DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

VISION

The Department will provide quality and value-based education to produce innovative world-class computing engineers and will enhance quality research for the betterment of society

MISSION

- To impart high quality training, education and competence in information science domain through best-in class faculty and facilities
- To produce globally acceptable information science graduates who can contribute professionally to the industry and research activities by offering courses on emerging technologies.
- To provide platforms to work effectively and innovatively in multi-disciplinary domain.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1: Our graduates will be professionally successful in information technology career.

PEO 2: Our graduates will successfully pursue higher studies in globally recognized institutions.

PEO 3: Our graduates will build professionally successful careers in the field of emerging technologies.

PROGRAM SPECIFIC OUTCOMES

PSO 1: Information Science Engineers able to understand and analyze computer systems focused with hardware and software needs.

PSO 2: Develop software systems/solutions, with knowledge of software design process and skills with broad range of programming platforms and tools.

PSO 3: Demonstrate professional competence in communication skills, project management and involve in life-long learning

PROGRAM OUTCOMES

1. **Engineering Knowledge:** Real world engineering problems are solved by applying knowledge of science.
2. **Problem Analysis:** Identify, devise and analyze real world engineering problems using principles of mathematics, sciences and information technologies.
3. **Design and Develop solutions:** Designing and developing solutions for engineering problems based on needs while considering the norms of Safety and environmental conditions.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
5. **Modern Tool usage:** Applying appropriate engineering techniques and tools that includes simulation and modeling to solve complex engineering problems
6. **The engineering and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and their consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and norms of engineering practice
9. **Individual and Team Work:** Participate and performs effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environment
10. **Communication:** Communicate effectively with engineering community and the society through reports and presentations
11. **Project Management and finance:** Apply the principles of software engineering and fundamentals of finance to manage a project in multidisciplinary environment. In the verge of technological changes, there is a need to recognize and learn independently and also in a team.
12. **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

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SCHEME OF TEACHING AND EXAMINATION
DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING
SEVENTH SEMESTER – B.E

Sl. No	Course Code	Course Title	Teaching Dept	Contact Hours / Week				Credits
				L	T	P	Total	
1	IS7C01	Advanced Computer Architecture	IS & E	4	0	0	4	4
2	IS7C02	Human Computer Interface Systems	IS & E	4	0	0	4	4
3	IS7E2xx	Dept. Elective – 2	IS & E	3	0	0	3	3
4	IS7E3xx	Dept. Elective – 3	IS & E	3	0	0	3	3
5	IS7Ixx	Industry Driven Elective	IS & E	2	0	0	2	2
6	IS7Oxx	Open Elective	IS & E	2	0	0	2	2
7	IS7E4xx	Dept. Elective – 4 (2 Credit)	IS & E	2	0	0	2	2
8	IS7C03	Seminar / Paper Presentation	IS & E	0	0	2	2	1
9	IS7C04	Major Project Phase - 1	IS & E	0	0	2	2	1
10	IS7C05	Competency Training	IS & E	-	-	-	-	1
			TOTAL	**20**	**0**	**4**	**24**	**23**

DEPT. ELECTIVE – II

IS7E201	Cloud Computing	(3-0-0) 3
IS7E202	Mobile Application Development	(3-0-0) 3
IS7E203	Cognitive Science	(3-0-0) 3
IS7E204	Parallel Programming	(3-0-0) 3

DEPT. ELECTIVE – III

IS7E301	Unix System Programming	(3-0-0) 3
IS7E302	Multimedia Computing	(3-0-0) 3
IS7E303	System Simulation And Modeling	(3-0-0) 3
IS7E304	Client Server Programming	(3-0-0) 3
IS7E305	Block Chain Technology	(3-0-0) 3

INDUSTRY DRIVEN ELECTIVE

IS7I01	Internet of things	(2-0-0) 2
IS7I02	Artificial Intelligence	(2-0-0) 2
IS7I03	Software Testing	(2-0-0) 2

OPEN ELECTIVES (Excluding CS & IS Students)

IS7O01	OOP with C ++	(2-0-0) 2
IS7O02	C # & .net	(2-0-0) 2
IS7O03	Introduction to Cyber Security	(2-0-0) 2
IS7O04	Data Science and Analytics	(2-0-0) 2

DEPT. ELECTIVE – IV

IS7E401	Game theory	(2-0-0) 2
IS7E402	Deep Learning	(2-0-0) 2
IS7E403	Business Intelligence	(2-0-0) 2
IS7E404	Advanced Algorithms	(2-0-0) 2
IS7E405	Research Methodology	(2-0-0) 2

SCHEME OF TEACHING AND EXAMINATION
DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING
EIGHT SEMESTER – B.E

Sl. No	Course Code	Course Title	Teaching Dept	Contact Hours / Week				Credits
				L	T	P	Total	
1	IS8E5xx	Dept. Elective – 5	IS & E	3	0	0	3	3
2	IS8E6xx	Dept. Elective – 6$	IS & E	3	0	0	3	3
3	IS8E7xx	Dept. Elective – 7$	IS & E	3	0	0	3	3
4	IS8E8xx	Dept. Elective – 8* (2 Credits)	IS & E	2	0	0	2	2
5	IS8C01	Internship	IS & E	0	0	-	-	3
6	IS8C02	Major Project Phase – 2	IS & E	0	0	8	8	4
			TOTAL	**9**	**0**	**8**	**17**	**16**
			TOTAL (Lateral Entry)	**5**	**0**	**8**	**13**	**12**

$ For regular students
*** For Lateral Entry students**

DEPT. ELECTIVE – V

IS8E501	Real Time Systems	(3-0-0) 3
IS8E502	Distributed Operating System	(3-0-0) 3
IS8E503	Wireless Communication And Networks	(3-0-0) 3
IS8E504	Wireless Adhoc Network	(3-0-0) 3

DEPT. ELECTIVE – VII

IS8E701	Information Storage	(3-0-0) 3
IS8E702	Network Management	(3-0-0) 3
IS8E703	IT Enabled Services	(3-0-0) 3
IS8E704	Green IT – Principles and Practices	(3-0-0) 3

DEPT. ELECTIVE – VI

IS8E601	Management and Information Systems	(3-0-0) 3
IS8E602	Computer Forensics	(3-0-0) 3
IS8E603	Big Data Analytics	(3-0-0) 3
IS8E604	Information Retrieval System	(3-0-0) 3

DEPT. ELECTIVE – VIII

IS8E801	Decision Support and Business Intelligence Systems	(2-0-0) 2
IS8E802	Expert Systems	(2-0-0) 2
IS8E803	Software Testing Principles	(2-0-0) 2
IS8E804	Semantic Web	(2-0-0) 2

ADVANCED COMPUTER ARCHITECTURE (4:0:0)

Course Code : IS7C01 **CIE : 50 Marks**
Hrs/week : 04 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Explain the pipeline design and scheduling techniques.
2. Identify the challenges in different levels of parallelism.
3. Discuss the concepts of parallel processing and hardware-based speculation.
4. Explain the performance criteria for single and multicore processors.
5. Describe Data-level parallelism in Vector Architectures.
6. Explain the various cache optimization techniques.

MODULE 1: **9 Hrs**

FUNDAMENTALS REVIEW PIPELINING: Introduction: Pipeline scheduling, Implementation of an Instruction pipeline.
Self Learning Exercise: Arithmetic pipelines.

MODULE 2: **9 Hrs**

INSTRUCTION –LEVEL PARALLELISM – 1

Concepts and challenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with prediction; Overcoming Data hazards with Dynamic scheduling, Tomasulo's Algorithm.
Self Learning Exercise: Tomasulo's Algorithm Examples.

MODULE 3: **8 hrs**

INSTRUCTION –LEVEL PARALLELISM – 2

Hardware-based speculation, Exploiting ILP using multiple issue and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation.
Self Learning Exercise: Studies of the limitations of ILP.

MODULE 4: **9 Hrs**

THREAD –LEVEL PARALLELISM:

Introduction; Centralized Shared-Memory Architectures; Distributed shared memory and Directory-based coherence; Basics of synchronization.
Self Learning Exercise: Models of Memory Consistency: An introduction

MODULE 5: **9 Hrs**

DATA-LEVEL PARALLELISM IN VECTOR, SIMD, AND GPU ARCHITECTURES

Introduction, Vector Architecture, SIMD Instruction Set extensions for multimedia, Graphic Processing Units.

Self Learning Exercise: NVIDIA GPU Instruction Set Architecture

MODULE 6: **8 Hrs**

MEMORY HIERARCHY DESIGN:

Introduction, Basics of Memory Hierarchy, Cache Optimizations- First Optimization, Second Optimization, Third Optimization, Fourth Optimization, Fifth Optimization, Sixth Optimization, Seventh Optimization, Eighth Optimization, Ninth Optimization, Tenth Optimization.

Self Learning Exercise: Case-study: Performance of the Cortex-A8 Memory Hierarchy.

TEXT BOOKS:

1. **Computer Architecture, A Quantitative Approach –**John L. Hennessey and David A. Patterson: 5th Edition, Elsevier, 2011.

REFERENCE BOOKS:

1. **Advanced Computer Architecture Parallelism, Scalability Programmability–** Kai Hwang: Tata McGraw- Hill, 2003.
2. **B. Parhami, Introduction to Parallel Processing: Algorithms and Architectures**, Plenum series, Kluwer Academic Publishers, 2008.

OOKS:

1. **A Book on Computer Architecture, available at-** https://ict.iitk.ac.in/wp-content/uploads/CS422-Computer-Architecture-ComputerOrganizationAndDesign5thEdition2014.pdf.
1. **A Book on Computer Architecture, available at-**
2. https://poojavaishnav.files.wordpress.com/2015/05/mano-m-m-computer-system-architecture.pdf

MOOC's:

Carnegie Mellon Computer Architecture lecture videos in YouTube.

CO-PO Mapping

PO□ CO □	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	M	W									
CO3	S	M										
CO4	S											
CO5	S											
CO6	S											

CO-PSO Mapping

Course Outcome	PSO-1	PSO-2	PSO-3
CO1	S		
CO2	S	W	
CO3	S	W	
CO4	S		
CO5	S		
CO6	S		

HUMAN COMPUTER INTERFACE SYSTEMS (4:0:0)

Course Code : IS7C02 **CIE : 50 Marks**
Hrs/week : 04 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Describe the Foundations and Interaction of HCI Systems. (Module 1)
2. Explain the Design Basics (Module 2)
3. Explain the Process and Design Rules of HCI. (Module 3)
4. Analyze the Cognitive Models and Architecture. (Module 4)
5. Build Design Models for Mobile HCI. (Module 5)
6. Create user experience using Contextual Tools and Design Patterns. (Module 6)

Module 1: **Foundations of HCI – Introduction** **9 Hrs**

Introduction to HCI, Input-output channels, Human Memory, Thinking, Design Focus, Psychology, and the design of interactive systems. Text entry devices, Positioning, pointing and drawing. Display devices, VR and 3D Interactions. Physical controls, sensors, and special devices. **Interaction:** Introduction, models, and Frameworks. Ergonomics, Interaction styles. Interactivity and the Paradigms for Interaction.

Self Learning Exercise: Elements of The WIMP Interface.

Module 2: **Design of HCI.** **9 Hrs**

Introduction to Interaction Design Basics, Process of Design, User Focus, Scenarios. Navigation design. Screen Design and Layout. Interaction and Prototyping. The software life cycle. Usability Engineering. Iterative Design Prototyping.

Self Learning Exercise: Design Rationale.

Module 3: **Software Process** **7 Hrs**

HCI in software process: Software Lifecycle, Usability Engineering. Iterative Design and Prototyping. **Design Rules:** Principles to support Usability. Standards and Guidelines.

Self Learning Exercise: HCI Patterns

Module 4: **Models and Theories.** **9 Hrs**

Cognitive Models: Introduction, Goal and Task Hierarchies, Linguistic Models, Challenge of Display based system. Physical and Device Models. Cognitive Architectures. **Task Analysis:** Introduction to task analysis. Difference between task analysis and other techniques. Task Decomposition. Knowledge-based analysis. Entity-relationship-based techniques. **Models of the system:** Introduction, Standard Formalism. Interaction Models. Continuous Behaviour.

Self Learning Exercise: **Modeling Rich Interaction:** Status-Event analysis. Low Contexts.

Module 5: **Mobile HCI.** **9 Hrs**

Mobile Design: Interpreting Design. Mobile Design Tent-Pole. Designing for the Best Possible Experience. Elements of Mobile Design. Mobile Design Tools. Designing for Right Device.
Self Learning Exercise: Designing for Different Screen Sizes.

Module 6: **Web Interface Design** **9 Hrs**

Contextual Tools: Interaction in the Context. Fitts's Law. Contextual Tools. Always-visible Tools. Hover-Reveal Tools. Toggle-Reveal Tools. Multi-Level Tools. **Reach Immediately Principle:** Lookup Patterns. Feedback Patterns.
Self Learning Exercise: Secondary Menu of Contextual Tools.

TEXT-BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, **"Human Computer Interaction"**, 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, **"Mobile Design and Development"**, First Edition , O"Reilly Media Inc., 2009 (UNIT –IV)
3. Bill Scott and Theresa Neil, **"Designing Web Interfaces"**, First Edition, O"Reilly, 2009.(UNIT-V)

REFERENCE BOOK:

1. **"Designing the User Interface - Strategies for Effective Human-computer Interaction"** by Ben Shneiderman, Catherine Plaisant · 2010, Addison-Wesley Publisher.

MOOC:

NPTEL Course Link

Course Name: **Human Computer Interaction (HCI)** -from Indian Institute of Technology Guwahati https://nptel.ac.in/courses/106/103/106103115/

E-Books

Directory of Open Access Books

1. Interacting with Presence. HCI and the Sense of Presence in Computer-mediated Environments https://directory.doabooks.org/handle/20.500.12854/50450

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M								W		
CO2	M		S									
CO3	M			S	W							
CO4	M	S										
CO5	M		S		M							
CO6	M		S									

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1			W
CO2			
CO3		M	
CO4	M		
CO5	S		
CO6	M		M

DEPT. ELECTIVE – II
CLOUD COMPUTING (3:0:0)

Course Code : IS7E201 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Identify the open-source platforms for private clouds, service – level and Compliance – level agreements, and software licensing.
2. Discuss applications of cloud.
3. Describe cloud virtualization.
4. Compare different queuing and scheduling technique in cloud.
5. Discuss the security issues in cloud.

MODULE 1: **8 Hrs**

Introduction: Network-centric computing and network-centric content, Peer-to-peer systems, Cloud computing – an old idea whose time has come, Cloud computing delivery models and services, Ethical issues in cloud computing, Cloud vulnerabilities, Major challenges faced by cloud computing.

Cloud Infrastructure: Cloud Computing at Amazon, Cloud Computing: The Google Perspective, *Microsoft Windows Azure* and Online Services, Open-Source Software Platforms for Private Clouds, Cloud Storage Diversity and Vendor Lock- in, Cloud Computing Interoperability: The Intercloud, Energy Use and Ecological Impact of Large-Scale Data Centers, Service- and Compliance-Level Agreements.

Self Learning Exercise: Responsibility Sharing Between User and Cloud Service Provider.

MODULE 2: **8 Hrs**

Cloud Computing: Applications and Paradigms, Challenges for Cloud Computing, Existing Cloud Applications and New Application Opportunities, Architectural Styles for Cloud Applications, Workflows: Coordination of Multiple Activities, Coordination Based on a State Machine Model: The *ZooKeeper*, The *MapReduce* Programming Model, A Case Study: The *GrepTheWeb* Application, Clouds for Science and Engineering, High-Performance Computing on a Cloud, Cloud Computing for Biology Research

Self Learning Exercise: Social Computing, Digital Content, and Cloud Computing

Module 3: **8 Hrs**

Cloud Resource Virtualization: Virtualization, Layering and Virtualization, Virtual Machine Monitors, Virtual Machines, Performance and Security Isolation, Full Virtualization and Paravirtualization, Hardware Support for Virtualization, Case Study: Xen, a VMM Based on Paravirtualization, Optimization of Network Virtualization in Xen 2.0, A Performance Comparison of Virtual Machines.

Self Learning Exercise: The Darker Side of Virtualization, Software Fault Isolation.

MODULE 4: **8 Hrs**

Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two-Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds, Coordination of Specialized Autonomic Performance Managers, A Utility- Based Model for Cloud-Based Web Services, Resource Bundling: Combinatorial Auctions for Cloud Resources, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start-Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling *MapReduce* Applications Subject to Deadlines.

Self Learning Exercise: Resource Management and Dynamic Application Scaling

MODULE 5: **7 Hrs**

Cloud Security: Cloud Security Risks, Security: The Top Concern for Cloud Users, Privacy and Privacy, Trust, Operating System Security, Virtual Machine Security, Security of Virtualization, Security Risks Posed by Shared Images, Security Risks Posed by a Management OS.

Self Learning Exercise: *Xoar:* Breaking the Monolithic Design of the TCB, A Trusted Virtual Machine Monitor

TEXT BOOK:

1. **Cloud Computing: Theory and Practice** , Dan C. Marinescu, Morgan Kaufmann, 2013

REFERENCE BOOK:

1. **Cloud Computing Bible** by Barrie Sosinsky**,** Wiley India
2. **Cloud Security** by Ronald Krutz and Russell Dean Vines, Wiley-India.

OOKS:

1. Book on cloud computing
   - https://www.motc.gov.qa/sites/default/files/cloud_computing_ebook.pdf

MOOC's:

1. https://www.coursera.org/course/cloudcomputing

CO – PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	S	M	W	M								
CO 2	S	S										
CO 3	W				M							
CO 4	S	M										
CO5	S	M	M		S							

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO 1	S	S	
CO 2	S	M	
CO 3	W		
CO 4	M	M	
CO 5	S		

MOBILE APPLICATION DEVELOPMENT (3:0:0)

Course Code : IS7E202	**CIE : 50 Marks**
Hrs/week : 03	**SEE : 50% Marks**
SEE Hrs : 03	**Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Describe the world of mobility and outline various approaches and technologies to App development.
2. Design App user interface.
3. Illustrate App functionality and handling an App's data needs.
4. Apply Animation, graphics libraries and multimedia options available and Create location aware Apps
5. Usage of device sensors and Framework for testing individual app component and Publishing apps

MODULE 1: 8 Hrs

Mobility and Android:

Introduction, Mobility Panorama, Mobile Platforms, App Development Approaches, Android Overview

Getting Started with Android:

Introduction, Setting up Development Environment, Saying Hello to Android, Traversing an Android App Project Structure, Logical Components of an Android App.

Self Learning Exercise: Android Tool Repository, Installing and Running App Devices

MODULE 2: 8 Hrs

Learning with an Application – 3CheersCable:

Introduction, 3CheersCable App, Mobile App Development Challenges, Tenets of a Winning App

App User Interface:

Introduction, Activity, UI Resources, UI Elements and Events, Interaction among Activities, Fragments

Self Learning Exercise: Action Bar, Let's Apply

MODULE 3: 8 Hrs

App Functionality – Beyond UI:

Introduction, Threads, AsyncTask, Service, Notifications, Intents and Intent Resolution, Broadcast Receivers, Telephony and SMS

App Data – Persistence and Access:

Introduction, Flat Files, Shared Preferences, Relational Data, Data Sharing Across App

Self Learning Exercise: Enterprise Data, Let's Apply

MODULE 4: **8 Hrs**

Graphics and Animation:

Introduction, Android Graphics, Android Animation

Multimedia:

Introduction, Audio, Video and Images, Playback

Location Services and Maps:

Introduction, Google Play Services, Location Services, Maps

Self Learning Exercise: Capture and Storage

MODULE 5: **7 Hrs**

Sensors:

Introduction, Sensors in Android, Android Sensor Framework, Motion Sensors, Position Sensors, Environment Sensors

Testing Android Apps:

Introduction, Testing Android App Components, App Testing Landscape Overview

Publishing Apps:

Introduction, Groundwork

Self Learning Exercise: Configuring, Packaging, Distributing

TEXT BOOK:

1. **Composing Mobile Apps Using Android,** Anubhav Pradhan, Anil V Deshpande, Wiley, 1st Edition, 2014.

REFERENCE BOOK:

1. **Professional Android 4 Application Development,** by Reto Meier, WROX Press, Wiley Publishing
2. **Android programming Pearson publications by BM Hirwani, Pearson,**

OOKS:

1. http://iit.qau.edu.pk/books/Android.Application.Development.for.For.Dummies.pdf
2. http://it-ebooks.info/book/621/
3. http://it-ebooks.info/book/860/

MOOC's:

1. http://developer.android.com/guide/index.html
2. http://www.tutorialspoint.com/android/index.htm

CO-PO Mapping

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	M	S		M							
CO3	W			M	M							
CO4	M											
CO5	W	S	M		S							

CO-PSO Mapping

Course Outcomes	Program Specific Outcomes		
	PSO1	PSO2	PSO3
CO1	S	M	
CO2	S	S	
CO3		M	
CO4	M	M	
CO5			W

COGNITIVE SCIENCE (3:0:0)

Course Code : IS7E203 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Discuss the basics of cognitive science
2. Describe the philosophical approach towards cognitive science
3. Discuss the different theories of pattern recognition
4. Outline the Network Approach: Mind as a Web
5. Explain artificial intelligence used in cognitive science

MODULE 1: **8 Hrs**

Introduction: Exploring Inner Space

A Brave New World, What Is Cognitive Science? Representation, Digital Representations ,Analog Representations, The Dual Coding Hypothesis, Propositional Representations Computation, The Tri-Level Hypothesis, The Classical and Connectionist Views of Computation, The interdisciplinary Perspective, : The Philosophical Approach, The Psychological Approach, The Cognitive Approach , The Neuroscience Approach, The Network Approach ,The Evolutionary Approach, The Linguistic Approach, The Artificial Intelligence Approach, The Robotics Approach, Categories of 60 Mental Representation

Self Learning Exercise: categories of mental representation

MODULE 2: **8 Hrs**

The Philosophical Approach: Enduring Questions What Is Philosophy? The Mind-Body Problem, Flavors of Monism, Flavors of Dualism, Evaluating the Dualist Perspective, Functionalism ,Evaluating the Functionalist Perspective, The Free Will–Determinism Debate, The Issue of Determinism ,The Issue of Free Will, Evaluating the Free Will–Determinism Debate ,The Knowledge Acquisition Problem, Evaluating the Knowledge Acquistion Debate, The Mystery of Consciousness, The What It's-Like Argument, Mind as an Emergent Property,

Self Learning Exercise: Overall Evaluation of the Philosophical Approach, Minds On Exercise: Decision Making

MODULE 3: **8 Hrs**

The Cognitive Approach I: History, Vision, and Attention Evaluating the Modular Approach, Theories of Vision and Pattern Recognition, Template Matching Theory, Evaluating Template Matching Theory, Feature Detection Theory, Evaluating Feature Detection Theory, A Computational Theory of Vision, Evaluating the Computational Theory, of Pattern Recognition, The Deutsch Norman Memory Selection Model, Theory of Pattern Recognition

The Cognitive Approach II: Memory, Imagery, and Problem Solving Types of Memory, Sensory Memory, Working Memory, Long Term Memory, Memory Models, The Working Memory Model, Evaluating the Working Memory Model, Visual Imagery, Image Structures, Image Processes, The Imagery Debate, Problem Solving, The General Problem Solver Model, Evaluating the General Problem Solver Model,

Self Learning Exercise: Some History First: The Rise of Cognitive Psychology

MODULE 4: 8 Hrs

Outline: The Network Approach: Mind as a Web Evaluating the Connectionist Approach, Semantic Networks: Meaning in the Web, Characteristics of Semantic Networks, A Hierarchical Semantic Network, Evaluating the Hierarchical Model, Propositional Semantic Networks, Evaluating Semantic Networks, Overall Evaluation of the Network Approach, In Depth: NETtalk, Back Propagation and Convergent Dynamics, Artificial The Network Perspective, Principles Underlying Artificial Neural Networks,Early Conceptions of Neural Networks, Advantages, Problems and Disadvantages, Characteristics of Artificial Neural Networks

Self Learning Exercise: Neural Network Typologies

MODULE 5: 7 Hrs

Artificial Intelligence I: Definitional Perspective Introduction Historical and Philosophical Roots, The Quest for "Mechanical Life" , Philosophical Origins—Man as a Machine, Evaluating Descartes' Approach, Mechanical Computation, Defining Artificial Intelligence (AI), Evaluating the Concept of AI, Strong AI, Applied AI, Cognitive Simulation and Natural, Language Communication, AI Methodologies, The Computer as the Tool of AI research, Evaluation of the Computer as a Model of Brain Organization, Programming, Evaluation of Programming Languages, Evaluation of the Turing Test (TT) and Turing's Detractors, Battle Lines: Overall Evaluation of the AI Concept:

Self Learning Exercise: Summarizing the Meaning of AI In Depth: Behaviourism and Ned Block Evaluating the Block Approach

TEXT BOOK:

1. Jay Friedenberg, Gordon Silverman, cognitive science, An Introduction to the Study of Mind, SAGE publications 2006, ISBN 1-4129-2568-1

REFERENCE BOOK:

1. Philip Johnson-Liard, the computer and mind: an introduction to cognitive science, ISBN 1-4129-2568- 1, Sage publications, 2006

MOOC's:

1. www.youtube.com/watch?v=mTLr3GI5KT8
2. http://www.sussex.ac.uk/informatics/cogslib/csr. php?type=csrp

CO-PO Mapping

POCO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S											
CO3		S	W									
CO4		S	M									
CO5	S	M										

CO-PSO Mapping

PSO CO	PSO1	PSO2	PSO3
CO1	S		
CO2	M		
CO3	S	M	
CO4		M	
CO5		M	W

PARALLEL PROGRAMMING (3:0:0)

Course Code : IS7E204 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Explain the need for Parallel programming and OpenMP.
2. Outline the thread synchronization.
3. Apply the constructs of OpenMP to Write OpenMP Programs.
4. Describe the OpenMP language features.
4. Explain the OpenMP Synchronization Constructs.

MODULE 1: **8 Hrs**

Introduction: Why Parallel Computers Are Here to Stay, Shared-Memory Parallel Computers, Cache Memory Is Not Shared, Implications of Private Cache Memory, Programming SMPs and the Origin of OpenMP, What Are the Needs? A Brief History of Saving Time, What Is OpenMP? Creating an OpenMP Program, The Bigger Picture, Parallel Programming Models, Realization of Shared- and Distributed-Memory, Ways to Create Parallel Programs

Self Learning Exercise: A Simple Comparison.

MODULE 2: **7 Hrs**

Overview of OpenMP:I ntroduction, The Idea of OpenMP, The Feature Set, Creating Teams of Threads, Sharing Work among Threads, The OpenMP Memory Model, Thread Synchronization, OpenMP Programming Styles, Correctness Considerations,

Self Learning Exercise: Performance Considerations.

MODULE 3: **8 Hrs**

Writing OpenMP Program: Introduction, Matrix Times Vector Operation, C and Fortran Implementations of the Problem, A Sequential Implementation of the Matrix Times Vector Operation, Using OpenMP to Parallelize the Matrix Times Vector Product, Keeping Sequential and Parallel Programs as a Single Source Code

Self Learning Exercise: OpenMP wrap up

MODULE 4: **8 Hrs**

OpenMP Language Features: Introduction, Terminology, Parallel Construct, Sharing the Work among Threads in an OpenMP Program, Loop Construct, The Sections Construct, The Single Construct, Workshare Construct, Combined Parallel Work-Sharing Constructs, Clauses to Control Parallel and Work-Sharing Constructs, Shared Clause, Private Clause, Lastprivate Clause, Firstprivate Clause, Default Clause, Nowait Clause, Contents,

Self Learning Exercise: Schedule Clause.

MODULE 5: **8 Hrs**

OpenMP Synchronization Constructs: Barrier Construct, Ordered Construct, Critical Construct, Atomic Construct, Locks, Master Construct, Interaction with the Execution Environment, More OpenMP Clauses, If Clause, Num threads Clause, Ordered Clause, Reduction Clause 105 4.8.5 Copyin Clause 110 4.8.6 Copyprivate Clause 110 4.9 Advanced OpenMP Constructs, Nested Parallelism, Flush Directive, Threadprivate Directive,

Self Learning Exercise: Synchronization Wrap-Up.

TEXT BOOK:

1. Using OpenMP Portable Shared Memory Parallel Programming, Barbara Chapman, Gabriele Jost, Ruud van der Pas , The MIT Press Cambridge, Massachusetts , 2008.

REFERENCE BOOK:

1. Using MPI: Portable Parallel Programming with the Message-Passing Interface, 3rd Ed - William Gropp, Ewing Lusk, Anthony Skjellum (2014)

2. Programming Massively Parallel Processors: A Hands-on Approach, 3rd Ed. - David B. Kirk, Wen-mei W. Hwu (2016)

MOOC's:

1. https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-950-parallel-programming-for-multicore-machines-using-openmp-and-mpi-january-iap-2010/
2. https://www.youtube.com/watch?v=2GwZKJ4QpME

OOK:

1. https://apps2.mdp.ac.id/perpustakaan/ebook/Karya%20Umum/Portable_Shared_Memory_Parallel_Programming.pdf

CO – PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	S	M		S								
CO 2	S	S		M								
CO 3	S	M		M								
CO 4	S	M		M								
CO 5	S	M		M								

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO 1	S	M	
CO 2	M	M	
CO 3	M	M	
CO 4	S	M	
CO 5	M	M	

DEPT. ELECTIVE – III

UNIX SYSTEMS PROGRAMMING (3:0:0)

Course Code : IS7E301	**CIE : 50 Marks**
Hrs/week : 03	**SEE : 50% Marks**
SEE Hrs : 03	**Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Outline the basic features of UNIX Operating System.
2. Apply the system calls for handling files, I/O and directories.
3. Identify the features ofprocesses in UNIX environment.
4. Analyze the importance of process control and its relationship.
5. Identify the purpose of signals and daemon process concepts in UNIX environment

MODULE 1: 8 Hrs

UNIX System Overview- UNIX Standardization and Implementations: Introduction, UNIX Architecture, Logging In, Files and Directories, Input and Output, Program and Processes, Error Handling, User Identification, Signals, Time values, System calls and Library Functions. Introduction, UNIX Standardization, UNIX System Implementations, Relationship of Standards and Implementations, Limits.

Self Learning Exercise: Feature Test Macros, Primitive System Data Types, Conflicts between Standards.

MODULE 2: 8 Hrs

File I/O, Files and Directories: Introduction, File Descriptors, open Function, create Function, close Function, lseek Function, read Function, write Function, File Sharing, Atomic Operations, dup and dup2 Functions, fcntl Function. Introduction, stat, fstat, and lstat Functions, File Types, Set-User-ID and Set-Group-ID, File Access Permissions, Ownership of New Files and Directories, access Function, umask Function, chmod and fchmod Functions, Sticky Bit, chown, fchown, and lchown Functions, link, unlink, remove, and rename Functions, Symbolic Links, symlink and readlink Functions, File Times, utime Function, mkdir and rmdir Functions.

Self Learning Exercise: Reading Directories, chdir, fchdir, and getcwd Functions Device Special Files.

MODULE 3: 7 Hrs

UNIX Processes: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions.

Self Learning Exercise: getrlimit, setrlimit Functions.

MODULE 4: 8Hrs

Process Control, Process Relationships: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, system Function, Process Accounting, User Identification, Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp, tcsetpgrp, and tcgetsid Functions, Job Control.

Self Learning Exercise: Shell Execution of Programs, Orphaned Process Groups.

MODULE 5: 8 Hrs

Signals, Daemon Processes: Introduction, Signal Concepts, signal Function, kill and raise Functions, alarm and pause Functions, Signal Sets, sigprocmask ,sigpending, sigaction Function, abort, sleep Function. Introduction, Daemon Characteristics, Coding Rules.

Self Learning Exercise: Single-instance daemons, Daemon conventions.

TEXT BOOKS:

1. Advanced Programming in the UNIX Environment, W Richard Stevens, Stephen A Rago, 3rd Edition, Addison-Wesley, 2017.
2. Terrence Chan, Unix System Programming Using C++ -, PHI, 2015

REFERENCE BOOKS:

1. The Design of the UNIX Operating System –Maurice J Bach, Pearson Education PHI, 2016

Kay Robbins , Steven Robbins, Unix Systems Programming, Communication, concurrency, and threads, Pearson education, January 2008

Advanced Unix Programming- Marc J. Rochkind, 2nd Edition, Pearson Education, 2005.

EBOOKS:

1. ftp://ftp.bupt.edu.cn/pub/Documents/SystemAdmin/[ebook] O'Reilly Learning the UNIX Operating System.pdf
2. http://www.bitsinthewind.com/about-dac/publications/unix-systems-programming
3. http://www.freebookcentre.net/unix-books-download/UNIX-or-Linux-Programming-Lecture-Notes.html
4. www.freebookcentre.net/unix-books-download/The-Art-of-Unix-Programming-by-Eric-S.-Raymond,-copy;2003.html

MOOCs:

1. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=PracticalUnix
2. http://www.extension.harvard.edu/academics/courses/unixlinux-systems programming/240403

3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828-operating-system-engineering-fall-2012

CO – PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	-	-	-	-	-	-	-	-	-	-	-
CO2	S	S	S	-	-	-	-	-	-	-	-	-
Co3	W	S	W	-	-	-	-	-	-	-	-	-
CO4	M	S	M	-	-	-	-	-	-	-	-	-
CO5	W	M	M	M	-	-	-	-	-	-	-	-

CO – PSO Mapping

COs/POs	PSO1	PSO2	PSO3
CO1	M	M	-
CO2	M	S	W
CO3	M	S	-
CO4	S	M	-
CO5	M	M	-

MULTIMEDIA COMPUTING (3:0:0)

Course Code : IS7E302 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Explain the basic concept of multimedia communication, its applications and network terminologies.
2. Illustrate various representation of multimedia information viz text, Images, Audio and Video.
3. Discuss the compression principles and text compression methods used in multimedia computing.
4. Describe Image and audio compression techniques for multimedia communication.
5. Explain other audio compression techniques and video compression techniques for multimedia communication.

MODULE 1: **8Hrs**

Multimedia Communications: Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and network terminology-media types, communication modes, network types, multipoint conferencing, Network QoS.

Self Learning Exercise: Application QoS.

MODULE 2: **8Hrs**

Multimedia information representation: Introduction, DigitizationPrinciples- Analog signals, Encoder and Decoder design, Text- unformatted, formatted and hypertext, Images- graphics, digitized documents and pictures. Audio-PCM speech, CD-quality audio, synthesized audio. Video- Broadcast television, Digital Video.

Self Learning Exercise: PC video, Video content.

MODULE 3: **8Hrs**

Compression Techniques: Introduction, Compression principles- Source encoders and destination encoders, LosSelf Learning Exercisess and lossy compression, Entropy encoding, Source encoding. Text compression- Static Huffman coding, Dynamic Huffman coding, Arithmetic coding, Lempel-Ziv coding.

Self Learning Exercise: Lempel-Ziv-Welsh coding

MODULE 4: **8Hrs**

Image Compression: Graphics Interchange format, Tagged image file format, Digitized documents, Digitized pictures.

Audio Compression: Introduction, Audio compression-Differential pulse code modulation, Adaptive Differential PCM, Adaptive predicting coding, Linear predictive coding,

Self Learning Exercise:JPEG, Code-exited LPC

MODULE 5: **7Hrs**

Audio Compression: Perceptual coding, MPEG audio coders, Dolby audio coders

Video compression: Introduction, Video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2

Self Learning Exercise: MPEG-4

TEXT BOOK:

1. **Multimedia Communications – Applications, Networks, Protocols and Standards** – Fred Halsall, Pearson Education, 2011.

REFERENCE BOOKS:

1. **Multimedia Communications: Protocols and Applications** - Franklin F.Kuo, WolfgangEffelsberg, J. J. Garcia-Luna-Aceves, Prentice Hall PTR, 1998
2. **Introduction to Multimedia Communications- Applications, Middleware, Networking**, by Kamisetty Rao, Zoran Bojkovic, DragoradMilovanovic ,Wiley publication, 2006

OOKS

1. **Introduction to Multimedia Communications- Applications, Middleware, Networking**, by Kamisetty Rao, Zoran Bojkovic, DragoradMilovanovic ,Wiley publication, 2006
2. **Multimedia Communications-Directions and Innovations**,by Jerry D. Gibson, ElsevierScience, 2000

MOOC's

1. **Internet of Things: Multimedia Technologies**- by Harinath Garudadri, Coursera. Link: https://www.coursera.org/learn/internet-of-things-multimedia

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M									
CO2	S	M	M									
CO3	S	M	M									
CO4	S	M	M									
CO5	S	M	M									

CO – PSO MAPPING

	PSO1	**PSO2**	**PSO3**
CO1	**M**	**M**	
CO2	**M**	**M**	
CO3	**M**	**M**	
CO4	**M**	**M**	
CO5	**M**	**M**	

SYSTEM SIMULATION AND MODELING (3:0:0)

Course Code : IS7E303 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Outline the basics of simulation, modelling and replicating the practical situations in organizations.
2. Describe general principles and generate random numbers using different techniques.
3. Generate random variates and develop simulation model using heuristic methods.
4. Discuss selection of simulation Software and server utilization.
5. Analyse, verify and validate input models.

MODULE 1: 8 Hrs

Introduction to Discrete-Event System Simulation- Introduction to Simulation: Simulation Advantages and Disadvantages of Simulation, Areas of Application, Systems and System Environment, Components of a System, Model of a System, Types of Models, Steps in a Simulation Study

Self Learning Exercise: Simulation of Inventory Systems, Other Examples of Simulation

MODULE 2: 8 Hrs

General Principles: Concepts in discrete - event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling.

Random-Number Generation: Properties of Random Numbers, Generation of Pseudo-Random Numbers, Techniques for Generating Random Numbers, Linear Congruential Method, Combined, Tests for Random Numbers.

Self Learning Exercise: Frequency Tests, Tests for Autocorrelation

MODULE 3: 8 Hrs

Random Variate Generation: Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods.

Random-Variate Generation: Inverse-Transform Technique, Exponential Distribution, Uniform Distribution, Weibull Distribution, Acceptance Rejection Technique Optimisation Via Simulation: Meaning, Robust Heuristics.

Self Learning Exercise: Direct Transformation for the Normal and Lognormal Distributions, Convolution Method

MODULE 4: **8 Hrs**

Simulation Software: Selection of Simulation Software, An Example Simulation, Simulation Software Arena, Queueing Models: Characteristics of Queueing Systems

System Capacity: The Arrival Process, Queue Behavior and Queue Discipline, Service Times and the Service Mechanism Queueing Notation Long-Run Measures of Performance of Queueing Systems, Average Time Spent in System Per Customer w, Server Utilization.

Self Learning Exercise: Costs in Queueing Problems Steady-State Behavior of Infinite-Population Markovian Models Single-Server Queues with Poisson Arrivals and Unlimited Capacity: M/G/1

MODULE 5: 7 Hrs

Input Modelling: Data Collection, Identifying the Distribution with Data, Parameter Estimation, Preliminary Statistics: Sample Mean and Sample Variance, Suggested Estimators, Goodness-of-Fit Tests, Multivariate and Time-Series Input Models.

Self Learning Exercise: Multivariate Input Models, Time-Series Input Models

TEXT BOOKs:

1. Discrete-Event System Simulation, Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, P. Shahabudeen, 5th Edition, Prentice Hall, 2009.

REFERENCE BOOK:

1. Simulation Modeling and Analysis(SIE) by Averill Law , McGraw Hill Education ,2017

2. System Simulation, 2 Ed by Geoffrey Gordan, Pearson India, 2015

OOKS:

1. https://books.google.co.in/books/about/Discrete_event_System_Simulation.html?id=xK21QgAACAAJ&redir_esc=y
2. http://www.e-booksdirectory.com/listing.php?category=100

MOOCs:

1. https://ocw.tudelft.nl/course-lectures/5-4-discrete-event-modelling-simulation/?course_id=16906
2. https://nptel.ac.in/courses/112/107/112107220/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-875-mechanical-assembly-and-its-role-in-product-development-fall-2004/lecture-notes/cls20_smltion04.pdf
4. http://ce.sharif.edu/courses/95-96/2/ce634 1/resources/root/Books/Discrete%20Event%20System%20Simulation%20(Fifth%20Edition)%20.pdf
5. http://freevideolectures.com/Course/3364/Principles-of- Engineering-System-Design/27

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S				M							M
CO2	S	S		S								
CO3	M	S	S	S								
CO4		M	M	M								
CO5		S	M	M	S							M

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO1	M		
CO2	S		
CO3	S		
CO4	S		
CO5	M		

CLIENT-SERVER PROGRAMMING (3:0:0)

Course Code : IS7E304 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course outcomes

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

1. Analyze the requirements of the client and server environment.
2. Explain socket programming client server systems.
3. Illustrate the knowledge of current client/server system.
4. Develop client server applications.
5. Identify Algorithms and issues in server design.

MODULE 1: **8 Hrs**

The Client Server Model and Software Design, Concurrent Processing in Client-Server software: Introduction, Motivation, Terminology and Concepts, Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design,

Self Learning Exercise: Concurrency and Asynchronous I/O.

MODULE 2: **8 Hrs**

Program Interface to Protocols, The Socket Interface: Introduction, Loosely Specified Protocol

Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP, Introduction, Berkeley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program,

Self Learning Exercise: Symbolic Constants for Socket Call Parameters.

MODULE 3: **9 Hrs**

Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP,

Self Learning Exercise: Partial Close for UDP, A Warning about UDP Unreliability.

MODULE 4: 7 Hrs

Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service.

Self Learning Exercise: A UDP Client for the ECHO Service.

MODULE 5: 7 Hrs

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock.

Self Learning Exercise: Alternative Implementations.

TEXTBOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, PHI LEARNING PVT. LTD-NEW DELHI, 2nd Edition, 2009.

R**EFERENCE BOOK:**

1. W. Richard Stevens, "UNIX NETWORK PROGRAMMING", PHI LEARNING PVT. LTD-NEW DELHI 3RDIndian Reprint Edition,2009
2. W. Richard Stevens, "Unix Network Programming: Interprocess Communications", Volume – 2, Phi Learning Edition, 2nd Edition,2009

E-Books:

1. http://alandix.com/academic/tutorials/tcpip/TCP-IP-complete.pdf

MOOCs:

1. https://www.csd.uoc.gr/~hy556/material/tutorials/cs556-3rd-tutorial.pdf
2. http://ftp.sas.com/techsup/download/SASC/share5958-59/S5958v2.pdf

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S											
CO2	S	M	M	W	M	W						
CO3	S	M	M	W	M	W						
CO4	S	M	M	W	M	W						
CO5	S	M	M	W	M	W						

CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	M	W	W
CO2	M	S	M
CO3	M	S	M
CO4	M	S	M
CO5	M	S	M

BLOCK CHAIN TECHNOLOGY (3:0:0)

Sub code	**: IS7E305**	**CIE**	**: 50 Marks**
Hrs/week	**: 03**	**SEE**	**: 50% Marks**
SEE Hrs	**: 03 Hours**	**Max. Marks: 100**	

COURSE OUTCOMES:

On Successful completion of the course, the students will be able to:

1. Describe the underlying architecture and basics of cryptographic concepts for blockchain technology.
2. Understand the Bitcoin blockchain.
3. Distinguish the working of Ethereum against the Bitcoin blockchain.
4. Understand the altcoins and regulations of blockchain.

MODULE 1: **8 Hrs**

Introduction to Fundamentals and Cryptography:

Basics: Distributed Database, Two Generals' Problem, Byzantine Generals Problem and Fault Tolerance, Cryptographic Hash Functions, Hash Pointers and Data structures, Digital Signatures, Public keys as Identities, Application Specific Integrated Circuits (ASIC)

Self-Learning Exercise: Memory Hard Functions

MODULE 2: **8 Hrs**

Bitcoin Blockchain-1

History of Bitcoin, Transactions, Blocks, Mining and the Blockchain, Bitcoin Transactions, Constructing a Transaction, Bitcoin Mining, Mining Transaction in Blocks, Spending the Transaction, Bitcoin Addresses, Wallets, Transactions: Transaction Lifecycle, Transaction Structure, Transaction Outputs and Inputs, Transaction Chaining and Orphan Transactions, Transaction Scripts and Script Language, Standard Transactions- Pay to Public Key Hash (P2PKH)

Self-Learning Exercise: Pay to Script Hash (P2SH).

MODULE 3: **8 Hrs**

Bitcoin Blockchain-2:

Structure of a Block, Block Header, Block Identifiers - Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the Blockchain, De-centralized Consensus, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Constructing the Block Header, Mining the Block- Proof of Work, Successfully Mining the Block, Validating a New Block, Blockchain Forks

Self-Learning Exercise: Mining Pools.

MODULE 4: **7 Hrs**

Ethereum Blockchain:

Introduction, Comparison with Bitcoin Blockchain, Ether currency Units, Choosing a Ethereum Wallet, A Simple Contract: A Test Ether Faucet, Ethereum's Cryptographic Hash Function, Ethereum Addresses, Transactions: The Structure of a Transaction, The Transaction Nonce, Transaction Gas, Transaction Recipient, Transaction Value and Data, Proof-of-Stake, Introduction to DApps.

Self-Learning Exercise: Multiple-Signature (Multisig) Transactions

MODULE 5: **8 Hrs**

Altcoins and the Cryptocurrency Ecosystem:

Cryptocurrency Regulation: Stakeholders, Roots of Bitcoin, Legal Aspects-Crypto currency Exchange, Altcoins: History and Motivation, Few Altcoins in Detail- Namecoin, Litecoin, Dogecoin, Relationship Between Bitcoin And Altcoins- Comparing Altcoins

Self-Learning Exercise: Merge Mining

Textbooks:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies", A Comprehensive Introduction, Princeton University Press, 2016
2. Andreas M. Antonopoulos, "Mastering Bitcoin", O'Reilly Media, Inc, 2017
3. Andreas M. Antonopoulos, Galvin Wood, "Mastering Ethreum", O'Reilly Media, Inc, 2018

Reference Books:

1. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
2. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

MOOCs

1. https://www.my-mooc.com/en/categorie/blockchain-and-cryptocurrencyhttps://www.lopp.net/pdf/princeton_bitcoin_book.pdf
2. https://crypto.stanford.edu/cs251_fall16/syllabus.html
3. https://www.mooc4dev.org/blockchain1

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M		W								
CO2	S	S		M								
CO3	S	S	M	W								
CO4	S			M								

CO-PSO Mapping:

	PSO1	PSO2	PSO3
CO1	S		
CO2	S		
CO3	S	M	
CO4	S		

INDUSTRY DRIVEN ELECTIVE
INTERNET OF THINGS (2:0:0)

Course Code : IS7I01 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Define IoT and its architecture.
2. Understand IoT Protocols
3. Design logic for IoT Platform

Module 1: **8 Hrs**

Introduction to IoT: Terms and Definition, Characteristics, Advantages & Disadvantages, IoT Ecosystem: Enabling Technologies, Applications, Marketplace and Vision, IoT Reference Model
Self Learning Exercise: Web Application Development

Module 2: **9 Hrs**

IoT Protocols: Classification, MQTT, XMPP, DDS, REST, Domain Specific IoT: Smart Home & Smart Cities, Environment & Agriculture, Retail & logistics, Health & Lifestyle
Self Learning Exercise: RaspberryPi Interface

Module 3: **9 Hrs**

IoT Platform design methodology: Specification, Integration, Development, Logic design using Python: Data Types, Control Flow, Functions, Modules, Classes, Packages of interest for IoT
Self Learning Exercise: Programming RaspberryPi with Python

Textbook:

1. Internet of Things by Srinivasa K.G, Siddesh G.M, Hanumantha Raju R

Reference book:

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

E-books:

1. https://bookauthority.org/books/new-internet-of-things-ebooks

MOOCs:

1. **https://nptel.ac.in/courses/106/105/106105166/**

CO-PO Mapping

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M									
CO2	S	M	M									
CO3	S	S	M	M	W							

CO- PSO Mapping

Course Outcome / PSOs	PSO1	PSO2	PSO3
CO1	M	M	-
CO2	M	M	-
CO3	S	S	-

ARTIFICIAL INTELLIGENCE (2:0:0)

Course Code : IS7I02 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

COURSE OUTCOMES:

On Successful completion of the course, the students will be able to:

1. Define Artificial Intelligence and categorize the properties of task environment.
2. Devise various strategies in formulation of problems.
3. Compare various search techniques used in AI.

Module 1: Introduction to AI and Agents. 10 Hrs

Introduction, what is AI? The foundations of Artificial Intelligence. The history of artificial Intelligence. Intelligent agent, Agents and environments, behavior. The concept of rationality. The nature of environments. The structure of agents.

Self Learning Exercise: Working of the components in agent program.

Module 2: Solving Agents in AI. 8 Hrs

Solving problems by searching. Problem-solving agents, example problems, searching for solutions, uninformed search strategies, Informed (heuristic) search strategies, Heuristic functions

Self Learning Exercise: Learning heuristics from experience.

UNIT 3: Beyond classical search and Optimization. 8 Hrs

Local search algorithms and optimization problems – Hill climbing search, simulated annealing, local beam search, genetic algorithms, local search in continuous spaces. Searching with nondeterministic actions. Searching with partial observations. Online search agents and unknown environments

Self Learning Exercise: Learning in online search.

TEXTBOOK: ***Artificial Intelligence a Modern Approach*** Stuart Russell, Peter Norvig Third Edition, Pearson publication, 2010.

REFERENCE BOOK: ***Introduction to Artificial Intelligence*** Third Edition by Philip C. Jackson · 2019. Dover Publications.

MOOC: ***An Introduction to Artificial Intelligence*** by Prof. Mausam, IIT Delhi.
SWAYAM LINK https://onlinecourses.nptel.ac.in/noc21_cs42/preview

E-Book:

1. **New Trends in the Use of Artificial Intelligence for the Industry 4.0**
   https://directory.doabooks.org/handle/20.500.12854/36218
2. **Deterministic Artificial Intelligence**
   https://library.oapen.org/handle/20.500.12657/43844

CO-PO Mapping

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M			W							
CO2	M	M	W									
CO3		M		W								

CO-PSO Mapping

PSO → CO ↓	PSO1	PSO2	PSO3
CO1	W		
CO2	M		
CO3		M	

SOFTWARE TESTING (2:0:0)

Course Code : IS7I03 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Design test cases for any given problem
2. Classify the different testing techniques
3. Compare and Contrast White box and Black box testing.

MODULE– 1: 9 Hrs

Introduction

Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. **Problem Statements:** Generalized pseudocode.

Self Learning Exercise: The triangle problem

MODULE- 2: 10 Hrs

Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, Nextdate problem and commission problem, Equivalence classes, Equivalence tesate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem.The currency converter, Saturn windshield wipe.

The cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. **Fault Based Testing:** Overview, Assumptions in fault based testing, Mutation analysis.

Self Learning Exercise: Fault-based adequacy criteria, Variations on mutation analysis.

MODULE – 3: 7 Hrs

Black Box testing: What is Black Box Testing? Why Black Box Testing? What is white Box testing? Why white box testing? **System testing:** System Testing overview, Why is system testing done? How is it Done?

Self Learning Exercise: Types of system testing.

TEXT BOOKS:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008.
2. **Software Testing Principles and Practices** – Srinivasan Desikan, Gopalaswamy Ramesh, Ninth Impression: 2011, PEARSON

REFERENCE BOOKS:

1. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
2. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
3. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.
4. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995.
5. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015.
6. Naresh Chauhan, Software Testing, Oxford University press.

MOOCs:

1. https://www.mooc-list.com/tags/software-testing
2. https://www.katalon.com/**software**/**testing**
3. https://www.mooc-list.com/course/software-testing-udacity

E-Books:

1. https://www.softwaretestinghelp.com/practical-software-testing-new-free-ebook-download/
2. https://www.cigniti.com/e-books/

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	S	S	M	M	M		M	M	M		M	M
CO 2	S	M	M			M		M	M	W		M
CO 3	M	M				M						W

CO – PSO Mapping

	PSO1	PSO2	PSO3
CO 1		W	M
CO 2	W	M	M
CO 3		M	W

OPEN ELECTIVE

OOP with C++ (2:0:0)

Course Code : IS7O01 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Apply the concepts of Object-Oriented Programming.
2. Illustrate the usage of Function Overloading, Default Arguments and Operator Overloading.
3. Demonstrate the concept of Inheritance and Polymorphism.

MODULE1: **8Hrs**

An Overview of C++:

What Is Object-Oriented Programming?,Some C++ Fundamentals, Classes and Objects, Friend Classes, Constructors, Parameterized Constructors, Destructors,Inline Functions, 'this' pointer.

Self Learning Exercise: Static Class Members.

MODULE2: **9 Hrs**

Function Overloading, Copy Constructors, DefaultArguments and Operator Overloading

Functions: Inline Functions, Friend Functions, Function Overloading, Copy Constructors, Default Function Arguments,Operator Overloading: Creating a Member Operator Function.

Self Learning Exercise: Operator Overloading Using a Friend Function.

MODULE3: **9hrs**

Inheritance, Virtual Functions and Polymorphism

Base-Class Access Control, Inheritance and protected Members, Inheriting Multiple Base Classes, Constructors, Destructors, and Inheritance, Virtual Functions, Pure Virtual Functions, Using Virtual Functions.

Self Learning Exercise: Early vs. Late Binding.

TEXTBOOKS:

1 C++: The Complete Reference- Herbert Schildt, McGraw-Hill, 4th Edition, 2003.
2 Object-Oriented Programming with C++, E. Balagurusamy, McGraw-Hill, 7th Edition, 2017.

REFERENCE BOOKS:

1 Programming: Principles and Practice Using C++, Bjarne Stroustrup, Addison-Wesley Professional; 2nd edition, 2014.
2 C++ Primer, Stanley B. Lippman, Addison-Wesley Professional; 5th edition, 2012.

EBOOKS:

1 A Book of C++,available at- http://www.uml.org.cn/c%2B%2B/pdf/C%2B%2BComplete%20Reference%20(3rd%20Ed.).pdf

2 A Book of C++, available at- http://www.lmpt.univ-tours.fr/~volkov/C++.pdf

MOOC's:

1. https://www.edx.org/course/introduction-to-c-3

CO-PO Mapping

PO□ CO □	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	W									
CO2	S	M	S									
CO3	S	M	M									

CO-PSO Mapping

Course Outcome	PSO-1	PSO-2	PSO-3
CO1	S	W	
CO2	S	M	
CO3	S	W	

C # and .net (2:0:0)

Course Code : IS7O02 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes

On Successful completion of the course, the students will be able to:

1 Explain the basics of .Net platform and the role of base class libraries, role of common intermediate language and namespaces.
2 Discuss the fundamentals of c# and to build the basic c# program using different constructs.
3 Apply the exception handling technique and to define the use of interfaces.

Module 1 **8 Hrs**

THE PHILOSOPHY OF .NET: Understanding the Previous State of Affairs, The .NETSolution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries, the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifast, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Run-time A tour of the .NET Namespaces.

Self Learning Exercise: Increasing Your Namespace Nomenclature

Module 2 **8 Hrs**

C# LANGUAGE FUNDAMENTALS: The Anatomy of a Basic C# Class, Creating objects:Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node System.Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces.

Self Learning Exercise: Programming using basic constructs of c#

Module 3 **10 Hrs**

EXCEPTIONS :Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handing, the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System.System Exception), Custom Application-Level Exception (System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance

Exception Dynamically Identifying Application – and System Level Exception Debugging System.
INTERFACES AND COLLECTIONS: Defining Interfaces Using C# Invoking Interface Members at the object Level, Understanding Explicit Interface Implementation.
Self Learning Exercise: Building custom Interfaces and collections using VS.NET

TEXT BOOK

1. C# and the .NET platform - Andrew Troelsen, Special Edition, Dream Tech Press, India, 2003.

REFERENCE BOOK:

1. Inside C# - Tom Archer, WP Publishers, 2001.

E-books:

1. https://www.tutorialspoint.com/csharp/csharp_tutorial.pdf

Moocs:

1. https://www.coursera.org/learn/introduction-programming-unity#syllabus
2. https://docs.microsoft.com/en-us/dotnet/csharp

CO – PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		**S**										
CO 2		**S**										
CO 3		**M**										

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO 1	**S**		
CO 2	**M**		
CO 3	**M**		

INTRODUCTION TO CYBER SECURITY (2:0:0)

Course Code : IS7O03 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Describe cybercrime, its classifications and various types of Cyber attacks
2. Describe security challenges faced by the mobile devices.
3. Distinguish the different tools and methods used in cybercrime and discuss the impact of Phishing

MODULE 1: **8 Hrs**

Introduction to Objectives and cyber offenses

Introduction to cybercrime, Cybercrime and information security, who are Cybercriminals, Classification of Cybercrimes, Cybercrime: The Legal Perspectives, An Indian Perspective, Cybercrime and the Indian ITA 2000,A global perspective on cybercrimes.

Cyber offenses: Introduction, How criminal plan the attacks, Social engineering, Cyber stalking, Cyber cafe and cybercrimes, Botnets: The fuel for cybercrime, Attack vector

Self Learning Exercise: Cloud Computing, Cybercrime era: Survival mantra for the citizens

MODULE 2: **8Hrs**

Cyber crime: Mobile and Wireless devices

Introduction, Proliferation of mobile and wireless devices, Trends in mobility, Security challenges posed by mobile devices, Registry setting for mobile devices, authentication service security, Attacks on mobile/ cell phones, Mobile devices: security implications for organizations, Organization measures for handling mobile, Organizational security policies.

Self Learning Exercise: Measures in mobile computing era, Laptops.

MODULE 3: **10Hrs**

Tools and method used in Cybercrime:

Introduction, Proxy servers and anonymizers, Phishing, Password cracking Introduction, Proxy servers and anonymizers, Phishing, Password cracking, Key loggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL injection, Buffer overflow, Phishing and identity theft: Introduction, Phishing

Self Learning Exercise: Attacks on wireless networks, :Identity theft (id theft).

TEXT BOOK:

1. Cyber Security by Nina Godbole,SunitBelapure, Wiley India, 1st edition copyright 2011, reprint 2013.

REFERENCEBOOK:

1 ComputerForensicsandCyberCrimeAnIntroductionbyMarjieT.Britz,Pearsonpublication, 3rdedition,2013.

EBOOK:

1 Introduction to computer Networks and cyber security by chwan-Hwa, David Irwin, CRC Press, 2013.

MOOCs:

1 http://www.open.edu/openlearn/futurelearn/cyber-security
2 http://www.cyberdegrees.org/resources/free-online-courses/

CO – PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	M	M	S	S		M						
CO 2	S	M	W	M	M							
CO 3	S	M	S	M	S	W						

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO 1	S	W	
CO 2	M	M	
CO 3	M	W	M

DATA SCIENCE AND ANALYTICS (2:0:0)

Course Code : IS7O04 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Identify the importance of Big Data.
2. Determine the Data Analytics Lifecycle
3. Implement Statistical Methods using R Programming

MODULE 1: **7 Hrs**

Introduction to Big Data Analytics:

Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem,

Self Learning Exercise: Virtualization Examples of Big Data Analytics.

MODULE 2: **7 Hrs**

Data Analytics Lifecycle:

Data Analytics Lifecycle Overview, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communicate Results, Phase 6: Operationalize,

Self Learning Exercise:. Case Study: Global Innovation Network and Analysis (GINA)

MODULE 3: **7 Hrs**

Basic Data Analytic Methods Using R:

Introduction to R, Exploratory Data Analysis, Statistical Methods for Evaluation,

Self Learning Exercise: ANOVA

.

TEXT BOOK:

1. Data Science and Big Data Analytics – Discovering, Analyzing, Visualizing and Presenting Data by David Dietrich, Barry Heller and Beibei Yang , EMC Education Services , Wiley, 2015.

REFERENCE BOOKS:

1. Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, by Davy Cielen (Author), Arno D.B. Meysman (Author), Mohamed Ali (Author) Dreamtech Press, 2016

EBOOKS:

1. https://www.researchgate.net/publication/258698880_The_Field_Guide_to_Data_Science

MOOCs:

1. https://www.coursera.org/browse/data-science

CO – PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	S											
CO 2	M		W									
CO 3	M	S	M									

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO 1	S		
CO 2	M		
CO 3		S	

DEPT. ELECTIVE – IV

GAME THEORY (2:0:0)

Course Code : IS7E401 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Describe pure and mixed strategy Nash equilibrium, and an extensive game model to study long-term relationships
2. Illustrate strategies, concepts of dominant, dominated, and rationalizable strategies
3. Describe concepts of asymmetric information, pure and mixed strategies, and best responses

MODULE 1: **9 Hrs**

Introduction: What is game theory? 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

Extensive Games with Perfect Information: Theory, Introduction, Extensive games with perfect information

Self Learning Exercise: Illustrations.

MODULE 2: **9 Hrs**

Strictly Competitive Games and max-minimization, Introduction, Definitions and examples, Strictly competitive games, testing the theory of Nash equilibrium in strictly competitive games

Rationalizability: Introduction,

Self Learning Exercise: Iterated elimination of strictly dominated actions

MODULE 3: **8 Hrs**

Evolutionary Equilibrium, Introduction, Monomorphic pure strategy equilibrium, Evolutionary game theory: some history, Mixed strategies and polymorphic equilibrium, Asymmetric equilibria,

Self Learning Exercise: Explaining the outcomes of contests in nature

TEXT BOOK:

1. **An Introduction to Game Theory** – Martin Osborne, Oxford University Press, Indian Edition, 2004.

REFERENCE BOOKS:

1. A. Dixit, S. Skeath and D. Reiley, Games of Strategy, 3rd edition, 2009 or 4th edition, 2015, W.W. Norton & Company: New York.
2. 2.Introduction to Game Theory A Behavioral Approach, Kenneth C. Williams, June 2012
3. 3.The Joy of Game Theory: An Introduction to Strategic Thinking Presh Talwalkar, Kindle Edition,2014

OOKS:

1. 1.https://books.google.co.in/books/about/An_Introduction_to_Game_Theory.html?id=_C8uRwAACAAJ&redir_esc=y
2. http://ce.sharif.edu/courses/95-96/2/ce634-1/resources/root/Books/Discrete%20Event%20System%20Simulation%20(Fifth%20Edition)%20.pdf

MOOCs:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-254-game-theory-with-engineering-applications-spring-2010/lecture-notes/

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	S	S	S							
CO2	M	S	M	M	W							
CO3	S	S	S	S	W							W

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO1	S		
CO2	S		
CO3	S		

DEEP LEARNING (2:0:0)

Course Code : IS7E402 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course outcomes

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

1. Analyze the basics of Deep Networks.
2. Develop an understanding what is involved in learning models from data
3. Analyze the basics of Convolutional Neural Network.

Module 1 : 9 Hrs

Historical Trends in Deep Learning, Deep Feedforward Networks: Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

Self Learning Exercise: Historical Notes

Module 2 : 10 Hrs

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training,

Self Learning Exercise: Tangent Distance, Tangent Prop, and Manifold Tangent Classifier

Module 3 : 9 Hrs

Convolutional Networks: The Convolution Operation, Motivation , Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basis for Convolutional Networks.

Self Learning Exercise: Convolutional Networks and the History of Deep Learning

Text Book:

1. Deep Learning: Ian Goodfellow, Yoshua Bengio, Aaron Courville. MIT Press 2016

Reference Books:

1. Introduction to Machine Learning by Ethem Alpaydin, PHI Learning.
2. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
3. Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer.

4. Machine Learning by Tom Mitchell, McGraw Hill Education.

Online Material: https://www.deeplearningbook.org/

Companion Videos : https://www.youtube.com/playlist?list=PLsXu9MHQGs8df5A4PzQGw-kfviylC-R9b

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	S	M	W	M	M	M						M
CO2	S	M	W	M	M	M						M
CO3	S	M	W	M	M	M						M

CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	M	M	S
CO2	M	M	S
CO3	M	M	S

BUSINESS INTELLIGENCE (2:0:0)

Course Code : IS7E403 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Understand basic knowledge of business intelligence (BI), BI technology, and related concepts.
2. Discuss data integration methods, architecture and technology.
3. Understand multi-dimensional data modeling.

Module 1: **8 Hrs**

Introduction to Business Intelligence: Types of digital data; Introduction to OLTP, OLAP and Data Mining; BI Definitions & Concepts; Business Applications of BI; BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology.
Self Learning Exercise: BI Roles & Responsibilities

Module 2: **9 Hrs**

Basics of Data Integration: Basics of Data Integration (Extraction Transformation Loading); Concepts of data integration; Need and advantages of using data integration; Introduction to common data integration approaches; Introduction to data quality, data profiling concepts and applications. Introduction to SSIS Architecture, Introduction to ETL using SSIS; Integration Services objects; Data flow components – Sources, Transformations and Destinations; Working with transformations.
Self Learning Exercise: containers, tasks, precedence constraints and event handlers.

Module 3: **9 Hrs**

Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. Multi-dimensional modeling; Concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema; Introduction to business metrics and KPIs.
Self Learning Exercise: Creating cubes using SSAS

TEXT BOOKS:

1. **Fundamentals of Business Analytics** by R N Prasad and Seema Acharya, Publishers: Wiley India Pvt. Ltd, 2nd Edition, 2016.
2. **Business Intelligence: The Savvy Manager's Guide,** David Loshin - Publisher:Morgan Kaufmann

REFERENCE BOOKS:

1. David Loshin, Business Intelligence, 2nd edition , Morgan Kaufmann, 2012.
2. Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional, 2003.
3. Larissa Terpeluk Moss and ShakuAtre, Business Intelligence Roadmap, Addison Wesley, 2003.
4. Cindi Howson, Successful Business Intelligence: Secrets to making BI a Killer Applications, Tata McGraw-Hill Edu.Pvt.ltd, 2007.

E-books:

1. https://www.tutorialspoint.com/business_analysis
2. https**://**data-flair.training/blogs/business-intelligence/

Moocs:

1. https://www.coursera.org/programs/Business+intelligence

CO – PO MAPPING

PO → CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M							
CO2	M	M			S							
CO3	M	M		M	M							

CO – PSO MAPPING

PSO→ CO ↓	PSO1	PSO2	PSO3
CO 1	M		
CO 2	M		
CO 3	M	M	

ADVANCED ALGORITHMS (2:0:0)

Course Code : IS7E404	**CIE : 50 Marks**
Hrs/week : 02	**SEE : 50 Marks**
SEE Hrs : 02	**Max. Marks: 50**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Discuss on basic and amortized analysis techniques for advanced algorithms like randomised algorithms
2. Explain various representation of polynomials and few advanced algorithms related to graphs and networks.
3. Describe number theoretic algorithms and approximation algorithms

MODULE 1: **9 Hrs**

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Randomized Algorithms: The hiring problem, Indicator random variables, Randomized algorithms; Amortized Analysis: Aggregate, Accounting. and Potential Methods.

Self Learning Exercise: Probabilistic analysis and further uses of indicator random variables

MODULE 2: **9 Hrs**

Graph Algorithms: Bellman-Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching.

Polynomials and the FFT: Representation of polynomials; The DFT and FFT;

Self Learning Exercise: Efficient implementation of FFT.

MODULE 3: **8 Hrs**

Number Theoretic Algorithms: Elementary notions; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; Primality testing; Integer factorization. Approximation algorithms: The vertex-cover problem, The traveling-salesman problem

Self Learning Exercise: Randomization and linear programming, The set-covering problem

TEXT BOOKS:

1. **Introduction to Algorithms,** T. H Cormen, C E Leiserson, R L Rivest and C Stein: 3rd Edition, Prentice-Hall of India, 2010.
2. **Algorithms, Cengage Learning,** Kenneth A. Berman, Jerome L. Paul, 2002.

REFERENCE BOOKS:

1. **Computational Geometry and Computer Graphics in C**, Michael J. Laszlo: Prentice Hall India, 1996
2. **Fundamentals of Computer Algorithms**, E. Horowitz, S. Sahni and S. Rajasekaran, University Press, Second edition, 2007

EBOOKS:

1. **Introduction to Algorithms,** T. H Cormen, C E Leiserson, R L Rivest and C Stein: 3rd Edition, Prentice-Hall of India, 2010.
   https://edutechlearners.com/download/Introduction_to_algorithms-3rd%20Edition.pdf
2. **Advanced Algorithms and Data Structures, by Marcello La Rocca**
   https://www.manning.com/books/advanced-algorithms-and-data-structures

MOOCs:

1. Advanced algorithms and data structures in Python, by Holczer Balazs
   https://www.udemy.com/course/advanced-algorithms-python/
2. Introduction top algorithms and analysis, By Prof. Sourav Mukhopadhyay , IIT Kharagpur,
   https://onlinecourses.nptel.ac.in/noc21_cs89/preview
3. Advanced algorithms and complexity, by Alexander S. Kulikov, Coursera,
   https://www.coursera.org/learn/advanced-algorithms-and-complexity

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S									
CO2	S	S	S									
CO3	S	S	S									

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO1	**S**	**S**	
CO2	**S**	**S**	
CO3	**S**	**S**	

RESEARCH METHODOLOGY (2:0:0)

Course Code : IS7E405 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Describe research methodology and techniques for defining a research problem.
2. Illustrate research design with different sampling designs.
3. Categorize different methods of data collection and data preparation.

MODULE 1: 9 Hrs

Research Methodology: An Introduction

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Defining the Research Problem: What is a Research Problem? Selecting the Problem, Necessity of Defining the Problem, Conclusion.

Self Learning Exercise: Technique Involved in Defining a Problem, An Illustration.

MODULE 2: 9 Hrs

Research Design:

Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Conclusion, Basic Principles of Experimental Designs.

Sampling Design: Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample? Random Sample from an Infinite Universe, Conclusion.

Self Learning Exercise: Complex Random Sampling Designs.

MODULE 3: 8 Hrs

Measurement and Scaling Technique: **Measurement in Research, Measurement Scales**, **Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling, Scale Classification Bases**

Methods of Data Collection:

Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.

Self Learning Exercise: Case Study Method

TEXT BOOK:

1. Research Methodology, Methods and Techniques, by C.R. Kothari, New age publishers, 2nd Edition, 2012.

REFERENCE BOOK:

1. Research Methodology, by Mukul Gupta, Deepa Gupta, PHI, 2011

MOOC's:

1. https://www.coursera.org/learn/research-methods
2. https://www.mooc-list.com/course/understanding-research-methods-coursera?static=true
3. https://www.mooc-list.com/course/research-methods-labsaylororg?static=true

CO- PO Mapping

PO→ CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	M	S	W	S	M		M			S
CO2	M	M		S	S							
CO3	M	M		S	W	M		S				M

CO - PSO MAPPING

CO	PSO1	PSO2	PSO3
CO1	S	M	
CO2		S	
CO3	M		

SEMINAR (0:0:2)

Course Code : IS7C03 **Max. Marks: 50**
Hrs/week 02

Student has to carry out any one of Seminar to earn one Credit.

Course Outcomes
On Successful completion of the course, the students will be able to:

1. Recognize relevance of the topic chosen
2. Explain current real world issues by doing literature survey
3. Identify the depth of the topic
4. Prepare presentations to convey the essence of the topic clearly
5. Justify the comments and questionnaires from audience.

Seminar should be given by individual student based on current emerging area and technologies.

CO – PO Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	S	M	-	-	-	-	-	-	W	-	-	-
CO2	-	S	-	-	-	-	-	-	-	W	-	-
CO3	S	M	-	-	-	-	-	-	-	-	-	-
CO4	S	-	-	-	-	-	-	-	M	S	-	-
CO5	M	M	-	-	-	-	-	-	M	S	-	-

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	M	-	S
CO2	W	-	M
CO3	W	-	-
CO4	M	-	M
CO5	S	-	M

The students can refer the following websites for carrying out there work
Text / Reference

1. http://www.Ieee.org
2. http://www.Acm.org
3. http://www.sciencedirect.com
4. https://link.springer.com/

PAPER PRESENTATION (0:0:2)

Course Code : IS7C03 **Max. Marks: 50**
Hrs/week 02

Student has to carry out any one of Paper Presentation to earn one Credit.

Course Outcome for Paper Presentation:
On Successful completion of the course, the students will be able to:

1. Analyze the problem to be investigated
2. Propose a design of the problem formulated
3. Compile the solved engineering problem with a publication

CO – PO Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	S	M	M	M	M	M	W	M	M	S	-	-
CO2	S	S	S	M	M	M	-	M	M	M	-	-
CO3	S	S	M	M	M	-	-	-	M	-	-	-

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3
CO1	W	M	S
CO2	W	M	M
CO3	-	M	-

The students can refer the following websites for carrying out there work

Text / Reference

1. http://www.Ieee.org
2. http://www.Acm.org
3. http://www.sciencedirect.com
4. https://link.springer.com/

MAJOR PROJECT PHASE – 1 (0:0:2)

Course Code : IS7C04 **Max. Marks: 100**
Hrs/week 02

Course Outcome

On Successful completion of the course, the students will be able to:

1. Identify emerging areas of interest, feasible to the project group.
2. Formulate the problem and perform problem analysis.
3. Develop the design methods to provide alternative solution or the best possible solution for the identified problem.

Note: A team consists of minimum of three or maximum four students.

CO - PO MAPPING

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	S	S			S				S			S
CO2	S	S			S				M			S
CO3	S	S	S	M	S	S	S	M	M		M	S

CO - PSO MAPPING

CO	PSO1	PSO2	PSO3
CO1	S		S
CO2		S	W
CO3		S	W

COMPETENCY TRAINING (0:0:2)

Course Code : IS7C05 **Max. Marks: 50**

Hrs/week 02

VIII Semester

DEPT. ELECTIVE – V

REAL TIME SYSTEMS (3:0:0)

Course Code : IS8E501 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Compare Hard and Soft real time systems.
2. Compare approaches to real time scheduling.
3. Explain different types of clock driven scheduling.
4. Understand the concepts of priority scheduling.
5. Analyze the different real time protocols

MODULE 1: **7 Hrs**

Hard Versus Soft Real-Time Systems: Jobs and Processors, Release Times, Deadline and Timing Constraints, Hard and Soft timing Constraints, Hard Real-Time Systems, Soft Real-Time Systems.

A Reference model of Real-Time systems: Processors and Resources, Temporal Parameters of Real-Time Work load. Periodic task model.

Self Learning Exercise: Aperiodic and Sporadic Tasks.

MODULE 2: **8 Hrs**

Approaches to Real-Time Scheduling: Clock-Driven approach, Weighted Round-Robin approach. Priority driven approach. Dynamic Versus Static Systems, Effective Release times and deadlines, optimality of the EDF and LST algorithms.

Self Learning Exercise: off-Line versus on-line scheduling

MODULE 3: **8 Hrs**

Clock-driven Scheduling: Notations and assumptions, static, Timer-Driven Scheduler, General Structure Cyclic Schedulers Cyclic executives, Improving the average response time of Aperiodic jobs

Self Learning Exercise: Scheduling Sporadic Jobs.

MODULE 4: **8 Hrs**

Priority-Driven Scheduling of Periodic Tasks: Static assumption, Fixed Priority Versus Dynamic Priority algorithms, Maximum Scheduling utilization, Optimality of the RM and DM algorithms,

Self Learning Exercise: A schedulability test for fixed-Priority tasks with arbitrary response times.

MODULE 5: 8 Hrs

Resources and Resources Access Control: Assumptions on resources and their usage, Effects of resources contention and resources access control, Non preemptive critical section, Basic Priority – Ceiling Protocol, Stack-Based priority – Ceiling Protocol, Use of priority-ceiling protocol in Dynamic-Priority Systems.

Self Learning Exercise: Real time protocol.

TEXT BOOK:

1. **Real Time Systems – Jane W.S. Liu Pearson Education Asia, First Indian Reprint-2001.**

REFERENCE BOOK:

1. **Real Time Systems Design and Analysis: An Engineer's Hand book Second Edition, Lapante.**

MOOC's:

1. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science for video lectures
2. www.nptel.com/rtos for lecture notes
3. www.wikipedia.com for primary information.

CO-PO MAPPING

PO□ CO □	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	W									
CO2	S	W	W									
CO3	S	W										
CO4	S	M										
CO5	S	M	W									

CO-PSO MAPPING

CO	PSO1	PSO2	PSO3
CO1	M	W	--
CO2	M	W	--
CO3	M	W	--
CO4	S	M	--
CO5	S	W	--

DISTRIBUTED OPERATING SYSTEMS (3:0:0)

Course Code : IS8E502 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Understand the design issues of Distributed Systems.
2. Analyze the different Distributed Systems and the challenges involved in the design of the Distributed Systems.
3. Explain how computing power is created and synchronized in Distributed systems.
4. Discuss the concepts of threading in Distributed Systems.
5. Explain the implementation of Distributed File System.

MODULE 1: **7hrs**

Introduction to Distributed Systems: What is a Distributed System? Goals, Hardware concepts, Software concepts , Design issues.
Self Learning Exercise : Scalability.

MODULE 2: **8hrs**

Communication in Distributed Systems: Layered Protocols, ATM networks,
The Client – Severmodel : Clients and Servers, An example Client and Server , Addressing, blocking versus non blocking primitives, buffered versus unbuffered primitives, reliable versus unreliable primitives, Implementing the client server model.
RPC: Basic operation, Parameter passing, Dynamic binding.
Self Learning Exercise : RPC semantics in the presence of failures.

MODULE 3: **8hrs**

Synchronization in Distributed System: Clock Synchronization, Logical clocks.
Clock synchronization algorithm: Averaging algorithm, Multiple external time sources. Use of synchronized clocks.
Mutual Exclusion: A Centralized algorithm, A Distributed Algorithm, A Token ring algorithm,
Election algorithms: Bully Algorithm, Ring Algorithm.
Deadlocks in Distributed Systems: Distributed Deadlock Detection, Distributed Deadlock Prevention.
Self Learning Exercise: Transaction primitives, Properties of Transactions**.**

MODULE 4: **8hrs**

Process and processors in Distributed System threads: Threads, Introduction to threads, three ways to construct a server, Design issues for threads.
System Models: Workstation model, A registry based algorithm for finding and using idle workstations, Processor pool model.
Processors allocation: Allocation models, Design issues for processor allocation algorithm, Implementation issues for processor allocation algorithm, A graph theoretic deterministic algorithm. Scheduling in Distributed System,

Fault tolerance: Component fault, System failures, Synchronous versus Asynchronous systems, use of redundancy, fault tolerance using Active Replication.
Real time Distributed Systems: What is a Real-Time System? Design Issues, Real-time communication, A typical TTP packet, Real time Scheduling, Dynamic Scheduling.
Self Learning Exercise: Static Scheduling.

MODULE 5: 8hrs
Distributed File Systems, Distributed File System Design,
Distributed File System implementation : File usage, System Structure, Caching, Replication.
Trends in Distributed File System: New hardware, Scalability, Wide area networking, Mobile users.
Self Learning Exercise: Fault tolerance, Multimedia.

TEXT BOOK:

1. **Distributed Operating systems**, Andrew S. Tanenbaum, Pearson Education Limited, 2013, ISBN: 9788177581799

OOKS:

1. https://books.google.co.in/books?id=SewHKWac2I4C&printsec=copyright&redir_esc=y#v=onepage&q&f=false
2. https://davarpanahjazi.iut.ac.ir/sites/davarpanahjazi.iut.ac.ir/files//u125/distribute_os-tanenbaum.pdf

CO-PO MAPPING

PO□ CO □	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	W	M								
CO2	S	S	W	M								
CO3	S	M	M	W								
CO4	S											
CO5	S	W	W									

CO-PSO MAPPING

CO	PSO-1	PSO-2	PSO-3
CO1	S	M	-
CO2	S	W	-
CO3	S	W	-
CO4	M	-	-
CO5	M	M	-

WIRELESS COMMUNICATION AND NETWORKS (3:0:0)

Course Code : IS8E503 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Describe and use advances in wireless technology and ubiquitous access to information.
2. Analyse the evolution of mobile radio communications.
3. Describe the basic cellular concepts.
4. Explain mobile radio propagation.
5. Illustrate traffic routing in wireless networks and wireless data services.

MODULE 1: **8 Hrs**

Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications, Mobile Radio Systems around the world, Examples of Wireless Communication Systems, Paging System, Cordless Telephone System, Cellular Telephone Systems, how a cellular call is made, Comparison of Common Wireless Communications Systems

Self Learning Exercise: Trends in cellular radio and personal communications.

MODULE 2: **8 Hrs**

Modern Wireless Communication Systems: Second generation (2G) Cellular Networks, Evolution of 2.5G, TDMA Standards, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs).

Self Learning Exercise: Bluetooth and Personal Area Networks (PANS)

MODULE 3: **8 Hrs**

The Cellular Concept-System Design Fundamentals, Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations. Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference.

Self Learning Exercise: power control for reducing interference.

MODULE 4: **8 Hrs**

Mobile Radio Propagation: Introduction to radio wave propagation, Free space propagation model, The three basic propagation mechanisms: Reflection, reflection from Dielectrics, Brewster Angle, Diffraction, Fresnel zone geometry, knife-edge diffraction model, multiple knife-edge diffraction, Scattering.

Self Learning Exercise: Radar Cross Section Model

MODULE 5: **7 Hrs**

Wireless Networking: Introduction to wireless networks, Differences between wireless and fixed telephone networks, PSTN, Limitations in wireless networking, Merging wireless networks and the PSTN, Development of wireless networks, first generation, second generation, third generation, Fixed network transition hierarchy, Traffic routing in wireless networks, circuit switching, packet switching, The X.25 protocol, Wireless data services

Self Learning Exercise: common channel signalling

TEXT BOOK:

1. Wireless Communications, Principles and Practice, second edition, Theodore S Rappaport, Publisher: New Delhi: Dorling Kindersley, 2009.

REFERENCE BOOKS:

1. Mobile Communications Engineering Theory and Applications, Second Edition, William C Y Lee McGraw Hill Telecommunications1998.
2. Wireless Communications and Networks, William Stallings Pearson Education Asia,2005

OOKS:

1. www.coursetalk.com› MIT, Principles of Wireless Communications online course.
2. https://onlinecourses.nptel.ac.in/noc15_ec05,PrinciplesofModernCDMA/MIMO/OFDM Wireless Communications

MOOCs:

1. https://nptel.ac.in/courses/108/106/106106167/

CO-PO MAPPING

PO□ CO □	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	M										
CO3	S	M		M								
CO4	M	S	W									
CO5	S	M		W								

CO-PSO MAPPING

CO	PSO-1	PSO-2	PSO-3
CO1	S	M	-
CO2	S	W	-
CO3	S	M	-
CO4	M	M	-
CO5	M	M	-

WIRELESS Ad-HOC NETWORKS (3:0:0)

Course Code : IS8E504 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Apply knowledge of wireless sensor networks to various application areas.
2. Discuss the working of routing protocols.
3. Apply the knowledge of Multicast Routing in Ad hoc Wireless Networks and solve problems.
4. Compare different Transport Layer and Security Protocols for Ad hoc Networks.
5. Solve the Energy Management issues by applying the knowledge of energy management

MODULE 1: **8 Hrs**

Ad hoc Wireless Networks: Introduction, Issues in Ad hoc Wireless Networks, Ad hoc Wireless Internet; MAC Protocols for Ad hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms.

Self Learning Exercise: MAC Protocols that Use Directional Antennas.

MODULE 2: **8 Hrs**

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 Protocols: Destination Sequenced Distance-Vector Routing Protocol, Cluster-Head Gateway Switch Routing Protocol; On-Demand Routing Protocols: Dynamic Source Routing Protocol, Ad Hoc On-Demand Distance-Vector Routing Protocol, Hierarchical State Routing Protocol.

Self Learning Exercise: Power-Aware Routing Protocols

MODULE 3: **8 Hrs**

Multicast Routing in Ad hoc Wireless Networks: Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols: Preferred Link-Based Multicast Protocol.

Self Learning Exercise: Mesh-Based Multicast Routing Protocols: On-Demand Multicast Routing Protocol.

MODULE 4: **8 Hrs**

Transport Layer and Security Protocols for Ad hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions: Why Does TCP Not Perform Well in Ad Hoc Wireless, TCP with Explicit Link Failure Notification, TCP-Bus, Split TCP, A Comparison of TCP Solutions for Ad Hoc Wireless Networks; Security in Ad hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks: Transport Layer Attacks, Application Layer Attacks, Other Attacks; Key Management.

Self Learning Exercise: Security-Aware AODV Protocol.

MODULE 5: **7 Hrs**

Quality of Service and Energy Management in Ad hoc Wireless Networks Introduction, Issues and Challenges in Providing QoS in Ad hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions: IEEE 802.11e, DBASE, Network Layer Solutions: Ticket-Based Qos Routing Protocol, Bandwidth Routing Protocol.

Self Learning Exercise: On-Demand QoS Routing Protocol.

TEXT BOOK:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

REFERENCES:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding- Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.

MOOC:

1. https://pdfs.semanticscholar.org/0e97/adc7bef883ab8a7f20ad997ebf007110c144.pdf

CO – PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	S											
CO 2	S	M										
CO 3		M	S									
CO 4	M	W		S								
CO5			S		M							

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO 1	S		
CO 2	S	M	
CO 3		S	
CO 4	S	W	
CO 5		S	

DEPT. ELECTIVE - VI

MANAGEMENT AND INFORMATION SYSTEMS (3:0:0)

Course Code : IS8E601 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Explain the Role of information management system in business.
2. Evaluate the role of major types of information systems in a business environment.
3. Understand Customer relationship management.
4. Analyzing the essentials and scope of e-Commerce.
5. Interpret how to use information technology to solve business problems.

Module 1: **8 Hrs**

Information Systems in Business :

Introduction, The real world of Information Systems, Networks, What you need to know, The fundamental role of IS in business, Trends in IS, Managerial challenges of IT. System Concepts: A foundation, Components of an Information System, Information System Resources, Information System activities, Recognizing Information Systems. Fundamentals of strategic advantages: Strategic IT, Competitive strategy concepts, The competitive advantage of IT, Strategic uses of IT, Building a customer-focused business, The value chain and strategic IS, Re engineering business processes.

Self Learning Exercise: Becoming an agile company Creating a virtual company, Building a knowledge- creating company.

Module 2: **7 Hrs**

Enterprise Business Systems: Introduction, Cross-functional enterprise applications, Enterprise application integration, Transaction processing systems, Enterprise collaboration systems. Functional Business Systems: Introduction, Marketing systems,
Manufacturing systems, Human resource systems, Accounting systems.

Self Learning Exercise: Financial management systems.

Module 3: **8 Hrs**

Customer relationship management:

Introduction, What is CRM? The three phases of CRM, Benefits and challenges of CRM, Trends in CRM Enterprise resource planning: Introduction, What is ERP? Benefits and challenges of ERP, Trends in ERP. Supply chain Management: Introduction, What is SCM? The role of SCM.

Self Learning Exercise: Benefits and challenges of SCM, Trends in SCM.

Module 4: **8 Hrs**

Electronic commerce fundamentals:

Introduction, The scope of e-Commerce, Essential e- Commerce, processes, Electronic payment processes. e-Commerce applications and issues: e-Commerce application trends, Business-to-Consumer e-Commerce, Web store requirements, Business-to- Business e-Commerce, e-Commerce marketplaces

Self Learning Exercise: Clicks and bricks in e-Commerce.

Module 5: **8 Hrs**

Decision support in business:

Introduction, Decision support trends, Decision support systems (DSS), Management Information Systems, Online analytical processing, Using DSS, Executive information systems, Enterprise portals and decision support, Knowledge management systems, Business and Artificial Intelligence (AI),

Self Learning Exercise: An overview of AI, Expert systems.

TEXTBOOK:

1. James A.O'Brien, George M Marakas, Management Information Systems, 7th Edition, Tata McGrawHill.

REFERENCE BOOKS:

1. Kenneth C. Laudon and Jane P.Laudon, Management Information System, Managing the Digital Firm, 9th Edition, Pearson Education.
2. Steven Alter, Information Systems the Foundation of E-Business, 4th Edition, Pearson Education.
3. W.S. Jawadekar, Management Information System, Tata McGraw Hill.

OOKS:

1. **https://www.ebookee.net/Management-Information-Systems_4388150.html**
2. **https://www.melbhattan.com/management-information-systems**

MOOCs:

1. **https://www.prepadviser.com/careers-blog/introduction-management**
2. **https://mooc.es/course/management-information-system**

CO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	S		M									
CO 2						M						
CO 3							M					
CO 4						M	S					
CO 5					M							

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO 1		M	
CO 2		M	
CO 3			W
CO 4		S	
CO 5			M

COMPUTER FORENSICS (3:0:0)

Course Code : IS8E602 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Identify the need for computer forensics
2. Describe the computer forensic technology
3. Illustrate the process of data recovery
4. Determine various aspects of collecting and preserving computer evidence
5. Analyze the authenticity of evidences and forensic identification.

MODULE 1: **8 Hrs**

Computer forensics fundamentals:

Introduction: what is computer forensics? Use of computer forensics in law enforcement, Computer forensics assistance to human resources/employment proceedings, Computer forensics services, Benefits of professional forensics methodology, Steps taken by computer forensics specialists.

Self Learning Exercise: Use of computer forensic evidence and problems of computer forensic evidence.

MODULE 2: **7 Hrs**

Types of computer forensics technology:

Types of military computer forensic technology, Types of law enforcement, Computer forensic technology, Types of business computer forensic technology, Occurrence of cybercrime, Cyber detectives, Fighting cybercrime with risk –management techniques, Computer forensics investigative services.

Self Learning Exercise: Forensic process improvement**.**

MODULE 3: **8 Hrs**

Data recovery: Introduction of Data recovery, Data back-up and recovery, the role of back- up in data recovery.

Self Learning Exercise: The data-recovery solution**.**

MODULE 4: **8 Hrs**

Evidence collection and data seizure:

Why collect evidence?, Collection options, Obstacles, Types of evidence, The rules of evidence, Volatile evidence, General procedure, Collection and archiving, Methods of collection, Artifacts, Collection steps, Preserving the digital crime scene, Computer evidence processing scene, Legal aspects of collecting forensic evidence.

Self Learning Exercise: Controlling contamination: The chain of custody

MODULE 5: **8 Hrs**

Computer image verification and authentication:

Special needs of evidential authentication, Practical consideration, Practical implementation, Electronic document discovery: a powerful new litigation tool, How to become a digital detective, Useable file formats, Unusable file formats, Converting files.

Self Learning Exercise: Forensics identification and Analysis of technical surveillance devices.

TEXTBOOK:

1. Computer Forensics computer crime scene investigation by John R VACCA, Firewall Media, Second edition Reprint 2015.

REFERENCE BOOKS:

1. Guide to computer forensics and investigations by Bill Nelson, Amelia Phillips, Christopher Stuart, Cengage Learning publications, 4th edition2013.
2. Computer Forensics by David Cowen-CISSP, McGraw Hill Education, Indianedition2013.

OOKS:

1. https://www.pdfdrive.com/computer-forensics-digital-investigation-with-encase-forensic-v7-e53817675.html

MOOC:

1. https://www.youtube.com/watch?v=HKzcQD8KbtE

CO – PO Mapping

COs / POs	PO1	PO 2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M						W				
CO2	S	M										
CO3	S	M			M				W			
CO4	S		W	M								
CO5	S	M			W							

CO – PSO Mapping

COs / PSOs	PSO1	PSO2	PSO3
CO1	M	S	W
CO2	M	M	
CO3	M	S	
CO4	M	M	
CO5	M	M	

BIG DATA ANALYTICS (3:0:0)

Course Code : IS8E603 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcome
On successful completion of the course the students will be able to

1. Overview of Big Data and Related Technologies
2. Analyze Technologies for Handling Big Data and Hadoop Ecosystem
3. Illustrate Map Reduce Fundamentals and HBase
4. Acquire a clear understanding of Analytics and Big Data
5. Analyze the various Analytical Approaches Tools to Analyze Data and Exploring R

MODULE 1 **6 Hrs**

Getting an Overview of Big Data: What is Big Data?, History of Data Management – Evolution of Big Data, Structuring Big Data, Types of Data, Elements of Big Data, Volume, Velocity, Variety, Veracity, Big Data Analytics, Advantages of Big Data Analytics, Careers in Big Data, Skills Required, Future of Big Data.

Self Learning Exercise: Business Intelligence, Preventing Fraud Using Big Data Analytics

MODULE 2 **9 Hrs**

Introducing Technologies for Handling Big Data and Hadoop Ecosystem:Distributed and Parallel Computing for Big Data, Introducing Hadoop, How does Hadoop Function?, Cloud Computing and Big Data, Features of Cloud Computing, Cloud Deployment Models, Cloud Delivery Models, Cloud Services for Big Data, Cloud Providers in Big Data Market, In-Memory Computing Technology for Big Data, Hadoop Ecosystem, Hadoop Distributed File System, HDFS Architecture, Features of HDFS, MapReduce, Features of MapReduce, Hadoop YARN.

Self Learning Exercise: HBase, Hive, Pig, Sqoop, Flume

MODULE 3 **8 Hrs**

Understanding MapReduce Fundamentals and HBase, The MapReduce Framework, Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions, Techniques to Optimize MapReduce Jobs, Hardware/Network Topology,Synchronization, File System, Uses of MapReduce, Role of HBase in Big Data Processing, Characteristics of HBase.

Self Learning Exercise: Installation of Hbase

MODULE 4 **8 Hrs**

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Reporting, Analysis, The Analytic Process, Types of Analytics, Basic Analytics, Advanced Analytics,

Operationalized Analytics, Monetized Analytics, Characteristics of Big Data Analysis, Points to Consider during Analysis, Frame the Problem Correctly, Statistical Significance or Business Importance? , Making Inferences versus Computing Statistics, Developing an Analytic Team, Convergence of IT and Analytics, Understanding Text Analytics

Self Learning Exercise: Skills required for an Analyst.

MODULE 5 **8 Hrs**

Analytical Approaches: Tools to Analyze Data, Exploring R Analytical Approaches, Ensemble Methods, Text Data Analysis, History of Analytical Tools, Graphical User Interfaces, Point Solutions, Data Visualization Tools, Introducing Popular Analytical Tools, The R Project for Statistical Computing, IBM SPSS, SAS, Comparing Various Analytical Tools, Exploring Basic Features of R, Statistical Features, Programming Features, Packages, Graphical User Interfaces, Exploring RGui, R Console, Developing a Program, Exploring RStudio, Handling Basic Expressions in R, Basic Arithmetic in R, Mathematical Operators, Variables in R, Calling Functions in R, Working with Vectors, Storing and Calculating Values in R, Creating and Using Objects, Interacting with Users, Handling Data in R Workspace, The ls() Function, The rm() Function, The getwd() Function, The save() Function, The load () Function, Executing Scripts, Creating Plots, Accessing Help and Documentation in R, Using Built- in Datasets in R

Self Learning Exercise: Installing R, R Studio.

TEXTBOOK:

1. Big Data: Black Book, DT Editorial Services, Wiley India Pvt Ltd, 2016 Edition

REFERENCE BOOKS:

1. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", 1st Edition, IBM Corporation, 2012
2. Big Data Analytics with R and Hadoop, VigneshPrajapati, -Packt Publishing 2013

E Book:

1. https://book4you.org/book/2072853/3015a1
2. https://book4you.org/book/3504505/c62c2d

MOOC

1. https://www.coursera.org/specializations/big-data
2. https://onlinecourses.nptel.ac.in/noc21_cs86/preview

CO – PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**S**											
CO2	**S**	**S**										
CO3	**S**	**S**	**S**		**M**							
CO4	**S**	**S**	**M**	**M**								
CO5	**S**	**S**	**M**	**M**	**M**							

CO – PSO MAPPING

	PSO1	PSO2	PSO3
CO1	**S**		
CO2	**S**	**S**	
CO3	**S**	**M**	

INFORMATION RETRIEVAL SYSTEMS (3:0:0)

Course Code : IS8E604 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcome

On successful completion of the course the students will be able to

1. Illustrate the process of retrieving information.
2. Describe retrieval performance and types of queries.
3. Determine automatic local- global analysis, document clustering and text compression techniques.
4. Analyze different indexing and searching algorithms.
5. Describe the Challenges of searching the web.

MODULE 1: 8 Hrs

Introduction, Motivation, Basic concepts, The retrieval process.
Modeling: Introduction, A taxonomy of information retrieval models, A formal characterization of IR models, Classic information retrieval, Alternative set theoretic models: Fuzzy set model, Alternative algebraic models, Alternative probabilistic models: Bayesian Networks. Structured text retrieval models.
Self Learning Exercise: Models for browsing.

MODULE 2: 8 Hrs

Retrieval Evaluation: Introduction, Retrieval performance evaluation.
Query Languages: Introduction, keyword-based querying, Pattern matching, Structural queries
Self Learning Exercise: Hierarchical Structure,Query protocols.

MODULE3: 8 Hrs

Query Operations: Introduction, User relevance feedback (Variant of probabilistic Term re-weighting is not included), Automatic local analysis, Automatic, Global Analysis. Text Operations : Introduction, Document preprocessing, Document clustering, Text compression.
Self Learning Exercise: Comparing Text compression Techniques

MODULE4: 7 Hrs

Indexing & Searching
Introduction; Inverted Files; Other indices for text; Boolean queries; Sequential searching(Suffix automaton not included); Pattern matching.
Self Learning Exercise: Pattern matching using indices,Structural queries; Compression.

MODULE5: 8 Hrs

User Interfaces and Visualization: Introduction, Human-Computer interaction, The information access process, Starting points, Query specification, Context, Using relevance judgments.
Searching the Web: Introduction, Challenges, Characterizing the web, Search engines, Browsing, Metasearchers.

Self Learning Exercise: Searching using hyper-links.

TEXTBOOKS:

1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto: Modern Information Retrieval, Pearson.

REFERENCE BOOKS:

1. David A. Grossman, Ophir Frieder: Information Retrieval Algorithms and Heuristics, 2nd Edition, Springer, 2004.

EBOOKS:

1. https://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf
2. http://www.math.unipd.it/~aiolli/corsi/0910/IR/irbookprint.pdf
3. https://www.sites.google.com/site/johnpaulnie/information-retrieval-systems?authuser=0

MOOC:

1. https://www.youtube.com/watch?v=q0srNT_XM_Y&list=PL0ZVw5-GryEkGAQT7lX7oIHqyDPeUyOMQ
2. https://www.youtube.com/watch?v=uJezLnFUZ48
3. https://www.youtube.com/watch?v=V5-7GzOfADQ

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M									
CO2		S	M									
CO3		S	S		M							
CO4	M	S	S	M	M							
CO5	S	S			M	M						

CO - PSO Mapping

Cos / PSOs	PSO1	PSO2	PO3
CO1	S	M	
CO2	S	S	
CO3	S	M	
CO4	S	M	
CO5	S	M	

DEPT. ELECTIVE - VII

INFORMATION STORAGE (3:0:0)

Course Code : IS8E701 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Distinguish between various physical and logical components of storage systems.
2. Determine efficient storage provisioning technique and RAID implementation.
3. Identify different components of FC SAN and fabric login types.
4. Explain storage networking option such as IP SAN and NAS solutions.
5. Describe business continuity strategy and solution.

MODULE 1: **7 Hrs**

Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure.

Data Center Environment: Application, Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application Requirements and Disk Performance, Disk Native Command Queuing

Self Learning Exercise: Virtualization and Cloud Computing.

MODULE 2: **7 Hrs**

Data Protection: RAID, RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares.

Intelligent Storage Systems: Components of an Intelligent Storage System, Storage Provisioning

Self Learning Exercise: Types of Intelligent Storage System.

MODULE 3: **7 Hrs**

Fibre Channel Storage Area Networks: Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies

Self Learning Exercise: Virtualization in SAN.

MODULE 4: **8 Hrs**

IP SAN and FCoE: iSCSI, FCIP, FCoE

Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance

Self Learning Exercise: File-Level Virtualization.

MODULE 5: **10 Hrs**

Object-Based and Unified Storage: Object-Based Storage Devices, Content-Addressed Storage Unified Storage.

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions

Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets.

Self Learning Exercise: Data De-duplication for Backup.

TEXTBOOKS:

1. **Information Storage and Management,** 2nd Edition, John Wiley- India 2012, G. Somasundaram, Alok Shrivastava (Editors)

REFERENCE BOOKS:

1. **Storage Networks Explained,** Wiley India, 2003. Ulf Troppens, Rainer Erkens and Wolfgang Muller
2. **Storage Networks, The Complete Reference,** Tata McGraw Hill, 2003.Rebert Spalding
3. **Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs,** Wiley India, 2002. Richard Barker and Paul Massiglia**.**

EBOOKS:

1. http://aad.tpu.ru/practice/EMC/Information%20Storage%20and%20Management-v.2.pdf

MOOCs:

1. https://www.youtube.com/watch?v=JITUFtzGhM0

CO-PO Mapping

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S	M								
CO2	S	S	W									
CO3	S	S										
CO4	S		S		W							
CO5	S		S			W						

CO-PSO Mapping

Course Outcomes	Program Specific Outcomes		
	PSO1	PSO2	PSO3
CO1		M	
CO2		S	
CO3	S		
CO4		M	
CO5			W

NETWORK MANAGEMENT (3:0:0)

Course Code : IS8E702 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Describe the basics of Network Management.
2. Discuss the Network management standards, terminology, symbols and conventions.
3. Discuss the SNMP V1 network management and communication models
4. Explain the concepts of RMON.
5. Explain the broadband network management.

MODULE 1: **7 Hrs**

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform

Self Learning Exercise: Current Status and Future of Network Management.

MODULE 2: **8 Hrs**

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824;Encoding Structure; Macros

Self Learning Exercise: Functional Model.

MODULE 3: **8 Hrs**

SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. **The SNMP Communication Model** – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group

Self Learning Exercise: SNMP Functional ModelText

MODULE 4: 8 Hrs

SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMONI1-RMON1Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base.

Self Learning Exercise: RMON2 Conformance Specifications.

MODULE 5: 8 Hrs

Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable. Reference Architecture;

HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes;

ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2,

Self Learning Exercise: ADSL Configuration Profiles.

TEXTBOOKS:

1. **Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.**

REFERENCE BOOKS:

1. **J. Richard Burke: Network management Concepts and Practices s: aHands-On Approach, PHI,2008**.

E BOOK:

1. **https://www.usi.edu/business/aforough/Chapter%2020.pdf**

MOOC:

1. http://nptel.ac.in/courses/106105081/37

CO- PO Mapping

PO→ CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**M**	**M**										
CO2				**S**								
CO3	**S**		**M**									
CO4	**S**	**S**		**M**								
CO5	**S**	**M**				**W**						

CO - PSO MAPPING

CO	PSO1	PSO2	PSO3
CO1	S		
CO2		M	
CO3	S		
CO4	S		
CO5	M	M	

IT-ENABLED SERVICES (3:0:0)

Course Code : IS8E703 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Understanding the opportunities and challenges in IT industry in business perspective
2. Describe the various planning strategies to sustain IT industry
3. Illustrate the different architectures of Enterprise IT industry
4. Describe the service management strategies in IT industry
5. Explain the web services and current trends in IT industry.

MODULE 1: **8 Hrs**

Business Strategy: Challenges and Opportunities in the Globalized, Interconnected, Convergent World, Establish Principles before Practice, IT Strategy, Application Strategy, Technology Strategy for IT, IT Management Strategy, Developing IT Strategy for Competitive Advantage, Stages of IT Strategy Development and Implementation, Challenges of IT and Business Strategy Alignment, Inhibitors of Business and IT Strategy Alignment,

Self Learning Exercise: Three-D Framework for Business and IT Strategy Alignment.

MODULE 2: **7 Hrs**

Business Implications for IT Strategic and Planning, Strategic IT Planning Motivations, SITP Process: Prevalent Planning Approaches, Difficulties in Developing and Executing SITP, Best Practices for Achieving Good SITP,

Self Learning Exercise: SITP Approaches-Prevalent Researches

MODULE 3: **8 Hrs**

Defining EITA, Contents of a Typical Enterprise IT Architecture, Standard for Enterprise IT Architecture,Technology Management strategy Framework, Prevalent Technology Reference Architectures Framework and Standards, Program Management, Benefits of PMO, Desired Qualities of a Program Office Manager, Maturity of PMO, Implementation of PMO Strategy, Measuring PMO Performance, Success Factors for PMO, Project Scope Management

Self Learning Exercise: PMO Dashboard and Reporting

MODULE4: **8 Hrs**

Information Technology Infrastructure Library (ITIL), ITIL Overview, ITIL Service Support Processes, Incident Management, Problem Management, Service Delivery, Service Level Management, Financial Management, Capacity Management, IT Service Continuity Management (ITSCM), Availability Management, Imperatives for Outsourcing, IT Management Layers, Variants of Outsourcing,

Self Learning Exercise: Business Process Outsourcing, In sourcing.

MODULE 5: **8 Hrs**

Overview of basic features of PHP: arrays, functions and state management, working with PHP forms, More advanced PHP, OOP's concept in PHP, Portable database supported with different, exception handling, concepts of UDDI, WSDL, SOAP. Current Employment in the IT and ITES industry: Newly emerging area and requirement of IT enabled service sector.

Self Learning Exercise: Industry Oriented Human Resource Requirement: Outlook of the IT and ITES Industry.

TEXTBOOKS:

1. Sanjiva Shankar Dubey, " IT strategy and Management", PHI.
2. K.Venkatesh, " Marketing of Information Technology",TMH.

REFERENCE BOOKS:

1. Shiro Uesugi, "IT Enabled Services", Springer; 2013 edition, 2013.
2. Sanjiva Shankar Dubey, "IT Services Business Management: Concepts, Processes and
3. Practices", PHI, 2012.
4. Nikhil Treebhoohu, "Promoting IT Enabled Services", Addison-Wesley, 2013.
5. Steve Suehring, Timconverse, Joyoe Park , "PHP 6 and MySQL Bible", Willey.

OOKS:

1. http://cs.petrsu.ru/~musen/php/2015/Books/PHP6%20and%20MySQL%20Bible%20by%20Steve%20Suehring.pdf

MOOC:

1. https://www.youtube.com/watch?v=PEhUGYT-89A
2. https://www.youtube.com/watch?v=UlwPMx6Sgak
3. https://www.youtube.com/watch?v=7QM50ogcw0w

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M									
CO2		S	S	M								
CO3		M	S		M							
CO4	S	M	M	M								
CO5	S	S	M									

CO - PSO Mapping

	PSO1	PSO2	PO3
CO1	S	M	
CO2	M	S	
CO3	S	M	
CO4	M	M	
CO5	S	M	

GREEN IT – PRINCIPLES AND PRACTICES (3:0:0)

Course Code : IS8E704 **CIE : 50 Marks**
Hrs/week : 03 **SEE : 50% Marks**
SEE Hrs : 03 **Max. Marks: 100**

Course Outcomes

On Successful completion of the course, the students will be able to:

1. Describe awareness among stakeholders and promote green agenda and green initiatives in their working environments leading to green movement
2. Identify IT Infrastructure Management and Green Data Centre Metrics for software development
3. Recognize Objectives of Green Network Protocols for Data communication.
4. Use Green IT Strategies and metrics for ICT development.
5. Illustrate various green IT services and its roles

Module 1: Introduction **8 Hrs**

Environmental Impacts of IT, Holistic Approach to Greening IT, Green IT Standards and EcoLabeling, Enterprise Green IT Strategy, Green IT: Burden or Opportunity? Hardware: Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose. Software: Introduction, Energy Saving Software Techniques

Self Learning Exercise: Evaluating and Measuring Software Impact to Platform Power

Module 2: Software development and data centers **8 Hrs**

Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics, Sustainable Software Methodology, Data Centres and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, IT Infrastructure Management

Self Learning Exercise: Green Data Centre Metrics

Module 3: Data storage and communication **8 Hrs**

Storage Media Power Characteristics, Energy Management Techniques for Hard Disks, System-Level Energy Management, Objectives of Green Network Protocols

Self Learning Exercise: Green Network Protocols and Standards.

Module 4: Information systems, Green IT strategy and metrics **8 Hrs**

Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation, Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Organizational Level Information, Regional/City Level Information

Self Learning Exercise: Measuring the Maturity of Sustainable ICT.

Module 5: Green IT services and roles **7 Hrs**

Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), SITS Strategic Framework, Sustainable IT Roadmap, Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise: IT Usage and Hardware, Inter-organizational Enterprise Activities and Green Issues

Self Learning Exercise: Enablers and Making the Case for IT and the Green Enterprise.

TEXT BOOKS:

1. San Murugesan, G. R. Gangadharan, Harnessing Green IT, John Wiley and Sons 1st Edition-2012

REFERENCES:

1. Mark O'Neil , Green IT for Sustainable Business Practice: An ISEB Foundation Guide, BCS
2. Jae H. Kim, Myung J. Lee Green IT: Technologies and Applications, Springer, ISBN: 978-3-642- 22178-1
3. Elizabeth Rogers, Thomas M. Kostigen The Green Book: The Everyday Guide to Saving the Planet One Simple Step at a Time, Springer
4. Mohammad Dastbaz Colin Pattinson Babak Akhgar, Green Information Technology A Sustainable Approach, Elsevier 2015.

CO-PO Mapping

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2	S	S		M								
CO3	S	S		W								
CO4	S		S		S							
CO5	S	M	S									

CO-PSO Mapping

Course Outcomes	Program Specific Outcomes		
	PSO1	PSO2	PSO3
CO1	W		
CO2	S		
CO3	M		
CO4		S	
CO5	S		

DEPT. ELECTIVE – VIII

DECISION SUPPORT AND BUSINESS INTELLIGENCE SYSTEMS (2:0:0)

Course Code : IS8E801 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Describe decision support system and frame work for decision support.
2. Explain DSS Development Methodologies and Technology Levels.
3. Illustrate Data mining methods, tools and Neural Networks for business Intelligence

MODULE 1: **8 Hrs**

Decision Support Systems and Business Intelligence

Changing Business Environments and Computerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), A Framework for Business Intelligence (BI), A Work System View of Decision Support, The Major Tools and Techniques of Managerial Decision Support

Self Learning Exercise: Application Case: United Sugars Corporation Optimizes Production, Distribution, and Inventory Capacity with Different Decision Support Tools.

MODULE 2: **9 Hrs**

Computerized Decision Support, Concepts, Methodologies, and Technologies

Decision Making: Introduction and Definitions, Models, Phases of the Decision-Making Process, Decision Making: The Intelligence Phase, Decision Making: The Design Phase, Decision Making: The Choice Phase, Decision Making: The Implementation Phase, How Decisions Are Supported, Decision Support System Description, Decision Support System Characteristics and Capabilities, Decision Support System Classifications, Components of Decision Support Systems

Self Learning Exercise: The Data Management Subsystem

MODULE 3: **9 Hrs**

Business Intelligence

Data Mining Concepts and Applications, Data Mining Applications, Data Mining Process, Data Mining Methods, Data Mining Software Tools, Basic Concepts of Neural Networks, Learning in Artificial Neural Networks

Self Learning Exercise: Data Mining Myths and Blunders

TEXT BOOKS:

1. **Decision Support and Business Intelligence Systems** by Efraim Turban, Ramesh Sharda, DursunDelen, Pearson Publication, 9th Edition, 2011.

Reference Book:

1. Sprague R.H. Jr and H.J. Watson: Decision Support Systems, 4th Edition, Prentice Hall, 1996.
2. Rajiv Sabherwal, Irma Becerra-Fernandez "Business Intelligence: Practice, Technologies and Management", John Wiley and sons,2011

MOOC

1. https://nptel.ac.in/courses/110/105/110105147/
2. https://www.coursera.org/lecture/business-intelligence-tools/decision-support-systems-video-lecture-E8P9x

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	S	S	W		S							
CO 2	S	M	M	M	S							
CO 3	S	S	M	S								

CO – PSO MAPPING:

	PSO1	PSO2	PSO3
CO 1	S	M	
CO 2	S	S	
CO 3	M	M	

EXPERT SYSTEMS (2:0:0)

Course Code : IS8E802 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Describe the basic understanding and the need of expert systems in artificial intelligence.
2. Understand the basic data structures that support the development of expert system utilities.
3. Apply the reasoning logic in developing the expert system applications.

MODULE 1: 8 Hrs

The meaning of an expert system, problem domain and knowledge domain, the advantages of an expert system, general stages in the development of an expert system, general characteristics of an expert system, history and uses of expert systems today, rule-based expert systems, procedural and nonprocedural paradigms, characteristics of artificial neural systems. -The study of logic, difference between formal logic and informal logic, meaning of knowledge, how knowledge can be represented, semantic nets, how to translate semantic nets into PROLOG, limitations of semantic nets, schemas, frames and their limitations.

Self Learning Exercise: How to use logic and set symbols to represent knowledge.

MODULE 2: 8 Hrs

Trees, lattices, and graphs, state and problem spaces, AND-OR trees and goals, methods of inference, rules of inference, limitations of propositional logic, logic systems, resolution rule of inference, resolution systems, and deduction, shallow and causal reasoning, applying resolution to first-order predicate logic, forward and backward chaining

Self Learning Exercise: Additional methods of reference.

MODULE 3: 10 Hrs

The meaning of uncertainty and theories devised to deal with it, types of errors attributed to uncertainty, errors associate, with induction, features of classical probability, experimental and subjective probabilities, compound and conditional probabilities, hypothetical reasoning and backward induction, temporal reasoning, Markov chains, odds of belief, sufficiency and necessity, role of uncertainty in inference chains, implications of combining evidence, role of inference nets in expert systems.

Self Learning Exercise: How probabilities are propagated.

TEXTBOOK:

1. **Expert Systems – Principles and Programming** by Joseph C Giarratano, Gary D, Riley Thomson Publication, 4th Edition, 2011.

ADDITIONAL TEXT BOOK:

1. **Expert systems Design and Development by** Durkin, J., Macmillan, 1994

REFERENCE BOOK:

1. Building Expert Systems: Principles, Procedures, and Applications: Elias M. Awad Published by West Group (1996)

EBOOKS:

1. https://www.cs.ru.nl/P.Lucas/proe.pdf
2. https://www.researchgate.net/publication/259867658_Principles_of_Expert_Systems
3. https://www.cs.bham.ac.uk/~jxb/IAI/w9.pdf
4. http://www.uobabylon.edu.iq/eprints/publication_3_19127_213.pdf

MOOC:

1. https://www.youtube.com/watch?v=11nzrNkn9D8
2. https://www.youtube.com/watch?v=l0CRFuA0m_8
3. https://www.youtube.com/watch?v=Z-HdPw9fpqI

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M									
CO2	S	M	M									
CO3	M	M	M	M	S	S						

CO - PSO Mapping

	PSO1	PSO2	PSO3
CO1	S	M	
CO2	M	S	
CO3	M	S	

SOFTWARE TESTING PRINCIPLES (2: 0: 0)

Course Code : IS8E803 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Understanding the need of testing in the development of engineering applications.
2. Distinguish the different types of testing in the process of software development.
3. Apply the process of software integration process after performing the testing process.

MODULE 1: 8 Hrs

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester‘s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples

Self Learning Exercise: Developer/Tester Support of Developing a Defect Repositor.

MODULE 2: 10 Hrs

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches.

Self Learning Exercise: Evaluating Test Adequacy Criteria.

MODULE3: 8 Hrs

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing the documentation

Self Learning Exercise: Website Testing

TEXTBOOK:

1. **Software Testing Principles and Practices** – Srinivasan Desikan, Gopalaswamy Ramesh, Ninth Impression : 2011, PEARSON

ADDITIONAL TEXT BOOK:

Software Testing, Ron Patton, Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com

REFERENCE BOOKS:

1. Practical Software Testing, Ilene Burnstein, Springer International Edition, 2003.
2. Software Testing in the Real World, Improving the Process, Edward Kit, Pearson Education, 1995.
3. Software Testing Techniques, Boris Beizer, 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Foundations of Software Testing _ Fundamental Algorithms and Techniques, Aditya P. Mathur, , Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008

EBOOKS:

1. http://www.cse.hcmut.edu.vn/~hiep/KiemthuPhanmem/Tailieuthamkhao/Introduction%20to%20Software%20Testing.pdf
2. https://github.com/bigfool/free-software-testing-books/blob/master/free-software-testing-books.md
3. https://www.softwaretestingclass.com/wp-content/uploads/2016/06/Beginner-Guide-To-Software-Testing.pdf

MOOC:

1. https://www.youtube.com/watch?v=T3q6QcCQZQg
2. https://www.youtube.com/watch?v=jEBzQCsTqmE
3. https://www.youtube.com/watch?v=BSjRmiYP7vg

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	M									
CO2	S	S	M									
CO3	S	M	M	M	S	S						

CO - PSO Mapping

	PSO1	PSO2	PSO3
CO1	S	M	
CO2	S	S	
CO3	M	S	

SEMANTIC WEB (2:0:0)

Course Code : IS8E804 **CIE : 50 Marks**
Hrs/week : 02 **SEE : 50 Marks**
SEE Hrs : 02 **Max. Marks: 50**

Course Outcomes:

On Successful completion of the course, the students will be able to:

1. Apply semantic web technologies using RDF and querying of semantic web using SPARQL
2. Organize the knowledge representation using OWL
3. Distinguish between monotonic and non-monotonic rules in ontological representation of knowledge

MODULE 1: **9 Hours**

Semantic Web Vision and RDF

Introduction to semantic web technologies, Development of semantic web in layered architecture, describing web resources using RDF: Data Model, Syntaxes, RDFS Semantics, RDF Schema, Axiomatic Semantics for RDF Schema.
Querying Semantic Web: SPARQL Infrastructure, Matching Patterns, Filters, Constructs of SPARQL, Results sets, Querying Schemas, SPARQL Update.
Self Learning Exercise: A Direct Inference System for RDS and RDFS

MODULE 2: **8 Hours**

Web Ontology Language, : OWL Syntax, Ontology Documents, Property Types, Property Axioms, Class Axioms, Individual Facts.
Self Learning Exercise: OWL Profiles

MODULE 3: **9 Hours**

Logic and Inference Rules -I

Logic and Rules, Rules on the semantic web, Monotonic Rules examples, Syntax and Semantics of Monotonic Rules, Intersection of Logic and Rules, Rules Interchange Format.

Logic and Inference Rules -II

Semantic and Web Rules Language (SWRL), Rules in SPARQL: SPIN, Non-monotonic Rules: Syntax, Definition of Syntax,
Self Learning Exercise: Inconsistency Rules, List Rules, Datatype Rules.

TEXT BOOK:

1. ***A Semantic Web Primer*** 3rd Edition, Grigoris Antoniou, Paul Groth, Frank Van Harmelen and Rinke Hoekstra. MIT Press Publication. September 2012.

REFERENCE BOOKS:

1. ***Semantic Web Programming***, Mike Dean, Andrew Perez-Lopez, Ryan Blace, Matthew Fisher, John Hebeler. John Wiley and Sons Publication, April 2009.
2. ***OWL: Representing Information Using the Web Ontology Language,*** Lee W. Lacy. Trafford Publishing (July 6, 2006).
3. ***Practical RDF Solving Problems with the Resource Description Framework,*** Shelley Powers. O'Reilly Media Publishers, Feb 2009.

E-BOOKS:

1. ***A Developer's Guide to the Semantic Web 2nd Edition***, Liyang Yu. Springer 2014.

MOOC:

A related online MOOC Course on Knowledge Representation is available in the below link
https://onlinecourses.nptel.ac.in/noc19_cs19/preview

CO-PO mapping

PO → / CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	S									
CO2		S			M							
CO3	M	S										

CO-PSO mapping:

PSO → / CO ↓	PSO1	PSO2	PSO3
CO 1	M	S	
CO 2	W	S	
CO 3		S	

INTERNSHIP (0:0:6)

Course Code : IS8C01 **CIE : 50 Marks**
Hrs/week : 06 **Max. Marks: 50**

Course Outcomes for Internship
On Successful completion of the course, the students will be able to:
1. Explain the problem to be analyzed in the internship
2. Apply the knowledge of engineering to solve the problems.
3. Outline the internship work with a report.

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M	S	M	M	M	M						
CO2	M	S	S	M	M	M			M		M	M
CO3		S								S		

CO-PSO Mapping

	PSO 1	PSO 2	PSO 3
CO1	M	S	S
CO2	M	S	S
CO3	W	M	S

MAJOR PROJECT PHASE – 2 (0:0:8)

Course Code : IS8C02 **CIE : 50 Marks**
Hrs/week : 8 **Max. Marks: 100**

Course Outcome

On Successful completion of the course, the students will be able to:

1. Develop and Implement the cost-effective design methods the proposed design of phase – I.
2. Compute the results obtained from the implementation
3. Validate the obtain results using various test cases.
4. Demonstrate and present the project in a team.
5. Prepare the report of the project work.

CO - PO MAPPING

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	S	M	S		S	M
CO2	S	S	S						M		M	
CO3	S	S	M	M					M		M	
CO4									S	M		
CO5									S	S		

CO - PSO MAPPING

CO	PSO1	PSO2	PSO3
CO1	S		
CO2		M	
CO3		M	
CO4			S
CO5			M