effectively neural networks and genetic algorithms for appropriate applications.
	CO3	Apply Bayesian techniques and drive effectively learning rules.
	CO4	Apply and differentiate reinforcement and analytical learning techniques
	CO5	Apply machine learning principles in real life applications.

REAL TIME SYSTEMS		
Subject Code	**18IS742**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week: 3hours (Theory)		Total Hours:42

Prerequisite: The students Should have knowledge about basics of embedded system and operating system.

Course Objectives:

To enable the students to obtain the knowledge of Real Time Systems in the following topics.

- To understand real time systems and relate it to embedded systems.
- To understand the kernel construction ,real time scheduling and schedulability analysis.
- To understand the control of asynchronous processes, deadlocks, memory management, processor and disk scheduling.
- To compare performance of various real time systems its queuing methods and reliability

Modules	**Teaching Hours**
Module I **Basic Real Time Concept:** Basic Computer, Architecture-Bus transfer mechanism, Input and Output, Memory, CPU operations: Some terminology – Software concepts, System concepts, Real-Time definitions, Events and Determinism, Synchronous and Asynchronous events, Determinism, Time Loading; Real-Time Design issues; Examples Real- Time systems; Brief history- software ,Hardware. Real-Time Specification and Design Techniques: Natural Languages; Mathematical Specifications; Flowcharts; Structure Charts; Pseudo code and programming Design Languages; Finite state Automata; Data flow diagrams- De Marco's Rules, Hatley and Pribhai's extensions; Petri nets; Warnier-Orr notations- Indexed Loop; State charts- Depth, Orthogonality, Broadcast communication; Sanity in Graphical Techniques.	**9 Hours**

Module II **Real-Time Kernels:** Polled Loop System- Polled loop with interrupts; phase/State-Driven code; Coroutines; Interrupt-Driven Systems - Context switching, Round Robin System, Preemptive priority systems, Major and Minor Cycles, Hybrid Systems; Foreground/Background systems- Background processing, Inialization, Real-time operation; Full-Featured Real-Time operating system- Task-control Block model; Build or Buy? POSIX. Intertask Communication And Synchronization: Buffering Data- Time-Relative buffering, Ring Buffers; Mailboxes- Mailbox Implementation, Other operations on Mailboxes, Queues; Critical Regions; Semaphores – Mailboxes and Semaphores, Problems with Semaphores, The Test-and- Set Instruction; Event Flags and Signals; Deadlock - Avoidance, detect and Recover.	**9 Hours**
Module III **Real-Time Memory Management:** Process Stack Management – Task- Control Block model, Managing the Stack, Run-Time Ring Buffer, Maximum Stack size, Multiple stack arrangements, Task-Control Block Model; Dynamic Allocation- Swapping, Overlays, MFT, MVT, Demand Paging, Working Sets, Real Time garbage Collection, Contiguous file systems; Static Schemes.	**8 Hours**
Module IV **System Performance Analysis and Optimization:** Response-Time Calculation- Polled Loops, Coroutines /Phase-Driven Code, Interrupt System; Interrupt Latency - Propagation Delay, Macroinstruction Execution Times, Interrupts disabled, Preemption, Low Priority Interrupts high; Time- Loading and its Measurement – Using logic analyzer, Instruction Counting, Pictorial representation, Instruction execution time simulators, Deterministic performance; Scheduling is NP-Complete; Reducing response times and time loading – Compute at slowest cycle, Scaled Arithmetic, Binary angular measurement, Look-up tables.	**8 Hours**
Module V **Queuing Models:** Probability functions - Continuous; Discrete; Basic buffer Size calculation – handling Bursts of data, Variable Buffer size calculation, Classical Queuing Theory – The M/M/1 Queue, service a d production rates, More buffer calculations, Response - Time Modeling, Other queuing models; Little's Law; Erlang's Formula. **Reliability, Testing and Fault Tolerance :** Faults, Failures, Bugs and Effects; Reliability - Formal definition, Calculating System reliability; Testing– Unit level testing, System level testing, Statistically based testing, Cleanroom testing, stress testing; Fault Tolerance – General problems handling, N-Version Programming, Built-In-Test Software, CPU Testing, Memory Testing, Spurious and Missed Interrupts, Dealing with Bit Failures.	**8 Hours**

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1."Embedded systems Architecture; Programming and design"; RajKamal Tata McGraw-Hill; Second edition.

2."Real-Time Systems Design And Analysis", Phillip A. Laplante, Third Edition, 2004 Willey-IEEE Press.

Reference Books:

1."Real Time Systems",C.M.Krishna;KangG.shin,McGraw-Hill.

2."An Embedded software primer", David Simon, Addison Wesley,2000

3."Micro Controller : Architecture, Programming, Interfacing and System Design", Rajkamal, Pearson Education.

4."AnIntroductionToRealTimeSystems",RaymondJ.A.Buhr,DonaldL.Bailey,Prentice Hall International. "The 8051 Microcontroller and Embedded system",Mohammed Ali mazidi; Janice GillispiedMazidi;;Pearson Education Asia2002.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Classify the issues that arise in designing soft and hard real- time, concurrent, reactive, safety-critical and embedded systems.
	CO2	Demonstrate the functions of real time kernel.
	CO3	Illustrate the real time memory management issues.
	CO4	Analyze the system performance and optimization techniques.
	CO5	Demonstrate the fault tolerance issues, its effects and levels of testing

MOBILE ADHOC NETWORK		
Subject Code	**18IS743**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week:3hours(Theory)		Total Hours:42

Prerequisite: The students should have the basic knowledge of wired networks includes different protocols, Mac protocols, routing protocols and standards.

Course Objectives : To enable the students to obtain the knowledge of Adhoc Networks in the following topics.

- To analyze the various design issues and challenges in the layered architecture of Ad hoc wireless networks.
- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs), Wireless LANs (WLANs) and Wireless Sensor Networks WSNs).
- To expose students to emerging technologies and their potential impact

Modules	Teaching Hours
Module I **INTRODUCTION:** Ad hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.**MAC :** MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms.	**9 Hours**
Module II **MAC Contd.:** Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, other MAC protocols. ROUTING **:** Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table driven routing protocol, On- demand routing protocol.	**8 Hours**

Module III **ROUTING Contd.:** Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols. TRANSPORT LAYER**:** Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of Transport layer solutions	**9 Hours**
Module IV **SECURITY:** Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues and challenges in security provisioning. Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.	**8 Hours**
Module V **QoS:** Quality of service in Adhoc wireless Networks: Introduction, Issues and challenges in providing QoS in Adhoc wireless Networks, Classification of QoS solutions, MAC layer solutions, Network layer solutions.	**8 Hours**
Question paper pattern: 1. The question paper will have TEN questions. 2. There will be TWO questions in each module, covering all the topics. 3. The student need to answer FIVE full questions, selecting ONE full question from each module.	
Text books: **1.Ad hoc Wireless Networks** – C. Siva Ram Murthy & B. S. Manoj, 2nd Edition, Pearson Education, 2005.	

Reference Books:

1. Ad hoc Wireless Networks – Ozan K. Tonguz and Gianguigi Ferrari, John Wiley,2006.

2. Adhoc Wireless Networking–XiuzhenCheng,XiaoHung,Ding-ZhuDu,Kluwer Academic Publishers,2004

3. Adhoc Mobile Wireless Networks - C.K. Toh, Protocols and Systems, Prentice- HallPTR, 2002.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Interpret the different design issues and classification of MAC protocols
	CO2	Demonstrate the design issues and classification of Routing protocols.
	CO3	Demonstrate the design principles and issues of Transfer Layer Protocol
	CO4	Interpret the network security principles, attacks and key management issues.
	CO5	Propose the issues in QoS solutions and Energy Management Schemes in Ad-Hoc Wireless Networks.

DATA SCIENCE		
Subject Code	**18IS7OE**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week:3hours(Theory)		Total Hours:42hours
Prerequisites: The students should have the basic knowledge of Probability, Statistics and traditional database.		

Course Objectives: To enable the students to

- Learn the basics of Data warehouse and knowledge discovery techniques.
- Extract valuable information for use in strategic decision making, and trend analysis.
- Apply different mining algorithms
- Understand the applications of data science

Modules	Teaching Hours
Module I **A Crash Course in Python:** The Zen of Python Getting Python, Virtual Environments Whitespace Formatting ,Modules ,Functions ,Strings ,Exceptions ,Lists, Tuples, Dictionaries, default dict, Sets, Control Flow, Truthiness, Sorting, List Comprehensions, Automated Testing and assert, Object-Oriented Programming, Iterables and Generators, Randomness, Regular Expressions ,Functional Programming ,zip and Argument Unpacking, args and kwargs, Type Annotations. Visualizing Data. Matplotlib, bar Charts,Line Charts, Scatterplot.	**11 Hours**
Module II **Introduction:** AI, Machine Learning and Data Science, what is data science, Case for data science, Data science classification, Data science algorithms. **Data science process:** Prior knowledge Data preparation, Modeling, Application, knowledge.	**10 Hours**
Module III **Data Exploration:** Objectives of Data exploration**,** Datasets, Descriptive statistics, Data Visualization, Roadmap for data exploration. **Classification-1 :** Decision Trees, Rule Induction.	**10 Hours**
Module IV **Classification-2:** k-Nearest Neighbors, Naïve Bayesian, Artificial Neural Networks.	**10 Hours**
Module V **Regression Methods:** Linear Regression, Logistic Regression, Conclusion.	**11 Hours**
Question paper pattern: The question paper will have ten questions.	

There will be 2 questions from each module, covering all the topics from a module.
The students will have to answer 5 full questions, selecting one full question from each module**.**

TEXT BOOKS:

1. **Data Science Concepts and Practice,** Second Edition, Vijay Kotu and Bala Deshpande, Elsevier Inc. 2019.
2. **Data Science from scratch,** First Principles with Python, by Joel Grus, Publisher(s) O'Reilly, 2015

REFERENCES:

1. Doing Data Science by Cathy O'Neil, Rachel Schutt**,** Released October 2013 Publisher(s): O'Reilly Media.
2. Foundation of Data Science by Avrim Blum, John Hopgroft and Ravindran Kannan, Cambridge University Press, 2020.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Develop relevant programming abilities
	CO2	Develop the ability to build and assess data-based models.
	CO3	Demonstrate proficiency with statistical analysis of data.
	CO4	Apply classification algorithms to solve real world example.
	CO5	Analyze dataset and predicts futuristic values.

Web Application Security Lab		
Subject Code :18ISL71	Credit :1	CIE: 50
Number of Practical Hours	2	SEE: 50
Total Number of Lecture./Practical Hours	14	SEE Hours: 03

Prerequisites: Students should have good knowledge of HTML, HTTP, Python, computer networks and application security.

Course Objectives: To enable the students to

- Recognize common web application security vulnerabilities and how to determine if they are present in web applications.
- Understand the capabilities of various browser proxies and penetration testing tools.
- Detect SQL injection Vulnerabilities.
- Identify unguarded Authentication and Sessions

1. Analyze different encoding (Base64, URL, and HTML) and encryption (MD5, SHA1, SHA2 etc) mechanisms used in application.
2. Find out different input validation (Whitelist, Blacklist, RegEx) mechanisms used in the application.
3. Build a sitemap using the application mentioned for analysis.
4. Experiment to perform web application mirroring using HTTrack.
5. Build a checklist for Authentication and apply on the web application to analyses the outcomes.
6. Build a checklist for Session management and use the same to perform manual checks on the application.
7. List Horizontal and Vertical Access Controls in the application and bypass the roles based functionalities.
8. Experiment to perform SQL and NoSQL Injection in application using manual and automated tools.
9. Experiment to perform OS Command Injection in application and extend the attack to gain web shell access.
10. Build a checklist for file path traversal attacks to access the server internal files.
11. Experiment to Analyze XML Parsers working in the application using XML External Entities.
12. Find Business Login flaws in given applications.

Course Code	CO #	Course Outcome (CO)
	CO1	Develop and implement python interface for encryption and decryption algorithms.
	CO2	Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.

	CO3	Apply software engineering concepts to manage the complexity of client-side and server-side software.
	CO4	Demonstrate computer security concepts for designing web application which is robust to known and unknown attacks
	CO5	Design operational and strategic web security strategies and policies.

SEMINAR		
Subject Code	**18ISS1**	Credits:01
CIE:50	SEE:---	Total hours: 14 hrs
Prerequisite: The Students should have the knowledge of current technologies, Creativity and programming skills.		
Course Objectives: • To understand the current trends in the industries • To apply the documentation techniques. • To exhibit the presentation skills and interactive skills. • To apply the analysis skills.		
Modules		**Teaching Hours**

SEMINAR COMPRISES OF: - Technical survey – identifying the recent development in the modern technology - Technical requirement – identifying the current industrial skills - Co-related technologies – identifying the co-related technologies - Report generation – preparing the IEEE standard documents of the same. Seminar document contains Abstract, introduction, problem formulation, design and application based on the above factors. Document should be submitted in the mid of semester. Seminar will be evaluated for 1 credit by means of presentation.	**14 Hours**
Course outcomes: **On completion of the course, the student will have the ability to:**	

Course Code	**CO #**	**Course Outcome (CO)**
	CO1	To demonstrate the different surveys to understand the current industrial requirements.
	CO2	To analyze different technical requirements and demonstrate interactive skills.
	CO3	To demonstrate the presentation skills.
	CO4	To demonstrate the analytical skills.
	CO5	To examine the intensity of the interactive sessions.

PROJECT WORK PHASE - 1		
Subject Code	**18ISP1**	Credits:02
CIE:50	SEE:50	SEE: 03hours
Prerequisite: The students should have Thorough knowledge of Software Engineering and Mastering any one programming language.		

Course Objectives:

- To understand the current requirement of the Industries.
- To understand the different software development and testing methodologies.
- To understand and apply architectural model, data flow and control flow diagrams.
- To acquire good documentation, demonstration skills and impact of application on society

Project Phase – I comprises of:	Teaching Hours
1. Literature Survey 2. Requirement Analysis - S/w Requirements - H/w Requirements 3. Design Module presentation 4. Application 5. System Requirement Specification document SRS document contains synopsis, problem formulation and requirement analysis based on above factors. Document should be submitted by the end of VII Sem. Project Phase-I would be evaluated for 2 credits by means of presentation.	

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Demonstrate the skills of performing surveys on current industrial requirements.
	CO2	Analyze the requirements and apply appropriate software development methodology.

	CO3	Implement and Validate the architectural model, data flow and control flow structures.
	CO4	Demonstrate the documentation and presentation skills
	CO5	Implement the Societal and Ethical systems.

EIGHTH SEMESTER

BIG DATA ANALYTICS		
Subject Code	**18IS81**	Credits:04
CIE:50	SEE:50	SEE: 03hours
Hours/Week:4hours(Theory)		Total Hours:52hours
Prerequisite: The students should have the knowledge of DBMS		
Course Objectives: To enable the students to obtain the knowledge of Big Data Analytics in the following topics. • To explore the fundamental concepts of big data analytics. • To learn to analyze the big data using intelligent techniques. • To understand the applications using Map Reduce Concepts. • To introduce programming tools PIG & HIVE in Hadoop echo system		
Modules		**Teaching Hours**

Module I **INTRODUCTION TO BIG DATA** Types of Digital Data, Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data?: Volume, velocity, variety, Other characteristics of Data Which are not Definitional Traits of Big Data: Why Big Data? Are we just an information consumer or do we also produce information?: Traditional business intelligence (B1) versus Big data: A typical data warehouse environment:, A typical hadoop environment:, What is new today?:, Coexistence of Big data and data warehouse, What is changing in the realms of Big data?.	**8 Hours**
Module II **THE BIG DATA TECHNOLOGY LANDSCAPE** NoSQL(Not Only SQL),Where is it used?, What is it?, Types of NoSQL Databases, Why NoSQL?, Advantages of NoSQL, What We Miss With NoSQL?, Use of NoSQL in Industry,NoSQLVendors,SQL versus NoSQL,New SQL, Comparison of SQL, NoSQL, and NewSQL, **HADOOP**: Features of Hadoop, Key Advantages of Hadoop, Version of Hadoop, Overview of Hadoop Ecosysytems, Hadoop Distributions, Hadoop versus SQL, Integrated Hadoop Systems Offered by Leading Market Vendors, Cloud- Based Hadoop Solutions, **INTRODUCTION TO HADOOP** Introducing Hadoop, Data: The Treasure Trove, Why Hadoop?, Why not RDBMS?, RDBMS versus Hadoop,, Distributed Computing Challenges, Hardware Failure, How to process this Gigantic store of data?, History of Hadoop, The name “Hadoop” Hadoop Overview, key aspects of Hadoop, Hadoop Components, Hadoop Conceptual Layer, High-level Architecture of Hadoop, use case of Hadoop, Clickstream Data, Hadoop Distributors, HDFS:Hadoop Distributed File System), HDFS Daemons, Anatomy of file read, Anatomy of file write, Replica placement strategy, working with HDFS Commands, Special features of HDFS, processing Data with hadoop, MapReduce Daemons, How does MapReduce work?, MapReduce Example, Managing Resources and applications with Hadoop YARN (Yet Another Resource Negotiator), Limitations of Hadoop 1.0 Architecture, HDFS Limitation, Hadoop 2:HDFS, Hadoop2 YARN: Taking Hadoop beyond Batch, Interacting with Hadoop Ecosystem, pig, Hive, Sqoop, Hbase.	

Module III **INTORDUCTION TO MongoDB** What is Mongo DB?, Why Mongo DB?, Using Java Script Object Notation(JSON), Creatingorgenerationauniquekey,supportfordynamicqueries,storingbinarydata, replication, sharding, updating information in-place, terms used in RDBMS and	
Big Data Analytics What is big data analytics? What is big data analytics Isn't? Classification Analytics, Gratest challenges that prevent business for Capitalizing on Big Data, Top challenges facing Big data, What kind of technologies are we looking toward to help meet the challenges posed by big data ?.	

MongoDB, create database, drop database, data types in MongoDB, MongoDB Query language, insert method, save() method, Adding a new field to an existing document – update method, removing an existing field from an existing document,- remove method, finding documents based on search criteria-find method, dealing with NULL values, count, Limit, Sort, and skip, Arrays , Aggregate Function, MapReduce Function, Java Script Programming, Cursors in MongoDB, Indexes, Mongo Import, Mongo Export, Automatic Generation of unique numbers for the "-id"field. **INTRODUCTION TO CASSANDRA** Apache Cassandra, An introduction, Features of Cassandra, Peer-to-peer network, gossip and failure detection, partitioner, Replication Factor, Anti-Entropy and Read Repair, Writes in Cassandra,Hinted handoffs, tunable consistency, CQL Data types, CQLSH, Logging into cqlsh, keyspaces, CRUD(Create, Read, Update, and Delete) Operations, collections, Set collection, list collection, Map collection, More practice on Collections(SET and LIST), Using Map:Key, value pair, using a counter, time to live (TTL), Alter commands, Alter table to change the data type of a column, alter table to delete a column, drop a table, drop a database, import and export, export to CSV, Import from CSV, Import from STDIN, Export to STDOUT, Querying system Tables , Practice examples	**9 Hours**
Module IV **INTRODUCTION TO MAPREDUCE PROGRAMMING** Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. **INTRODUCTION TO HIVE:** What is Hive? History of Hive and recent releases of Hive, Hive features, Hive Integration and work flow, Hive data units, Hive Architecture, Hive Data Types, Primitive Data Types, Collection Data Types, Hive File Format, Text file, Sequential File, Rcfile (Record Columnar File), Hive Query Language(HQL), DDL (Date Definition Language) Statements, DML(Data Manipulation Language) Statements, starting Hive shell, Database, Tables, Partitions, Bucketing, Views, Sub-query, Joins, Aggregation, Group By and Having, RCfile Implementation, SerDe, User-Defined Function(UDF). **INTRODUCTION TO PIG** what is pig?, Key geatures of pig, The Anatomy of pig, pig on Hadoop, Pig philosophy, Use case for Piog:ETL Processing, Piglatin overview, pig latin statements, pig latin:keywords, pig latin: Identifiers, Pig latin: Comments, Pig Latin:Casesensitivity, Operators in pig latin, Data types in Pig, Simple data types, complex datatypes,	**8 Hours**

Running pig, Interactive mode, batch mode, Execution modes of Pig, local Mode, mapreduce Mode, HDFS Commands,	
Module V Relational Operators in PIG FILTER, FOREACH, GROUP, DISTINCT, LIMIT, ORDER BY, JOIN, UNION, SPLIT, SAMPLE, Eval function: AVG, MAX,COUNT, Complex Data Types:TUPLE, MAP,Piggy bank, user-defined functions(UDF), Parameter Substitution, Diagnostic Operator, Word Count Example using Pig, When to use Pig?, When not to use Pig?, Pig at Yahoo, Pig versus Hive. **INTRODUCTION TO MACHINE LEARNING** Introduction to machine learning, Machine learning definition, machine learning algorithms, regression model – linear regression, clustering, collaborative filtering, Association Rule mining, Decision Tree.**CASE STUDIES PNUTS:** Yahoo!'s hosted data serving platform. Finding a Needle in a haystack: Face book's photo storage	**8 Hours**
Question paper pattern: 1. The question paper will have TEN questions. 2. There will be TWO questions in each module, covering all the topics. 3. The student need to answer FIVE full questions, selecting ONE full question from each module.	
Text books: Big data and Analytics:Seema Acharya(Infosys ltd), Subhashini hellappan(Infosys ltd)	

Reference Books:

1. Noreen Burlingame, The little book on Big Data,New Street publisher(eBook)http://www.prlog.org/11800911-just-published-the-little-book-of-big-data-2012-edition.html
2. NormanMatloff,TheArt ofRProgramming:ATourofStatisticalSoftwareDesign, ISBN-13: 978-1-59327-384-2; ISBN-10:1-59327-384-3

http://www.johndcook.com/R_language_for_programmers.html
4. http://bigdatauniversity.com/
5. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Illustrate Big-data fundamentals and challenges in big data analytics.
	CO2	Demonstrate Hadoop, NOSQL frameworks toefficiently store retrieve and process Big Data.
	CO3	Apply big data programming to manipulate, store, and analyze the data.
	CO4	Illustrate Hive and Pig features, its architecture and data format for DDL and DML operations.
	CO5	Apply statistical analysis for machine learning algorithms.

VIRTUAL REALITY AND AUGMENTED REALITY		
Subject Code	**18IS821**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week:3hours		Total Hours:42
Prerequisite: The students should have the good knowledge of C# programming, computer graphics with open GL and real time 3D concepts.		

Course Objectives: To enable the students to obtain the knowledge of Virtual Augmented Reality in the following topics.

- To understand opportunities and the main issues related to designing and developing VR/AR systems architectures, both in local and in distributed (even web-based) contexts.
- To understand development of VR/AR applications with a multimodal perspective and approach.

Modules	Teaching Hours
Module I **Introduction:** The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Input Devices**: (Trackers, Navigation, and Gesture Interfaces): Three dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.	**9 Hours**
Module II **Output Devices:** Graphics displays, sound displays & haptic feedback.	**8 Hours**
Module III **Modeling:** Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model management.	**8 Hours**
Module IV **Human Factors:** Methodology and terminology, user performance studies, VR health and safety issues.	**8 Hours**
Module V **Applications:** Medical applications, military applications, robotics applications.	**9 Hours**

Question paper pattern:

1. The question paper will have TEN questions.

2. There will be TWO questions in each module, covering all the topics.

3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. Augmented Reality: A Practical Guide by Stephen Cawood and Mark Fiala**.**
2. Augmented Reality Principles and Practices by Dieter Schmalstieg and Tobias Hollerer.

Reference Books:

1. Understanding Virtual Reality, interface, Application and Design, William R. Sherman, Alan Craig, Elsevier (Morgan Kaufmann).

2. 3D Modeling and surfacing, Bill Fleming, Elsevier (Morgan Kauffman).

3. 3D Game Engine Design, David H.Eberly, Elsevier.

4. Virtual Reality Systems, John Vince, Pearson Education.

5. What is Virtual Reality? http://vr.isdale.com/WhatIsVR/frames/WhatIsVR4.1.html.

6. Augmented and Mixed Reality, http://www.mic.atr.co.jp/~poup/research/ar/.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	**CO #**	**Course Outcome (CO)**
	CO1	Describe the components of the virtual reality system
	CO2	Describe various input and output devices used for virtual reality
	CO3	Apply the different modeling concepts to visual virtualization
	CO4	Analyze the performance of given simple applications related to virtual reality
	CO5	Design 3D technology with virtual programming concepts in different applications.

DIGITAL IMAGE PROCESSING		
Subject Code	**18IS822**	Credits:03
CIE:50	SEE:50	SEE: 03hours
Hours/Week:3hours(Theory)		Total Hours:42

Prerequisite: The students should have the knowledge of Engineering Mathematics

Course Objectives:

To enable the students to obtain the knowledge of Digital Image Processing in the following topics.

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To understand the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.

Modules	Teaching Hours
Module I **Digitized Image And Its Properties :** Basic concepts, Image digitization, Digital image properties. **Image Preprocessing:** Image pre-processing: Brightness and geometric transformations, local processing.	**8 Hours**
Module II **Segmentation:** Thresholding, Edge-based segmentation. Region based segmentation, Matching.	**8 Hours**
Module III **Image Enhancement:** Image enhancement in the spatial domain: Background, Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Image enhancement in the frequency domain: Background, Introduction to the Fourier transform and the frequency domain, Smoothing frequency domain filters, sharpening frequency domain filters, Homorphic filtering**.**	**9 Hours**

Module IV **Image Compression:** Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression	**9 Hours**
Module V **Shape Representation:** Region identification, Contour-based shape representation and description,. Shape classes.	**8 Hours**

Question paper pattern:

1. The question paper will have TEN questions.

2. There will be TWO questions in each module, covering all the topics.

3. The student need to answer FIVE full questions, selecting ONE full question from each module.

4.

Text books:

1. **Image Processing, Analysis and MachineVision**-MilanSonka, VaclavHlavacand Roger Boyle, 2 nd Edition, Thomoson Learning,2001.
2. Digital Image Processing - Rafel C Gonzalez and Richard E Woods, 2nd Edition, Pearson Education,2003.

Reference Books:

1. **Fundamentals of Digital Image Processing** - Anil K Jain, Pearson Education/Prentice-Hall of India Pvt. Ltd.,1997.
2. **DigitalImageProcessingandAnalysis**-B.Chanda,DDuttaMajumder,Prentice- Hall, India,2002.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Demonstrate the concepts of a digital image properties and preprocessing techniques
	CO2	Interpret different image segmentation techniques

	CO3	Apply different techniques for image enhancement and analysis
	CO4	Categorize various Image compression techniques
	CO5	Interpret image representation techniques

GAME THEORY		
Subject Code	**18IS823**	Credits:03
CIE:50	**SEE:50**	**SEE: 03hours**
Hours/Week:3hours(Theory)		Total Hours:42hours
Prerequisite: None		

Course Objectives:

To enable the students to obtain the knowledge of Game Theory in the following topics.

- To explore the fundamental concepts of Game Theory.
- To learn &analyze the mixed strategy equilibrium, extensive games etc.
- To understand the Bayesian Game concepts, Strictly Competitive Games.

Modules	**Teaching Hours**
Module I **Introduction, Strategic Games:** What is game theory? The theory of rational choice; Interacting decision makers. Strategic games; Examples: The prisoner‟s dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Bestresponse functions; Dominated actions; Equilibrium in a single population: symmetric games and symmetric equilibria. **Mixed Strategy Equilibrium**: Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibria when randomization is allowed, Illustration: Expert Diagnosis; Equilibrium in a single population, Illustration: Reporting a crime; The formation of players‟ beliefs; Extensions; Representing preferences by expected payoffs.	**9 Hours**

Module II **Extensive Games**: Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding subgame perfect equilibria of finite horizon games: Backward induction. Illustrations: The ultimatum game, Stackelberg‟s model of duopoly, Buying votes, Extensions and Discussions: Extensions: Allowing for simultaneous moves, Illustrations: Entry in to a monopolized industry, Electoral competition with strategic voters, Committee decision making, Exit from a declining industry;	**9 Hours**
Module III **Bayesian Games, Extensive Games with Imperfect Information:** Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot‟s duopoly game with imperfect information, Providing a public good, Auctions; Auctions with an arbitrary distribution of valuations. Extensive games with imperfect information; Strategies; Nash equilibrium; Beliefs and sequential equilibrium; Signaling games; Illustration: Strategic information transmission.	**8 Hours**
Module IV **Strictly Competitive Games, Evolutionary Equilibrium**: Strictly competitive games and maximization; Maximization and Nash equilibrium; Strictly competitive games; Maximization and Nash equilibrium in strictly competitive games. Evolutionary Equilibrium: Monomorphic pure strategy equilibrium; Mixed strategies and polymorphic equilibrium; Asymmetric contests; Variations on themes: Sibling behavior, Nesting behavior of wasps, The evolution of sex ratio. Iterated Games: Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner‟s dilemma; Strategies in an infinitely repeated Prisoner‟s dilemma;	**8 Hours**
Module V **Iterated Games**: Some Nash equilibria of an infinitely repeated Prisoner‟s dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner‟s dilemma. **Coalitional Games and Bargaining:** Coalitional games. The Core. Illustrations: Ownership and distribution of wealth, Exchanging homogeneous items, Exchanging heterogeneous items, Voting, Matching. Bargaining as an extensive game; Illustration of trade in a market; Nash's axiomatic model of bargaining	**8 Hours**
Question paper pattern: 1. The question paper will have TEN questions. 2. There will be TWO questions in each module, covering all the topics. 3. The student need to answer FIVE full questions, selecting ONE full question from each module.	

Text books:
Martin Osborne: An Introduction to Game Theory, Oxford University Press, Indian Edition, 2004. (Listed topics only from Chapters 1 to 11, 13, 14, 16)

Reference Books:
1. Roger B. Myerson: Game Theory: Analysis of Conflict, Harvard University Press, 1997.
2. Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green: Microeconomic Theory. Oxford University Press, New York, 1995.
3. Philip D. Straffin, Jr.: Game Theory and Strategy, The Mathematical Association of America, January 1993.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Demonstrate the concepts of a strategic games, mixed strategy equilibrium, extensive games.
	CO2	Interpret different concepts of distinct game theories.
	CO3	Analyze various game theories
	CO4	Categorize the concepts of strictly competitive games.
	CO5	Design extensive and iterated games.

WEB TECHNOLOGY AND APPLICATIONS		
Subject Code	**18IS8OE**	Credits:3
CIE:50	SEE:50	SEE: 03 hrs
Hours/Week: 3 hrs (Theory)		Total Hours:42 Hrs
Prerequisite: The students must have knowledge of network Protocols, Basic HTML Programming and Database concepts.		
Course Objectives: To enable the students to obtain the knowledge of Web Technology & J2EE in the following		

topics.

- Understand the fundamentals of internet protocols and develop static web pages.
- Create interactive WebPages using style sheets.
- Learn the basics about Client side scripts and Server side scripts.
- Examine JavaScript frameworks such as jQuery, MVC and Backbone.

Modules	Teaching Hours
Module I **Fundamentals of Web, XHTML:** Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; Security; The Web Programmers Toolbox. XHTML: Origins and evolution of HTML and XHTML; Basic syntax; Standard XHTML document structure. Basic text markup. Images; Hypertext Links; Lists; Tables; Forms; Frames; Syntactic differences between HTML and XHTML.	**8 Hours**
Module II **CSS:** Introduction; Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; The Box model; Background images, The <Span> and tags; conflict resolution .	**8 Hours**
Module III **JAVASCRIPT:** Overview of JavaScript; Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; pattern matching using regular expressions, errors in scripts, examples.	**9 Hours**
Module IV PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are	**8 Hours**

Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling	
Module V Managing State, The Problem of State in Web Applications, Passing Information via Query Strings, Passing Information via the URL Path, Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Advanced JavaScript and jQuery, JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.	**9 Hours**

Question paper pattern:

1. The question paper will have TEN questions.
2. There will be TWO questions in each module, covering all the topics.
3. The student need to answer FIVE full questions, selecting ONE full question from each module.

Text books:

1. **Programming the World Wide Web –** Robert Sebesta 4th Edition Pearson
2. **Fundamentals of Web Development,** Randy Connolly, Ricardo Hoar, , 1st Edition, Pearson Education India. (ISBN:978-9332575271)

Reference Books:

1. **PHP and MySQL Web Development**, Luke Welling, Laura Thomson, 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
2. **Professional JavaScript for Web Developers** , Nicholas C Zakas, , 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Discuss the fundamentals of internet, web and identify the differences between XHTML and HTML.
	CO2	Apply the concepts of Cascading style sheets for web development and XHTML documents.
	CO3	Develop Client-Side Scripts using JavaScript .
	CO4	Analyze and solve common web application tasks by writing PHP programs.
	CO5	Inspect JavaScript frameworks like jQuery, MVC framework and Backbone which facilitates developer to focus on core features.

MOOC's Certificate Course		
Subject Code	**18ISMC84**	Credits:01
CIE : 50	SEE:50	

PROJECT WORK PHASE - II		
Subject Code	**18ISP2**	Credits:8
CIE:50	SEE:50	SEE: 03hours
Hours/Week: 3 Hrs(Theory)	Total Hours : 42	

Prerequisite: The Students should have the knowledge of Software Engineering, Object Oriented Modeling and Designing, Analysis and Design of Algorithms, Data Structures and Programming Skills.

Course Objectives:

- To apply programming skills for module implementation.
- To design test case and perform module testing.
- To understand the project management skills.
- To understand the impact of project on society.
- To demonstrate the documentation and presentation skills.

	Teaching Hours

Project Phase – II comprises of: Students should continue with the problem defined in Project Phase-II. The	
Project Phase-II comprises of: 1. Architectural design module analysis based on SRS. 2. Project implementation 3. Module validation and analysis 4. Future scope and limitations **5. Presentation** Evaluation of the project work will be done by means of conducting demo and checking the validation report periodically. Students should submit a project report along with executable code, at the end of the semester.	

Note:

1. Project will be carried out in batches with a maximum of 3 students.

2. Any batch which does not complete Project Phase-I will not be permitted to commence with Project Phase-II.

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	**CO #**	**Course Outcome (CO)**
	CO1	Implementation of functional modules and Architectural design representation.
	CO2	Evaluate the functional modules using advance testing tools and techniques.
	CO3	Evaluate module integration and Project management activities.
	CO4	Implementing the socio-economic and ethical systems.
	CO5	Demonstrate the documentation, publication and presentation skills.