NEW HORIZON
COLLEGE OF ENGINEERING

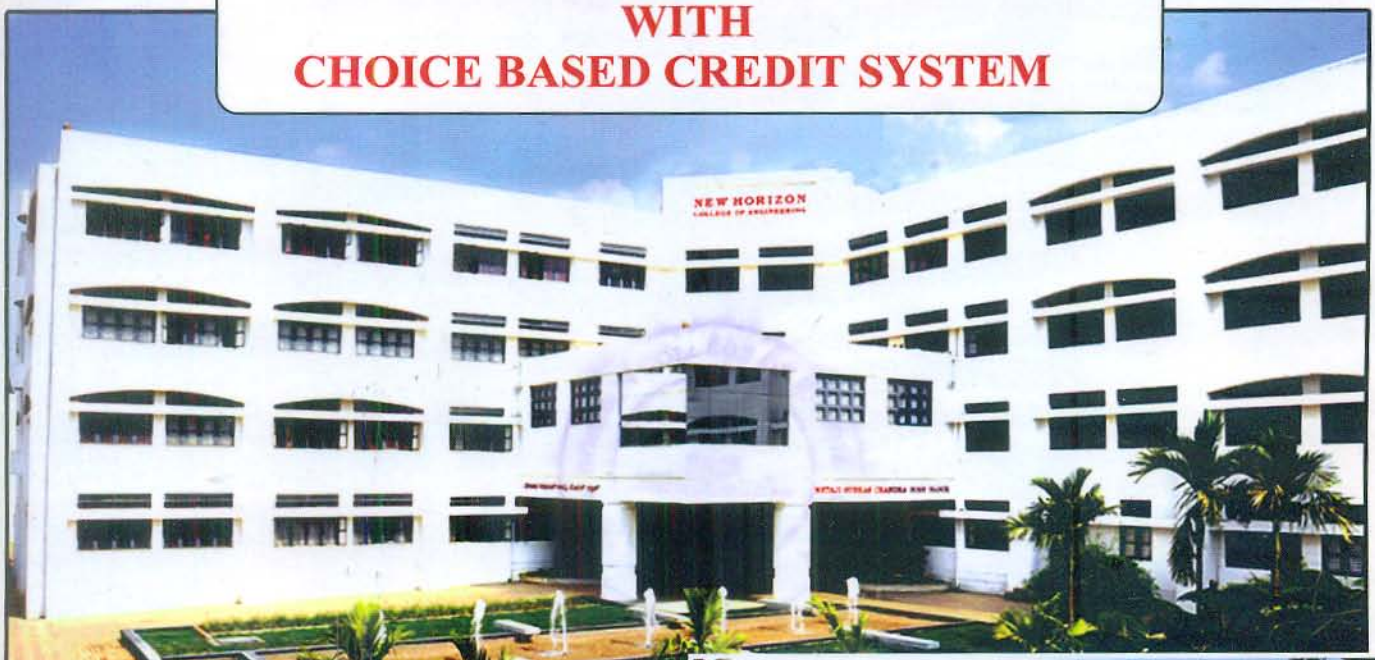
NHCE
IN PURSUIT OF EXCELLENCE

JAS-ANZ
ICS
ISO CERTIFIED

Approved by AICTE & ISO 9001:2008 certified
The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Govt. of Karnataka
Awarded Outstanding Technical Education Institute in Karnataka- 2014
Ring Road, Bellandur Post, Near Marathahalli, Bangalore-560103, India

(An Autonomous Institution Affiliated to VTU)

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM



M.Tech in Computer Network Engineering (CNE)
M.Tech in Computer Science and Engineering (CSE)
M.Tech in Software Engineering (SEE)

First and Second Semesters
Scheme and Syllabus

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W.E.F Academic Year 2015-16

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VISION

To achieve total quality in education and knowledge management through specifc, measurable, attainable, relevant, time bound goals and continuous improvement methods.

MISSION

To mould our students into holistic personalities who are accomplished in emotional, moral, intellectual, social and mental capabilities besides inculcating a capacity for critical and lateral thinking

GOAL

To adhere to the reputation of being able to channel our human resources and guide the transformation process of every individual's dream into a reality.

QUALITY POLICY

To provide education services of the highest quality both curricular and co-curricular so that our students can integrate skills and serve industry and society equally well at the Global level.

PREFACE

New Horizon College of Engineering was recently granted the autonomous status effective academic year 2015-16. The college offers B.E program in eight branches, M.B.A, M.C.A and M.Tech program in eight specializations. We look forward to implementing the prestigious autonomous status with utmost commitment and enthusiasm-true to our institution motto "In Pursuit of Excellence."

India has recently become a Permanent Member by signing the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degrees globally but also establishes equivalence to our degrees with those of the member nations such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

New Horizon College of Engineering has adopted the Choice Based Credit System (CBCS) semester structure with OBE scheme and grading system. The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. OBE emphasizes setting clear standards for observable, measurable outcomes of programs in stages. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement. Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which the students can choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline.

Outcome Base Education and CBCS greatly enhance the overall skills and employability of students. In order to increase the Industry readiness, many Soft Skills and Personality Development modules have been added to the existing curriculum. Industry Interactions have been made compulsory to enhance the dle experience. In order to enhance creativity and innovation Mini Project and Industrial visit & Interaction are included in all undergraduate programs.

Dr. Manjunatha
Principal-NHCE

CONTENTS

CREDIT SCHEME

SYLLABUS

CREDIT SCHEME FOR FIRST SEMESTER M.TECH COMPUTER SCIENCE AND ENGINEERING

S.No	Course Code	Course	BoS	Credit Distribution				Overall Credits	Marks		
				L	P	T	S		CIE	SEE	Total
1	15SCS11	Advanced Operating System	CSE	4	1	0	0	5	75	75	150
2	15SCS12	Artificial Intelligence	CSE	4	0	0	0	4	50	50	100
3	15SCS13	Advanced Computer Networks & Security	CSE	4	0	0	0	4	50	50	100
4	15SCS14x	Specialization Elective-1	CSE	4	0	0	1	5	50	50	100
5	15NHG15x	Global Elective-1*	CSE	3	0	0	1	4	50	50	100
6	15SCS16	Mini Project-ACN & Security	CSE					3	50	50	100
Total								25	325	325	650

Specialization Electives-1	
Course Code	**Course**
15SCS141	Object Oriented Software Engineering
15SCS142	Multi core Architecture and programming
15SCS143	Data Warehousing and Data Mining
15SCS144	Pattern Recognition and Image Processing

CREDIT SCHEME FOR SECOND SEMESTER M.TECH COMPUTER SCIENCE AND ENGINEERING

S.No	Course Code	Course	BoS	Credit Distribution				Overall Credits	Marks		
				L	P	T	S		CIE	SEE	Total
1	15SCS21	Advanced Algorithms	CSE	4	1	0	0	5	75	75	150
2	15SCS22	Cloud Computing	CSE	4	0	0	0	4	50	50	100
3	15SCS23	Big Data Analytics	CSE	4	0	0	0	4	50	50	100
4	15SCS24x	Specialization Elective-2	CSE	4	0	0	1	5	50	50	100
5	15NHG25x	Global Elective-2 (TBA)	CSE	3	0	0	1	4	50	50	100
6	15SCS26	Mini Project II – Cloud Computing	CSE					3	50	50	100
Total								25	325	325	650

Specialization Electives-2	
Course Code	**Course**
15SCS241	Human Computer Interaction
15SCS242	Middleware technologies in Web and Mobile domain
15SCS243	Service Oriented Architecture
15SCS244	Parallel Algorithms

M.TECH-COMPUTER SCIENCE AND ENGINEERING

ADVANCED OPERATING SYSTEM

Course Code	**: 15SCS11**	**Credits**	**: 05**
L:P:T:S	**: 4:1:0:0**	**CIE Marks**	**: 50+25**
Exam Hours	**: 03**	**SEE Marks**	**: 50+25**

Course Objectives:

1) To learn the fundamentals of Operating Systems
2) To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
3) To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
4) To know the components and management aspects of Real time, Mobile operating Systems.

Module 1

Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, Linux, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues, UNIX SVR4 Process Management. **9 Hrs**

Module 2

Threads, SMP, and Microkernel, Virtual Memory: Processes and Threads, SymmetricMultiprocessing (SMP), Microkernels, Windows Vista Thread and SMPManagement, Solaris Thread and SMP Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX and Solaris Memory Management, Linux Memory Management, Windows Vista Memory Management, Summary.**9 Hrs**

Module 3

Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-TimeScheduling, Linux Scheduling, UNIX PreclsSl) Scheduling, Windows VistaScheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.

9 Hrs

Module 4

Embedded Operating Systems: Embedded Systems, Characteristics of EmbeddedOperating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits. **9 Hrs**

Module 5

Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in theMachine, Modules and Device Management,MODULEOrganization, MODULEInstallation and Removal, Process and Resource Management, Running Process Manager, Creating a new Task, IPC and Synchronization, The Scheduler , Memory Manager , The Virtual AddressSpace, The Page Fault Handler , File Management.

The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects , Threads,Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive , Object Manager, Process and Thread Manager , Virtual MemoryManager, I/o Manager, The cache Manager, Kernel local procedure calls and IPC, The native API, subsystems.

8 Hrs

ADVANCED OPERATING SYSTEM LAB

Note: The following programs can be executed on Java/C#/ any equivalent language or toolwith suitable platform.

1) Design and Develop a shell that should support at least 20 commands.
2) Design and develop a program to implement lazy buddy system algorithm.
3) Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class.
4) Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.
5) Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.

Text Books:

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

Reference Books:

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rdEdition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

Expected Course Outcome:

At the end of the course graduate will be able to:

- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Learn the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Modify existing open source kernels in terms of functionality or features used.
- Demonstrate the shell.
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- Understand the various virus detection techniques.

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

CIE (Lab):

1. Day-to-day completion of experiment and submission – 10 marks, Internal test – 15 marks

SEE (Lab):

1. One experiment to be performed for 25 marks

ARTIFICIAL INTELLIGENCE

Course Code	**: 15SCS12**	**Credits**	**: 04**
L:P:T:S	**: 4:0:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To familiarize students with Artificial Intelligence techniques for building well-engineered and efficient intelligent systems.
2) To develop the student's understanding of the issues involved in trying to define and simulate intelligence.
3) To familiarize the student with specific, well known Artificial Intelligence methods, algorithms and results.
4) To provide the student additional experience in the analysis and evaluation of complicated systems.
5) To provide the student with paper and proposal writing experience.

Module 1

Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; thenature of environment; the structure of agents. Problem-solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies Learning: Forms of

Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory. **9 Hrs**

Module 2

Search strategies, Logical Agents: Informed search strategies; Heuristic functions; On-linesearch agents and unknown environment. Constraint satisfaction problems; Backtracking search for CSPs, Adversial search: Games; Optimal decisions in games; Alpha-Beta pruning. Knowledge-based agents; Logic; propositional logic Reasoning patterns in propositional logic; Effective Propositional inference; Agents based on propositional logic. AI: Present and Future Agent architectures **9 Hrs**

Module 3

First-Order Logic, Inference in First-Order Logic: Representation revisited; Syntax andsemantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. propositional versus first-order inference; Unification and lifting; Forward chaining; Backward chaining; Resolution.

9 Hrs

Module 4

Knowledge Representation and Planning: Ontological engineering; Categories andobjects; Actions, situations and events; Mental events and mental objects; The Internet shopping world; Reasoning systems for categories, Reasoning with default information; Truth

maintenance systems. The planning problem; Planning with state-space approach; Planning graphs; Planning with prepositional logic. **9 Hrs**

Module 5

Uncertainty, Probabilistic Reasoning: Uncertainty: Acting under certainty ;Inference usingfull joint distributions; Independence; Bayes ' rule and its use; Probabilistic Reasoning: Representing knowledge in an uncertain domain; The semantics of Bayesian networks; Efficient representation of conditional distributions; Exact inference in Bayesian networks;

Approximate inference in Bayesian Networks; Extending probability to first-order representations; Other approaches to Uncertain Reasoning. **8Hrs**

Text Book:

1) Stuart Russel, Peter Norvig: Artificial Intelligence a Modern Approach, 2nd Edition, Pearson Education, 2003.

Reference Books:

1) Elaine Rich, Kevin Knight: Artificial Intelligence, 2nd Edition, and Tat McGraw Hill, 1991.
2) Nils J.Nilsson: Principles of Artificial Intelligence, Elsevier, 1986

Expected Course Outcome:

At the end of the course graduate will be able to:

1. Understand the history, development and various applications of artificial intelligence
2. Familiarize with propositional and predicate logic and their roles in logic programming
3. Understand the programming language Prolog and write programs in declarative programming style
4. Learn the knowledge representation and reasoning techniques in rule-based systems, case-based systems, and model-based systems
5. Appreciate how uncertainty is being tackled in the knowledge representation and reasoning process, in particular, techniques based on probability theory and possibility theory (fuzzy logic)
6. Master the skills and techniques in machine learning, such as decision tree induction, artificial neural networks, and genetic algorithm
7. Apply and integrate various artificial intelligence techniques in intelligent system development as well as understand the importance of maintaining intelligent systems

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

ADVANCED COMPUTER NETWORKS & SECURITY

Course Code	**: 15SCS13**	**Credits**	**: 04**
L:P:T:S	**: 4:0:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To become familiar with the basics of Computer Networks and learn Network architectures.
2) To learn Concepts of fundamental protocols.
3) To gain the knowledge of internetworking concepts.
4) To understand the knowledge of internetworking concepts in various applications.
5) To acquire knowledge of implementation concepts in congestion control and error detections.
6) To get an overview of security and firewalls.

Module 1

Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. **9 Hrs**

Module 2

Internetworking- I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless

addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels. **9 Hrs**

Module 3

Internetworking- II: Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics,The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP.
9 Hrs

Module 4

End-to-End Protocols: Simple De-multiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

Congestion Control and Resource Allocation: Congestion-Avoidance Mechanisms, DECbit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS), Electronic Mail(SMTP, POP, IMAP, MIME),World Wide Web(HTTP), Network Management(SNMP). **9 Hrs**

Module 5

An Overview of Computer Security-Security Services-Security Mechanisms-Security Attacks-Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies. Network security Practice: Authentication applications; Kerberos, X.509 Directory Authentication Service, Electronic Mail Security; PGP, S/MIME, IP Security; Web Security, SSL and TLS, SET. System Security: Intruders, Viruses, worms and Related Threats. Firewalls; Firewall Design Principles, Trusted Systems. **8 Hrs**

Text Books:

1) Larry Peterson and Bruce S Davis "Computer Networks :A System Approach" 5th Edition , Elsevier -2014
2) Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI – 2014
3) Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a PublicWorld", Prentice-Hall, 2002.
4) Wong, Angus, Yeung, Alan "Network Infrastructure Security", Springer, 2009

Reference Books:

1) Uyless Black "Computer Networks, Protocols , Standards and Interfaces" 2nd Edition - PHI
2) Behrouz A Forouzan"TCP/IP Protocol Suite" 4th Edition – Tata McGraw-Hill
3) William Stallings, "Cryptography and Network Security: Principles and Practices",

Third Edition, Pearson Education, 2006.
4) Matt Bishop ,"Computer Security art and science ", Second Edition, Pearson Education, 2002
5) Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007 Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007 39
6) Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006
7) Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, First Edition, 2006.
8) Network Security and Cryptography, Menezes Bernard, Cengage Learning, New Delhi, 2011
9) Man Young Rhee, Internet Security, Wiley, 2003

Expected Course Outcome:

At the end of the course graduate will be able to:

1. List and classify network services, protocols and architectures, explain why they are layered.
2. Choose key Internet applications and their protocols, and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
3. Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
4. Explain various congestion control techniques.

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

OBJECT ORIENTED SOFTWARE ENGINEERING

Course Code	**: 15SCS141**	**Credits**	**: 05**
L:P:T:S	**: 4:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To learn about software prototyping, analysis and design
2) To learn UML and its usage
3) To estimate and scheduling of objects
4) To implement and test an object.

Module 1

INTRODUCTION: Software Engineering Paradigms - Software Development process models-Project & Process - Project management – Process & Project metrics – Object Oriented concepts & Principles. **9 Hrs**

Module 2

PLANNING & SCHEDULING: Software prototyping - Software project planning–Scope–Resources – Software Estimation - Empirical Estimation Models-Planning-Risk Management – Software Project Scheduling – Object Oriented Estimation & Scheduling. **9 Hrs**

Module 3

ANALYSIS & DESIGN: Analysis Modeling - Data Modeling - Functional Modeling &Information Flow Behavioral Modeling-Structured Analysis - Object Oriented Analysis – Domain Analysis-Object Oriented Analysis process - Object Relationship Model – Object Behavior Model. Design Concepts & Principles - Design Process – Design Concepts - Modular Design – Design Effective Modularity - Introduction to Software Architecture - Data Design – Transform Mapping – Transaction Mapping – OOD - Design System design process- Object design process – Design Patterns. **9 Hrs**

Module 4

IMPLEMENTATION & TESTING: Top-Down, Bottom-Up, object oriented productImplementation & Integration. Software Testing methods-White Box, Basis Path-Control Structure –Black Box- Unit Testing- Integration testing Validation & System testing. Testing OOA & OOD models-Object oriented testing strategies.

9 Hrs

Module 5

MAINTENANCE: Maintenance process-System documentation-program evolution dynamics-Maintenance costs Maintainability measurement – Case Studies **8Hrs**

Text Books:

1) Roger S. Pressman, "Software Engineering A Practitioner's Approach", Sixth Edition, Tata McGraw Hill 2010.
2) Grady Booch, Robert A.Maksimchuk Michael W. Engle, Bobby J.Young Jim Connallen Kelli A. Houston, "Object oriented analysis and design with application", Addison Wesley, 3rd edition, 2010.
3) PankajJalote "An Integrated Approach to Software Engineering" Narosa Publishing House 2005.
4) Carlo Ghezzi Mehdi Jazayer, Dino Mandrioli, "Fundamentals of Software Engineering", Prentice Hall of India 2002.

Reference Books:

1) Ivar Jacobson, "Object Oriented Software Engineering: A Use Case Driven Approach" 1st Edition.
2) Bertrand Meyer, "Object Oriented Software Construction", Prentice Hall International Series.

Expected Course Outcome:

At the end of the course graduate will be able to:

- Understand the principles of large scale software systems, and the processes that are used to build them;
- Have skills in the most widely used approach to software construction – object orientation (OO), including OO requirement specifications, OO analysis, OO design, OO Programming, OO testing and maintenance;
- Use tools and techniques for producing application software solutions from informal and semi-formal problem specifications;
- Acquire and develop many valuable skills such as the ability to use computer aided software Engineering tools to analyze, evaluate, select and synthesize information sources for the purpose of developing a software system;
- Develop an appreciation of the cost, quality, and management issues involved in software construction;

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

MULTICORE ARCHITECTURE AND PROGRAMMING

Course Code	**: 15SCS142**	**Credits**	**: 05**
L:P:T:S	**: 4:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To understand the recent trends in the field of Computer Architecture and identify performance related parameters
2) To expose the students to the problems related to multiprocessing
3) To understand the different types of multi core architectures
4) To expose the students to warehouse-scale and embedded architectures

Module 1

Introduction to Multi-core Architecture: Motivation for Concurrency in software, ParallelComputing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law.

System Overview of Threading :Defining Threads, System View of Threads, Threadingabove the Operating System, Threads inside the OS,Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

9 Hrs

Module 2

Fundamental Concepts of Parallel Programming: Designing for Threads, TaskDecomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

9 Hrs

Module 3

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock,

Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features.

Threading APIs : ThreadingAPIs for Microsoft Windows, Win32/MFC Thread APIs,Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking. **9Hrs**

Module 4

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, PerformanceorientedProgramming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension toOpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance. **9 Hrs**

Module 5

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races,Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32,DataOrganization for High Performance. **8Hrs**

Text Book:

1) Multicore Programming, Increased Performance through Software Multi-threading by ShameemAkhterand Jason Roberts , Intel Press , 2006.

Reference Book:

1) Stephen W. Keckler, KunleOlukotun, H. Peter Hofstee, "Multicore Processors and Systems ", Springer Science & Business Media

Expected Course Outcome:

At the end of the course graduate will be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.
- Critically analyze the different types of inter connection networks.
- Knowledge on architecture of GPUs, warehouse-scale computers and embedded processors.

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

DATA WAREHOUSING & DATA MINING

Course Code	**: 15SCS143**	**Credits**	**: 05**
L:P:T:S	**: 4:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To expose the students to the concepts of Data warehousing Architecture and Implementation
2) To Understand Data mining principles and techniques and Introduce DM as a cutting edge business intelligence
3) To learn to use association rule mining for handling large data
4) To understand the concept of classification for the retrieval purposes
5) To know the clustering techniques in details for better organization and retrieval of data.

Module 1

Introduction and Data Pre-processing: Why data mining, What is data mining, What kindsof data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted, Major issues in data mining. Data Pre-processing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization.

9 Hrs

Module 2

Data warehousing and online analytical processing: Data warehousing: Basic concepts,Data warehouse modelling: Data cube and OLAP, Data warehouse design and usage, Data warehouse implementation, Data generalization by attribute-oriented induction.

9 Hrs

Module 3

Classification: Basic Concepts: Basic Concepts, Decision tree induction, Bays ClassificationMethods, Rule-Based classification, Model evaluation and selection, Techniques to improve classification accuracy .

9 Hrs

Module 4

Cluster Analysis: Basic concepts and methods: Cluster Analysis, Partitioning methods,Hierarchical Methods, Density-based methods, Grid-Based Methods, Evaluation of clustering.

9 Hrs

Module 5

Data mining trends and research frontiers: Mining complex data types, othermethodologies of data mining, Data mining applications, Data Mining and society.

8Hrs

Text Book:

1) Jiawei Han, MichelineKamber, Jian Pei: Data Mining Concepts and Techniques, ELSEVIER(MK) 3rdedition 2012.

Reference Books:

1) Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw –Hill Edition, Tenth Reprint 2007.
2) K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", EasterEconomy Edition, Prentice Hall of India, 2006.
3) G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
4) Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

Expected Course Outcome:

At the end of the course graduate will be able to:

- Store voluminous data for online processing
- Pre-process the data for mining applications
- Apply the association rules for mining the data
- Design and deploy appropriate classification techniques
- Cluster the high dimensional data for better organization of the data

Assessment Method:

CIE:

4. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
5. Assignment - 10 marks
6. Quiz test / Seminar - 10 marks

SEE:

4. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
5. Two Questions will be set from each module carrying 20 Marks each.
6. Students have to answer 5 questions selecting one full question from each module.

PATTERN RECOGNITION & IMAGE PROCESSING

Course Code	**: 15SCS144**	**Credits**	**: 05**
L:P:T:S	**: 4:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To study the mathematical morphology necessary for Pattern recognition.

2) To introduce the student to various Pattern recognition techniques.
3) To study the Representation and description and feature extraction.
4) To study the Mathematical Preliminaries in image processing.
5) To understand the Image Restoration Technique.
6) To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
7) To understand the image segmentation and representation techniques.

Module 1

Pattern Recognition: The nature of statistical pattern recognition; three learningparadigms; the sub-problems of pattern recognition; the basic structure of a pattern recognition system; Comparing classifiers.

Bayes Decision Theory: General framework; optimal decisions; Classification; Simpleperformance bounds.

9 Hrs

Module 2

Learning –Parametric Approaches: Basic statistical issues; Sources of classification error;Bias and variance; three approaches to classification: density estimation, regression and discriminant analysis; Empirical error criteria; Optimization methods; Failure of MLE, Linear and quadratic discriminants, Perceptrons.

Feature Extraction: Optimal features; Optimal linear transformations; Linear and nonlinearprincipal components; Feature subset selection; Feature Extraction and classification stages, Unsupervised learning and clustering, Syntactic pattern recognition, Fuzzy set Theoretic approach to PR.

9 Hrs

Module 3

Image Processing: Digital Image Representation, Fundamental steps in Image Processing,Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display. Digital Image Formation A Simple Image Model, Geometric Model-Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Mathematical Preliminaries: Neighbour of pixels, Connectivity, Relations, Equivalence &Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Discrete Cosine & Sine Transform. **9 Hrs**

Module 4

Image Enhancement: Spatial Domain Method, Frequency Domain Method, ContrastEnhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering

Image Restoration: Degradation Model, Discrete Formulation, Algebraic Approach toRestoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation. **9 Hrs**

Module 5

Image Segmentation: Point Detection, Line Detection, Edge detection, Combined detection,Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Threshold - Foundation, Simple Global Threshold, Optimal Threshold; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

8Hrs

Text Books:

1. Digital Image Processing, Tao Gonzalez, Woods, Pearson
2. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005
3. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, Universities Press, ISBN 978-81-7371- 725-3,2011.
4. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI ISBN-81-203-1484-0, 1996.

Reference Books:

1. Digital Image Processing, Jahne, Springer India
2. Fundamentals of Digital Image Processing, Jain, PHI
3. Image Processing, Analysis & Machine Vision, Sonka, VIKAS
4. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
5. Scott.E.Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
6. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.
7. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000

Expected Course Outcome:

At the end of the course graduate will be able to:

1. Develop and analyze decision tress.
2. Design the nearest neighbor classifier.
3. Develop algorithms for Pattern Recognition.
4. Understand image formation and the role human visual system plays in perception of image data.
5. Apply image processing techniques in both the spatial and frequency (Fourier) domains.
6. Design image analysis techniques in the form of image segmentation and to evaluate

the

7. Methodologies for segmentation.
8. Apply algorithms in practical applications.

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

MINI PROJECT I – Advanced Computer Networks and Security

Course Code	**: 15SCS16**	**Credits**	**: 03**
L:P:T:S	**: 0:3:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Students are expected to independently identify a problem related to the field of Advanced Computer Networks and Security, and carry out a mini project on the problem defined. Projects should be coded (or programmed) individually and independently. The code developed towards the project will be reviewed by a panel of examiners at multiples levels. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the student is to submit a project report and make a presentation, which will be evaluated (end semester assessment) by duly appointed examiner(s).

ADVANCED ALGORITHMS

Course Code	**: 15SCS21**	**Credits**	**: 05**
L:P:T:S	**: 4:1:0:0**	**CIE Marks**	**: 50+25**
Exam Hours	**: 03**	**SEE Marks**	**: 50+25**

Course Objectives:

1) To introduce and practice advanced algorithms and programming techniques necessaryfor developing sophisticated computer application programs
2) To get accustomed with various graph algorithms and polynomials.
3) Understand and implement various string matching algorithms.
4) Develop the skills to design and implement efficient programming solutions to various problems

Module 1

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standardnotations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

9 Hrs

Module 2

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; Efficientimplementation of FFT.

9 Hrs

Module 3

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solvingmodular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization. **9 Hrs**

Module 4

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; Stringmatching withfinite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

9 Hrs

Module 5

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizingdeterministicalgorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

8 Hrs

ADVANCED ALGORITHMS LAB

Note: The following programs can be executed on Java/C#/any equivalent tool/language byadapting exception handling technique wherever it is suitable.

1) Design, develop, and write a program to implement the Bellman-Ford algorithm and determine its performance. Give its applications.
2) Design, develop, and write a program to implement a Monte Carlo algorithm to test the primalityof a given integer and determine its performance.
3) Design, develop, and write a program to solve string matching problem using naïve approach and the KMP algorithm. Compare their performances.
4) Design, develop, and write a program to solve String matching problem using Finite Automata and determine its performance.
5) Design, develop, and write a program to solve String matching problem using Robin Karp algorithm and determine its performance.

Text Books:

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

Reference Books:

1) Ellis Horowitz, SartajSahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007.

Expected Course Outcome:

At the end of the course graduate will be able to:

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.
- Design and apply graph search algorithms.
- Design and implement string matching algorithms.
- Design modular linear equation algorithms.

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks

3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

CIE (Lab):

1. Day-to-day completion of experiment and submission – 10 marks, Internal test – 15 marks

SEE (Lab):

1. One experiment to be performed for 25 marks

CLOUD COMPUTING

Course Code	**: 15SCS22**	**Credits**	**: 04**
L:P:T:S	**: 4:0:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To learn how to use Cloud Services.
2) To implement Virtualization
3) To implement Task Scheduling algorithms.
4) Apply Map-Reduce concept to applications.
5) To build Private Cloud.

Module 1

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery modelsand services, Ethical issues, Cloud vulnerabilities, 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, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems. **9 Hrs**

Module 2

Cloud Computing: Application Paradigms: Challenges of cloud computing, Architecturalstyles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, Acase study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research,

Social computing, digital content and cloud computing.

9 Hrs

Module 3

Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machinemonitors, Virtual Machines, Performance and Security Isolation, Full virtualization and para virtualization, Hardware support for virtualization, Case Study: Xen a VMM based para virtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

9 Hrs

Module 4

Cloud Resource Management and Scheduling: Policies and mechanisms for resourcemanagement, Application 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, Resourcing 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 Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

9 Hrs

Module 5

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

8Hrs

Text Book:

1) Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

Reference Books:

1) RajkumarBuyya,James Broberg, AndrzejGoscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2) John W Rittinghouse, James F Ransome: Cloud Computing Implementation,

Management and Security, CRC Press 2013.

Expected Course Outcome:

At the end of the course graduate will be able to:

- Demonstrate and experiment simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.
- Familiarize with Open Stack.

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

BIG DATA ANALYTICS

Course Code	**: 15SCS23**	**Credits**	**: 04**
L:P:T:S	**: 4:0:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To explore the fundamental concepts of big data analytics
2) To learn to analyze the big data using intelligent techniques.
3) To understand the various search methods and visualization techniques.
4) To learn to use various techniques for mining data stream.
5) To understand the applications using Map Reduce Concepts.

Module 1

INTRODUCTION TO BIG DATA: Introduction to BigData Platform–Challenges ofConventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and

Tools - Analysis vs. Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - ReSampling, Statistical Inference - Prediction Error **9 Hrs**

Module 2

MINING DATA STREAMS: Introduction To Streams Concepts–Stream Data Model andArchitecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics , Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

9 Hrs

Module 3

HADOOP: History of Hadoop - The Hadoop Distributed File System–Components of Hadoop - Analyzing the Data with Hadoop - Scaling Out - Hadoop Streaming - Design of HDFS - Java interfaces to HDFS Basics - Developing a Map Reduce Application - How Map Reduce Works - Anatomy of a Map Reduce Job run – Failures - Job Scheduling - Shuffle and Sort Task execution - Map Reduce Types and Formats - Map Reduce Feature . **9 Hrs**

Module 4

HADOOP ENVIRONMENT: Setting up a Hadoop Cluster - Cluster specification - ClusterSetup and Installation – Hadoop Configuration - Security in Hadoop - Administering Hadoop – HDFS - Monitoring – Maintenance – Hadoop benchmarks - Hadoop in the cloud **9 Hrs**

Module 5

FRAMEWORKS: Applications on Big Data Using Pig and Hive–Data processing operators inPig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphereBigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

8 Hrs

Text Books:

1) Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2) Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3) Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012
4) AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5) Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", JohnWiley & sons, 2012.
6) Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications,2013

7) Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011

Reference Books:

1) Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
2) PeteWarden, "Big Data Glossary", O'Reilly, 2011.
3) Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
4) Da Ruan, Guoquing Chen, Etienne E.Kerre, GeertWets, Intelligent Data Mining, Springer, 2007
5) Paul Zikopoulos, Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012

Expected Course Outcome:

At the end of the course graduate will be able to:

- Work with big data platform
- Analyze the big data analytic techniques for useful business applications.
- Design efficient algorithms for mining the data from large volumes.
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

HUMAN COMPUTER INTERACTION

Course Code	**: 15SCS241**	**Credits**	**: 05**
L:P:T:S	**: 4:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) Determine the need for computers and evaluate the use of computers
2) Identify the stages in software engineering that need to be modified for effectiveness of interacting with computers
3) Discover the various models that can be used for designing systems
4) Evaluate the design techniques by applying the apt statistical approach
5) Design dialogue for representation to computers

Module 1

DESIGN PROCESS: Humans–Information process–Computer–Information Process–Differences and Similarities between them – Need for Interaction – Models – Ergonomics – Style – Context – Paradigms– Designing of Interactive systems – Usability – Paradigm shift – Interaction design basics –Design Process – Scenarios – Users need – Complexity of design **9Hrs**

Module 2

DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS: Software Process–Usabilityengineering – Issue based Information systems – Iterative design practices – Design rules – maximum usability – Principles – Standards and guidelines– design patterns – Programming Tools – Windowing systems – Interaction tool kit – User Interface management system – Evaluation techniques – evaluation design – Evaluating implementations – Observational Methods. **9 Hrs**

Module 3

MODELS: Universal design principles–Multimodal systems–User Support–Presentationand Implementation Issues – types – requirements – approaches – Cognitive model – Hierarchical model – Linguistic model – physical and device models – Socio-technical models –Communication and Collaboration models – Task models – Task analysis and design. **9 Hrs**

Module 4

EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI: Basic Design structure–Single independent variable – multiple independent variable –factorial design – split-plot design – random errors – experimental procedure – Statistical analysis – T tests – Analysis of Variance test – Regression – Chi-Square test – Survey –Probabilistic sampling – Non-probabilistic sampling – developing survey questions **9 Hrs**

Module 5

THEORIES: Dialogue notations and design–Dialogue need–dialogue design notations–Graphical –Textual - representing dialogue – formal descriptions – Dialogue analysis – System models– Interaction models – relationship with dialogue – Formalisms – Formal notations – Interstitial behavior – Virtual reality – Modeling rich interaction – Status Event analysis – Properties –Rich contexts – Sensor-based systems – Groupware – Applications – Ubiquitous computing– Virtual reality. **8 Hrs**

Text Books:

1) Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.
2) Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in Human-Computer Interaction, Wiley, 2010.

Reference Books:

1. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0-321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

Expected Course Outcome:

At the end of the course graduate will be able to:

- explain why it is important to design interactive products that are usable
- define key terms used in interaction design
- explain key theories used in the design of interactive products
- explain the importance of iteration, evaluation and prototyping in interaction design

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

MIDDLEWARE TECHNOLOGIES IN WEB AND MOBILE DOMAIN

Course Code	**: 15SCS242**	**Credits : 05**	
L:P:T:S	**: 4:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To provide the foundation knowledge of middleware middleware.

2) To provide overview of using CORBA as middleware
3) Understand the Requirement of middleware and its connectivity.

Module 1

CORBA with Java: Review of Java concept like RMI, RMI API, and JDBC. Client/Server CORBA style, The object web: CORBA with Java.

Core CORBA / Java: Two types of Client/ Server invocations-static, dynamic.The static CORBA, first CORBA program, ORBlets with Applets, Java ORBs Meet C++ ORBs.

9 Hrs

Module 2

Dynamic CORBA- The portable count-CORBA Naming Services, the portable count client/server, the dynamic count –Dynamic invocations, the dynamic count ,run the client/server program, multi count- the design of multicounty, Multi console applet, The client, The coordinator. **CORBA and its Competitors**-HTTP/CGI versus CORBA/Java ORB, Caffeine-The pure CORBA/Java ORB **9 Hrs**

Module 3

DCOM Versus CORBA/Java ORBs- DCOM 101,DCOM and Java, DCOM Java count

The Existential CORBA-How do I find ORB, The server side of CORBA, Visi Broker Activation Daemon, CORBA 3.0 POA, Metadata, CORBA Java –to-IDL Mapping.

Java Bean Component Model: Events-driven java bean, propertied java bean, persistency java beans. **9 Hrs**

Module 4

From Java Beans to EJB-Smiley Java bean, Introspection of beans, CORBA Beans EJBs and CORBA: Object transaction monitors CORBA OTM's, EJB and CORBA OTM's, EJB container frame work, Session and Entity Beans, The EJB client/server development Process.

9 Hrs

Module 5

Other Types Of Middleware -Real-time Middleware –
RT CORBA ,Reflective Middleware– Agent-Based RFID Middleware. Middleware Requirements for Fixed Distributed Systems, How Mobility Affects Middleware Design,

Mobile Middleware Requirements Middleware for Nomadic Systems, Middleware for Ad Hoc Systems, Available Technologies for MobileMiddleware,MobileAgentTechnology

8 Hrs

Text Books:

1) Client/Server programming with Java and CORBA Robert Orfali and Dan Harkey,John Wiley & Sons ,SPD 2nd Edition.
2) Handbook of mobile Middleware (Auerbach Publication) by Paulo Bellavista,AntonioCorradi,

Reference Books:

1) Distributed Computing, Principles and applications, M.L.Liu, Pearson Education
2) Client/Server Survival Guide 3rd edition Robert Orfali Dan Harkey and Jeri Edwards, JohnWiley& Sons
3) Client/Server Computing D T Dewire, TMH.
4) IBM Webspere Starter Kit Ron Ben NatanOriSasson, TMh, New Delhi

Expected Course Outcome:

At the end of the course graduate will be able to:

- Implement applications using JDBC and RMI.
- Implement Distributed Java programming using CORBA
- Implement EJB component and
- Apply knowledge and techniques for dynamic adaptation in Mobile services.
- Apply problem solving approaches towards seamless connectivity and location management

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours

2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

SERVICE ORIENTED ARCHITECTURE

Course Code	**: 15SCS243**	**Credits**	**: 05**
L:P:T:S	**: 4:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To understand various architecture for application development.
2) To understand the importance of SOA in Application Integration.
3) To learn web service and SOA related tools.
4) To Learn implementation details of SOA.
5) To understand various case studies.

Module 1

SOA BASICS: Software Architecture–Types of IT Architecture–SOA–Evolution–Keycomponents

perspective of SOA – Enterprise-wide SOA – Architecture – Enterprise Applications – Solution Architecture for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOAprogramming models. **9 Hrs**

Module 2

SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design–Design of Activity,Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET –Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits of SPA – Cost Savings. **9 Hrs**

Module 3

SOA GOVERNANCE:SOA implementation and Governance–strategy–SOA development–SOAgovernance – trends in SOA – event-driven architecture – software as a service – SOA technologies – proof-of concept– process orchestration – SOA best practices. **9 Hrs**

Module 4

SOA IMPLEMENTATION:SOA based integration–integrating existing application–development of webservices – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL,SOAP and Java/XML mapping in SOA – JAXB

Data binding. **9 Hrs**

Module 5

APPLICATION INTEGRATION:JAX-WS 2.0 client side/server side development-Packagingand Deployment of SOA component - SOA shopper case study -WSDL centric java WS with SOA-J -related software - integration through service composition (BPEL) - case study - current trends. **8 Hrs**

Text Book:

1) Shankar Kambhampaly, "Service-Oriented Architecture for Enterprise Applications", Wiley 2008.

Reference Books:

1) Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.
2) WaseemRoshen, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009.

Expected Course Outcome:

At the end of the course graduate will be able to:

- Comparison of different IT architecture
- Analysis and design of SOA based applications
- Implementation of web service and realization of SOA
- Implementation of RESTful services
- Design and implementation of SOA based Application Integration using BPEL

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.
4.

PARALLEL ALGORITHMS

Course Code	**: 15SCS244**	**Credits**	**: 05**
L:P:T:S	**: 4:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

1) To learn parallel algorithms development techniques for shared memory and DCM models.
2) To study the main classes of fundamental parallel algorithms.
3) To study the complexity and correctness models for parallel algorithms.

Module 1

Introduction: Introduction to Parallel Algorithms–Models of computation–Selection–Mergin on EREW and CREW – Median of two sorted sequence – Fast Merging on EREW – Analyzing Parallel Algorithms. **9 Hrs**

Module 2

SORTING & SEARCHING: Sorting Networks–Sorting on a Linear Array Sorting on CRCW,CREW, EREW – Searching a sorted sequence –Searching a random sequence – Bitonic Sort.

9 Hrs

Module 3

ALGEBRAIC PROBLEMS: Permutations and Combinations–Matrix Transpositions–Matrixby Matrix multiplications – Matrix by vector multiplication. **9 Hrs**

Module 4

GRAPH & GEOMETRY: Connectivity Matrix–Connected Components–All Pair ShortestPaths – Minimum Spanning Trees – Point Inclusion –Intersection, Proximity and Construction Problems. **9 Hrs**

Module 5

OPTIMIZATION & BIT COMPUTATIONS: Prefix Sums–Job Sequencing Knapsack - Addingtwo integers – Adding n integers – Multiplying two integers – Selection

8 Hrs

Text Books:

1) Selim G. Akl, The Design and Analysis of Parallel Algorithms, Prentice Hall, New Jercy, 1989.

2) Michael J. Quinn, Parallel Computing: Theory & Practice, Tata McGraw Hill Edition, 2003.
3) Joseph JaJa, Introduction to Parallel Algorithms, Addison-Wesley, 1992

Reference Books:

1) Introduction to Parallel Computing: AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, Addison Wesley, Second edition.

2) Dependence Concept by Utpal Banerjee (Intel Corporation) Kluwer Academic Publishers

Expected Course Outcome:

At the end of the course graduate will be able to:

- Familiar with design of parallel algorithms in various models of parallel computation
- Familiar with the efficient parallel algorithms related to many areas of computer science: expression computation, sorting, graph - theoretic problems, computational geometry, etc.
- Familiar with the basic issues of implementing parallel algorithms

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

MINI PROJECT II – Cloud Computing

Course Code	**: 15SCS26**	**Credits**	**: 03**
L:P:T:S	**: 0:3:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Students are expected to independently identify a problem related to the field of Cloud Computing, and carry out a mini project on the problem defined. Projects should be coded (or programmed) individually and independently. The code developed towards the project will be reviewed by a panel of examiners at multiples levels. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the student is to submit a project report and make a presentation, which will be evaluated (end semester assessment) by duly appointed examiner(s).

List of Global Electives

Sl.	Course Code	Course	Branch	Dept
1	15NHG151	Human Computer Interaction	CNE	CSE
2	15NHG152	Management Information Systems	CSE	CSE
3	15NHG153	Software Testing Automation	SEE	ISE

4	15NHG154	Image Processing	CMS	ECE
5	15NHG155	Probability and Random Process	VLSI	ECE
6	15NHG156	Introduction to Aerospace Vehicle Systems	AERO	ME
7	15NHG157	Mechatronics System Design	MMD	ME
8	15NHG158	Agile Manufacturing	CIM	ME

Please Note: Students from a particular M.Tech branch **cannot** register for the Global Elective offered by their Branch.

Example: Students of M.Tech in Software Engineering can opt for any global elective **excluding**15NHG153 Software Testing and Automation

MANAGEMENT INFORMATION SYSTEMS

Course Code : 15NHG151
L:P:T:S : 3:0:0:1
Exam Hours : 03

Credits : 04
CIE Marks : 50
SEE Marks : 50

Course Objectives:

1) It is expected that students are able to understand the usage of Information Systems in management.
2) The students also would understand the activities that are undertaken in acquiring an Information System in an organization.
3) Further the student would be aware of various Information System solutions like ERP, CRM, Data warehouses and the issues in successful implementation of these technology solutions in any organization

Module 1

Information System in the Enterprise – Digital Convergence and the changing business environment – Perspectives on information systems – Business perspective on information systems – Dimensions of information systems - Contemporary Approaches to Information Systems – Learning to Use Information Systems – New Opportunities with Technology – Major types of Systems in Organizations – ESS – DSS – MIS – TPS – Systems from a functional perspective – Introduction to BPO & KPO – Case studies.**9 Hrs**

Module 2

Information Technology Infrastructure – Levels of IT infrastructure – Evolution of IT infrastructure – Technology drivers of infrastructure evolution – Managing data resources – Organizing data in a traditional file environment – The data base approach to data management – Types of data bases – Hierarchical and network DBMS – Object oriented data bases – Designing data bases – Distributing Data bases – Database trends – Data warehouses and Data mining – The web and the hyper media databases – Linking internal databases to the web – Cost benefit consideration – Data administration – Case Studies **9 Hrs**

Module 3

The knowledge management landscape – Important dimensions of knowledge – Knowledge Management value chain – Types of knowledge Management Systems – Enterprise wide Management Systems – Structured and Semi structured knowledge Systems – Knowledge network Systems – Knowledge work Systems – Intelligent techniques – Expert Systems – Case based reasoning – Fuzzy logic Systems – Neural networks - Genetic Algorithms – Hybrid AI Systems – Intelligent agents **9 Hrs**

Module 4

Decision making & Decision support Systems – Systems for decision support – Group decision support Systems – Executive support in the enterprise – Management Opportunities challenges & Solutions – Case studies.-Systems as planned organizational change – Business process reengineering & process improvement – Overview of Systems Development – System analysis – Systems design - Alternative System Building Approaches – Traditional Systems life cycle – Proto typing – End user development **9 Hrs**

Module 5

Information Systems security & Control – Systems vulnerability & Abuse – Internet vulnerabilities – Wireless security challenges – Malicious software – Hackers and Cyber vandalism – Computer crime and Cyber terrorism – Business value of security & control – Technologies & tools for security and control – Access Control – Firewalls, Intrusion Detection systems – Encryption and public key infrastructure – Case studies-Enterprise

Resource Planning – Introduction – Related Technologies – ERP Modules – Benefits of ERP – ERP Market – ERP Implementation Lifecycle – Future Directions in ERP – ERP Case studies:

- Design & Development of Human Resource Information Systems for an Educational Institution
- Design & Development of Marketing Information Systems for an Company
- Design & Development of Financial Information Systems for an Enterprise.
- Design & Development of Information Systems
- A study of Enterprise Information Planning Systems in a Company **8 Hrs**

Text Books:

1) Kenneth C. Laudon& Jane P.Laudon – Management Information Systems-Managing the Digital Form-Eighth Edition, Eastern Economy Edition
2) Alexis Leon, Enterprise Resource Planning – Tata McGraw Hill Publishing Co. Ltd., New Delhi – 2005
3) Raymond Meleod, JR Information Systems – Mac Millan Publishing Co. ltd – 4th Edition.
4) Gerald V.Post David L. Anderson, Management Information System-Solving Business Problems with Information Technology – Tata McGraw Hill Publishing Co. ltd, New Delhi
5) GordanB.DavisMargretteH.Olsan, Management Information System, Conceptual Foundations, Structure & Development – Second Edition – Tata McGraw Hill Co. Ltd, New Delhi

Reference Books:

1) S Sadagopan, "Management Information Systems", PHI Learning
2) Paige Baltzan, "Business Driven Information Systems"

Expected Course Outcome:

At the end of the course graduate will be able to:

- To understand the basic concepts of Information Systems applicable to Management
- To study the design, development and security of Management Information Systems
- To learn about the various modules in Enterprise Resource Planning System
- To Practice Data processing using MS-Excel and MS-Access

HUMAN COMPUTER INTERACTION

Course Code : 15NHG152
L:P:T:S : 3:0:0:1
Exam Hours : 03

Credits : 04
CIE Marks : 50
SEE Marks : 50

Course Objectives:

1) Determine the need for computers and evaluate the use of computers
2) identify the stages in software engineering that need to be modified for effectiveness of interacting with computers
3) discover the various models that can be used for designing systems
4) evaluate the design techniques by applying the apt statistical approach
5) design dialogue for representation to computers

Module 1

DESIGN PROCESS: Humans – Information process – Computer – Information Process – Differences and Similarities between them – Need for Interaction – Models – Ergonomics – Style – Context – Paradigms – Designing of Interactive systems – Usability – Paradigm shift – Interaction design basics – Design Process – Scenarios – Users need – Complexity of design **9 Hrs**

Module 2

DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS: Software Process – Usability engineering – Issue based Information systems – Iterative design practices – Design rules – maximum usability – Principles – Standards and guidelines – design patterns – Programming Tools – Windowing systems – Interaction tool kit – User Interface management system – Evaluation techniques – evaluation design – Evaluating implementations – Observational Methods **9 Hrs**

Module 3

MODELS: Universal design principles – Multimodal systems – User Support – Presentation and Implementation Issues – types – requirements – approaches – Cognitive model – Hierarchical model – Linguistic model – physical and device models – Socio-technical models – Communication and Collaboration models – Task models – Task analysis and design **9 Hrs**

Module 4

EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI: Basic Design structure – Single independent variable – multiple independent variable – factorial design – split-plot design – random errors – experimental procedure – Statistical analysis – T tests – Analysis of Variance test – Regression – Chi-Square test – Survey – Probabilistic sampling – Non-probabilisticsampling– developingsurvey questions **9 Hrs**

Module 5

THEORIES: Dialogue notations and design – Dialogue need – dialogue design notations – Graphical – Textual - representing dialogue – formal descriptions – Dialogue analysis – System models – Interaction models – relationship with dialogue – Formalisms – Formal notations – Interstitial behavior – Virtual reality – Modeling rich interaction – Status Event analysis – Properties – Rich contexts – Sensor-based systems – Groupware – Applications – Ubiquitous computing – Virtual reality **8 Hrs**

Text Books:

1) Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.
2) Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in Human-Computer Interaction, Wiley, 2010.

Reference Books:

1) Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0-321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

Expected Course Outcome:

At the end of the course graduate will be able to:

- explain why it is important to design interactive products that are usable
- define key terms used in interaction design
- explain key theories used in the design of interactive products
- explain the importance of iteration, evaluation and prototyping in interaction design

SOFTWARE TESTING AUTOMATION

Course Code	**: 15NHG153**	**Credits**	**: 04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

- Gaining confidence about the level of quality.
- Providing information for decision making.
- Understand the essential characteristics of Tools used for Automation test.
- Prevention of defects.
- Describe principles of system and component tesing.

Module 1

The software quality challenge, what is software quality, software quality factors, the components ofthesoftwarequalityassurance system–overview:anSQAarchitecture , Pre-projectcomponents,Softwareprojectlifecyclecomponents,Infrastructurecomponents for error prevention and improvement, Management SQA components, SQA standards, systemcertification,andassessmentcomponents,OrganizingforSQA– thehuman components,Considerationsguidingconstructionofanorganization'sSQAsystem

9Hrs

Module 2

Contractreview:Thecontractreviewprocessanditsstages,Contractreviewobjectives, Implementationofacontractreview,Contractreviewsubjects,Contractreviewsforinternal projects,Developmentandqualityplans,Reviews,objectives,formaldesignreviews,peer reviews,acomparisonofteamreviewmethods,expertopinions**9 Hrs**

Module3

Basicsof softwaretesting:humans, errors and testing, Requirements, behavior and Correctness. Correctness versus reliability, testing and debugging, test metrics, testing and Verification, static testing, types of testing **9 Hrs**

Module 4

Testgenerationfromrequirements: introduction,thetestselectionproblem,equivalence partitioning,boundaryvalueanalysisandcategorypartitionmethod,**Testgenerationfrom finitestatemodels:**SWdesignandtesting,finitestatemodel,conformance testing,fault model,characterizationtest,
WmethodandWpmethod.**9 Hrs**

Module 5

Testgenerationfromcombinatorial designs:combinatorialdesigns,acombinatorialtestDesign process, faultmodel, Regressiontesting: what isRT? , RT process, RTStheproblem, selecting RT, test selection using execution trace, TS using dynamic slice,ScalabilityofTSalgorithms,testminimization,testprioritization,toolsforRT**8 Hrs**

Text Book:

1. Explore It quality Assurance, Elisabeth Hendrickson-2015
2. Softwarequalityassurance-fromtheorytoimplementation,Daniel Galin, Pearson, 2009.(U1)
3. Lesson learned in Software Testing,cemkaner,james beach-2015

Reference books:

1. SoftwareQuality,MordecheiBen–Menachem,GarryS.Marlis,Thomson
2. SoftwareTesting-Principlesandpractices,SrinivasanD, GopalaswamyRamesh,Pearson,2006
3. SoftwareQualityTheoryandManagement,2nd Edition,AlanCGillies, CenagageLearning,2003

Expected Course Outcome:

Students shall:

- Realize how to apply theory in practical ways to design test based on test criteria.
- Demonstrate various test process and continuous quality improvement.
- Reveals the uses of various test Tools.
- Identifies the types of errors and fault models.

Assessment Method:

CIE:

1. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
2. Assignment - 10 marks
3. Quiz test / Seminar - 10 marks

SEE:

1. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
2. Two Questions will be set from each module carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each module.

IMAGE PROCESSING

Course Code	**: 15NHG154**	**Credits**	**: 04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

- To understand an image processing system and the steps involved in image processing
- To develop the ability to process digital images by applying various image processing concepts and methods
- To understand the causes of image degradation and methods of image restoration.
- To learn various color models and basic color image processing.

Module 1

Introduction: Fundamental Steps in Digital Image Processing, Components of Image processing system, Elements of Visual Perception, Image Processing Applications.

7Hrs

Module 2

Image Acquisition and Processing: Image Sampling and Quantization, Relationship between pixels, Linear and Non-linear operations.

Image Transforms:

Discrete Cosine transform, Sine Transform, Hadamard Transform, Haar Transform, Slant Transform, KL Transform

10Hrs

Module 3

Image Enhancement:

Image Enhancement in Spatial domain, Basic gray level transformation, Histogram processing, Arithmetic and Logic operations, Frequency Domain Filters, Homomorphic filters. **10Hrs**

Module 4

Image Degradation/Restoration:
Models of image degradation/restoration process, noise models, Restoration in the presence of noise, Spatial Filtering, Frequency domain filtering, Linear-position invariant degradation, Inverse filtering, Weiner filtering **10Hrs**

Module 5

Color Image Processing:
Color Fundamentals, Color Models, Pseudo color image processing, Basics of Full color image processing. **7Hrs**

Textbooks:

1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, TMH, 2010
2. Fundamentals of Digital Image Processing, Anil K. Jain, Pearson Education, 2007

References:

1. Digital Image Processing and Analysis, B. Chanda and D. Dutta Majumdar, PHI, 2005
2. Digital Image Processing, S. Sridhar, Oxford University Press, 2013

Course Outcomes:

- Understanding of digital image processing system.
- Ability to analyze and apply basic operations to digital images.
- Application of restoration methods to degraded images.
- Appreciate need of various color models and basics of color image processing

PROBABILITY AND RANDOM PROCESSES

Course Code	**: 15NHG155**	**Credits**	**: 04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

- To understand the basic concepts of Probability and its significance in modern communications scenario.
- To apply the concepts of Random Variables and Random Processes in communications engineering.

Module 1

Probabilityand Random Variable: Axioms of probability - Conditional probability - Total probability - Baye's theorem - Random variable - Probability mass function - Probability density functions- Properties -Moments - Moment generating functions and their properties, Characteristic Functions and their properties. **9Hrs**

Module 2

Standard Distributions: Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable. **9Hrs**

Module 3

Two Dimensional Random Variables: Joint distributions - Marginal and conditional distributions - Covariance - Correlation and regression - Transformation of random variables - Central limit theorem, Weak law of numbers, Strong law of numbers. **8Hrs**

Module 4

Classification of Random Processes: Definition and examples - first order, second order, strictly stationary, wide - sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process. **9Hrs**

Module 5

Correlation and Spectral Densities: Auto correlation - Cross correlation - Properties - Power spectral density - Cross spectral density - Properties - Wiener-Khintchine relation - Relationship between cross power spectrum and cross correlation function - Linear time invariant system - System transfer function -Linear systems with random inputs - Auto correlation and cross correlation functions of input and output. **9Hrs**

Textbooks:

1. Ross, S., "A First Course in Probability", Ninth Edition, Pearson Education, Delhi, 2014.
2. Peebles Jr. P.Z., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2002.

Reference Books:

1. Henry Stark and John W. Woods "Probability and Random Processes with Applications to Signal Processing", Pearson Education, Third edition, Delhi, 2002.
2. Scott Miller and Donald C. Childers, "Probability and Random Processes", Second Edition, Elsevier India Publishers, New Delhi, 2014.
3. Ochi, M.K., "Applied Probability and Stochastic Process", John Wiley & Sons, New York, 1990.
4. *Kai Lai* Chung, "Introduction to Probability," Third Edition, Elsevier, 2014.

Expected Course Outcomes:

- Able to understand the basic concepts of Probability and Random Processes and its significance in Communication Engineering.

Able to apply the concepts of Probability and Random Processes to implement real – time communication engineering problems.

INTRODUCTION TO AEROSPACE VEHICLE SYSTEMS

Sub Code	: 15NHG156	Credits: 04
L: P: T: S	: 3:0:0:1	CIE Marks: 50
Exam Hours	: 03	SEE Marks: 50

Course Objective:

- To understand the different mechanical systems and introduction of aeronautics
- TO study the different types of aircraft electrical systems and spacecraft configuration.
- To understand the working of the launch vehicles
- An ability to communicate knowledge and understanding in written reports and oral presentations.

MODULE 1

General introduction to Aeronautics: **Fixed wing & Rotary wing aircraft:** Light aircraft, Fighter aircraft, Passenger aircraft, and Cargo aircraft; Light helicopter, large passenger and cargo helicopters Exploded views of various types of aircraft, identification of various structural parts and their functions and materials used, prototype of aircraft model. **Aircraft Systems:** System design and development processes; **Mechanical systems:** Components and functions of Hydraulics Landing Gear systems & pneumatic systems, Aircraft crash investigation report (any 2) **8Hrs**

MODULE 2

Aircraft Electrical Systems: Generation, distribution and typical aircraft electrical systems and recent trends; **Avionic systems:** Flight control systems; Navigation system, Communication and radar systems their components and functions; Emergency systems and advanced systems. **Satellites:** Satellite missions, Different types of satellites and their applications, Spacecraft configurations, basics of orbital dynamics, case studies on concepts of wormhole and black hole. **8Hrs**

MODULE 3

Spacecraft Launch Vehicles: Rocket propulsion principles and types and propellants; Sounding Rockets, Staging of rockets; major subsystems of launch vehicles and their functions; Different types of satellite launch vehicles, General description about Launch Vehicles of Indian origin, Space shuttle, case study on space craft crash investigation(any 1) **10Hrs**

MODULE 4

Introduction to Airport Engineering: Development of air transportation, ICAO, IAAI,AAI, Aircraft characteristics which affect airport planning; Airport planning: Airport MasterPlan, Regional Plan, Site selection; Terminal area and airport layout, Visual aids

and ATC,case study on design and configuration of airport **10Hrs**

MODULE 5

Introduction to aerospace industries and institutions and their roles: Aircraft design and production industries; Components and systems manufactures, Service industries, Research and Development organizations and Academic institutions, Journal based on work done in aerospace industries and institutions, Industrial visit report. **8Hrs**

Text Books

☐**ChennaKeshu S and Ganapathy K K** "Aircraft Production Technology and Management", Interline Publishing, Bangalore 1993

☐ **Ian Moir and Allan Seabridge** "Aircraft Systems, mechanical, electrical and avionics subsystems integration", Professional Engineering Publishing Limited, UK, 2001

Reference Books:

7) **Raph D KimberliN** "Flight Testing of Fixed wing Aircraft", AIAA Education Series, 2003

8) **J. Gordon Leishman** "Principles of Helicopter Aerodynamics", Cambridge Aerospace series, 2000

9) Jane's All The World Aircraft

10) Current literature of relevance from website

11) ISRO Course Material on Satellite Architecture

6. **S K Khanna, M G Arora and S S Jain,** "Airport Planning and Design", NEM Chand and Brothers, Roorki,6thEdition,2001

EXPECTED COURSE OUTCOME:

Students shall demonstrate knowledge associated with:

- Ability to use and incorporate fundamental principles from mathematics, basic science and physics, and computer science
- Solve general fundamental problems associated with the broad field of Aerospace Systems.
- Ability to apply the fundamental principles and concepts of engineering to formulate one or more approaches or models to a new problem
- Suggest solutions or solution procedures to solve the problem.
- Introduction to airport engineering

ASSESSEMENT METHOD:

CIE (THEORY)

- Two internal test of 40 marks each are conducted and the average of the two test marks will be considered
- Two Assignment topic is evaluated for 10 marks

SIE (THEORY)

- SEE shall be conducted for 100 for Theory, and shall be of 3 hours duration
- Two questions are to be set from each unit, carrying 20 marks each
- Students have to answer 5 questions selecting one full question from each unit

MECHATRONICS SYSTEM DESIGN

Sub Code	**: 15NHG157**	**Credits: 04**
L: P: T: S	**: 3:0:0:1**	**CIE Marks: 50**
Exam Hours	**: 03**	**SEE Marks: 50**

Course Objective:

- To educate regarding integration of mechanical, electronic, electrical and computer systems in the design of CNC machine tools, Robots etc.
- To understand Mechatronic Design Process, actuators, Sensors, transducers, Signal Conditioning, MEMS and Microsystems
- To study the Advanced Applications in Mechatronics.
- To study in depth about Microsystems
- To understand the fabrication process of microsystems

MODULE 1

Introduction: Definition and Introduction to Mechatronic Systems. Modeling &Simulation of Physical systems Overview of Mechatronic Products and their functioning, measurement systems. Control Systems, simple Controllers. **Study of Sensors and Transducers:** Pneumatic and Hydraulic Systems, Mechanical Actuation System, Electrical Actual Systems, Real time interfacing and Hardware components for Mechatronics. **10 Hrs**

MODULE 2

Electrical Actuation Systems: Electrical systems, Mechanical switches, Solid state switches, solenoids, DC & AC motors, Stepper motors. **System Models: Mathematical models:-** mechanical system building blocks, electrical system building blocks, thermal system building blocks, electromechanical systems, hydro-mechanical systems, pneumatic system. **10 Hrs**

MODULE 3

Signal Conditioning: Signal conditioning, the operational amplifier, Protection, Filtering, Wheatstone Bridge, Digital signals , Multiplexers, Data Acquisition, Introduction to digital system processing, pulse-modulation. **MEMS and Microsystems:** Introduction, Working Principle, Materials for MEMS and Microsystems, Micro System fabrication process, Overview of Micro Manufacturing, Micro system Design, and Micro system Packaging. **10 Hrs**

MODULE 4

Micro System FabricationProcess: Photolithography, Ion Implantation, Diffusion,Oxidation,CVD,PVD,Epitaxy,Etching.

OverviewofMicroManufacturing: BulkMicroManufacturing,Surface,Micromachining, TheLIGAProcess. **8Hrs**

MODULE 5

Advanced Applications in Mechatronics: Fault Finding, Design, Arrangements and Practical Case Studies, Design for manufacturing, User-friendly design.**06 Hrs**

Text Books

1. **W. Bolton**, "Mechatronics" - Addison Wesley Longman Publication, 1999

2. **HSU** "MEMS and Microsystems design and manufacture"- Tata McGraw-Hill Education, 2002

Reference Books:

1. **Kamm**, "Understanding Electro-Mechanical Engineering an Introduction to Mechatronics"- IEEE Press, 1 edition ,1996

2. **Shetty and Kolk** "Mechatronics System Design"- Cengage Learning, 2010

3. **Mahalik** "Mechatronics"- Tata McGraw-Hill Education, 2003

4. **HMT** "Mechatronics"- Tata McGraw-Hill Education, 1998

5. **Michel .B. Histand& David. Alciatore**, "Introduction to Mechatronics & Measurement Systems"–. Mc Grew Hill, 2002

6. "Fine Mechanics and Precision Instruments"- Pergamon Press, 1971.

EXPECTED COURSE OUTCOME:

Students shall demonstrate knowledge associated with:

- Use of different techniques of micro system fabrication
- Understanding the concepts of mechatronic systems
- Advanced Application in mechatronics.
- Understanding the concepts of electrical actuation systems
- Micro-fabrication and micro-manufacturing
-

ASSESSEMENT METHOD:

CIE (THEORY)

- Two internal test of 40 marks each are conducted and the average of the two test marks will be considered
  /Two Assignment topic is evaluated for 10 marks

SIE (THEORY)

- SEE shall be conducted for 100 for Theory, and shall be of 3 hours duration
- Two questions are to be set from each unit, carrying 20 marks each

- Students have to answer 5 questions selecting one full question from each unit.

AGILEMANUFACTURING

Sub Code	: 15NHG158	Credits	: 04
L: P: T: S	: 3:0:0:1	CIE Marks	: 50
Exam Hours	: 03	SEE Marks	: 50

CourseObjectives:

TheStudentwill get

1. An overview of Agile Manufacturing, need and strategies.
2. To know the process of developing an agile manufacturing/enterprise.
3. Knowledge about integrating Product/Process development
4. To learn the computer control of agile manufacturing.

Module 1

AgileManufacturing: Definition,businessneed,conceptualframework,characteristics, genericfeatures.FourCoreconcepts:Strategy drivenapproach-integrating organization, peopletechnology,interdisciplinarydesignmethodology.

6Hrs

Module 2

Developing Agile Manufacturing: Enterprise design, System concepts as the basic manufacturingtheory-jointtechnical&Organizationaldesignandamodelforthedesign of agile manufacturing enterprise. Enterprise designprocess insights into design processes,whatisinterdisciplinarydesign,mainissues,simpledesignexample.

Integrationof Product/ProcessDevelopment: Principles,Robustdesignapproach, Approachestoenhance abilityinmanufacturing,RoleofQFD,ManagingpeopleinAgile organization,Approaches.

10Hrs

Module 3

ApplicationofIT/ISConceptsInAgileManufacturing: Strategies,Managementof complexitiesandinformation. flow,approaches,applicationsofmultimediatoimprove agilityinmanufacturing,systemconcepts. **Agile Supply Chain Management:** Principles, IT/IS concepts in supply chain

management,enterpriseintegrationandmanagementinagilemanufacturing,concepts, Agility,Adaptabilityand learners– comparisonof concepts. **10Hrs**

Module 4

ComputerControlOfAgileManufacturing:CAPPforAgileManufacturing, Aggregate capacityplanning andproduction linedesign/redesigninAgilemanufacturing, Cellular manufacturing,concepts,examples.

Corporate KnowledgeManagement In Agile Manufacturing: Strategies, strategic optionsinAgilemanufacturing,Roleofstandards. **10Hrs**

Module 5

Design of Skill &Knowledge: Enhancing technology for Machine tool system, Resumption ofdesignrequirementgeometry,definition, methods,decisionsupportfor selectionofcuttingparameters,designenhancements,parametricapproachonly.**8Hrs**

TEXTBOOKS:

1. 'Agile Manufacturing- Forging Mew Frontiers',Poul T Kidd, Amagow Co. UK, ISBN-0-201-63163-6, 1994.
2. "Agile Manufacturing", A Gunasekharan, the 21stCenturyCompetitive strategy, ISBN -13 978-0-08-04 3567-1, Elsevier Press, India.

REFERENCE BOOKS:

1. O Levine Transitions to Agile Manufacturing, Joseph C Moutigomery and Lawrence – Staying Flexible for competitive advantage, ASQC quality press, Milwaukee. Wisconsin, USA, 1996.
2. Agile Development for Mass Customization, David M Anderson and B Joseph Pine, Irwin Professional Publishing, Chicago, USA, 1997.

Course Outcomes:

Students will be able to:

1. Understand conceptual frame work of agile manufacturing environment.
2. Get insight into Enterprise design process, apply interdisciplinary design concepts.
3. Develop characteristic difference between lean manufacturing and agile manufacturing
4. Appreciate benefits that can be derived by adopting newer manufacturing strategies.

5. Know the skills and knowledge to design the machine tool systems.

ASSESEMENT METHOD

CIE:

1. Two internal tests (each 40 marks) are conducted, average of two tests marks will be considered.
2. Minimum two assignments Average of two will be considered for 10 marks.

SEE:

1. SEE Conducted for 100 marks for Theory exams and shall be 3 hours duration
2. Two Questions are to be set from each module, carrying 20 marks each.
3. Students have to answer 5 questions selecting one full question from each module.

Sl.	Course Code	Course	Branch	Dept
1	15NHG251	Information Retrieval	CNE	CSE
2	15NHG252	Big Data Analytics	CSE	CSE
3	15NHG253	Artificial Intelligence	SEE	ISE
4	15NHG254	Advances in VLSI	CMS	ECE

LIST OF ELECTIVES OFFERED IN SEMESTER

		Design		
5	15NHG255	AD-Hoc Wireless Networks	VLSI	ECE
6	15NHG256	Miniature Aircraft Systems	AERO	ME
7	15NHG257	Rapid Prototyping	MMD	ME
8	15NHG258	Advanced Materials Technology	CIM	ME

GLOBAL OFFERED TO BE EVEN 2016

Please Note: Students from a particular M.Tech branch **cannot** register for the Global Elective offered by their Branch.

Example: Students of M.Tech in Computer NetworkEngineering(CNE) can opt for any global elective **excluding**15NH251 Information Retrieval

INFORMATION RETRIEVAL

Course Code	**: 15NHG251**	**Credits**	**: 04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

5. To understand the basics of Information Retrieval with pertinence to modeling, query operations and indexing
6. To get an understanding of machine learning techniques for text classification and clustering
7. To understand the various applications of Information Retrieval giving emphasis to Multimedia IR, Web Search
8. To understand the concepts of queries specification judgment and search engines

Module 1

INTRODUCTION &MODELING: Introduction: Motivation, Basic concepts, Past, present,and future, the retrieval process. Modeling: Introduction, A taxonomy of information retrieval models, Retrieval: Adhoc and filtering, A formal characterization of IR models, Classic information retrieval, Alternative set theoretic models, Alternative algebraic models, Alternative probabilistic models, Structured text retrieval models, Models for browsing. **9 Hrs**

Module 2

RETRIEVAL EVALUATION: Retrieval Evaluation: Introduction, Retrieval performanceevaluation, Reference collections. Query Languages: Introduction, keyword-based querying, Pattern matching, Structural queries, Query protocols. Query Operations: Introduction, User relevance feedback, Automatic local analysis, Automatic global analysis. **9 Hrs**

Module 3

CLASSIFICATION AND CLUSTERING: Text Classification and Naïve Bayes–Vector SpaceClassification –Support vector machines and Machine learning on documents. Flat Clustering–Hierarchical Clustering–Matrix decompositions and latent semantic indexing – Fusion and Meta learning.**9 Hrs**

Module 4

INDEXING AND SEARCHING: Indexing and Searching: Introduction; Inverted Files; Otherindices for text; Boolean queries; Sequential searching; Pattern matching; Structural queries; Compression. Parallel and Distributed IR: Introduction, Parallel IR, Distributed IR.
9 Hrs

Module 5

APPLICATIONS: Searching the Web: Introduction, Challenges, Characterizing the web,Search engines, Browsing, Meta searchers, Finding the needle in the haystack, searching using hyperlinks
8 Hrs

Text Book:

2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto: Modern Information Retrieval, Pearson, 1999.

Reference books:

2. David A. Grossman, Ophir Frieder: Information Retrieval Algorithms and Heuristics, 2nd Edition, Springer, 2000

Expected Course Outcome:

Upon completion of the course, the students will be able to

6. Build an Information Retrieval system using the available tools
7. Identify and design the various components of an Information Retrieval system
8. Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval
9. Analyze the Web content structure
10. Design an efficient search engine

Assessment Method:

CIE:

4. Three internals tests of 30 marks each will be conducted and the average of the top two test marks will be considered.
5. Assignment - 10 marks
6. Quiz test / Seminar - 10 marks

SEE:

4. SEE will be conducted for 100 marks and shall be for a duration of 3 hours
5. Two Questions will be set from each module carrying 20 Marks each.
6. Students have to answer 5 questions selecting one full question from each module.

Course Code	: 15NHG252	Credits	: 04
L:P:T:S	: 3:0:0:1	CIE Marks	: 50
Exam Hours	: 03	SEE Marks	: 50

Course Objectives:

6) To explore the fundamental concepts of big data analytics
7) To learn to analyse the big data using intelligent techniques.
8) To understand the various search methods and visualization techniques.
9) To learn to use various techniques for mining data stream.
10) To understand the applications using Map Reduce Concepts.

Module 1

INTRODUCTION TO BIG DATA: Introduction to BigData Platform–Challenges ofConventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - ReSampling, Statistical Inference - Prediction Error **9 Hrs**

Module 2

MINING DATA STREAMS: Introduction To Streams Concepts–Stream Data Model andArchitecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics , Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. **9 Hrs**

Module 3

HADOOP: History of Hadoop - The Hadoop Distributed File System–Components of Hadoop - Analyzing the Data with Hadoop - Scaling Out - Hadoop Streaming - Design of HDFS - Java interfaces to HDFS Basics - Developing a Map Reduce Application - How Map Reduce Works - Anatomy of a Map Reduce Job run – Failures - Job Scheduling - Shuffle and Sort Task execution - Map Reduce Types and Formats - Map Reduce Feature **9 Hrs**

Module 4

HADOOP ENVIRONMENT: Setting up a Hadoop Cluster - Cluster specification - ClusterSetup and Installation – Hadoop Configuration - Security in Hadoop - Administering Hadoop – HDFS - Monitoring – Maintenance – Hadoop benchmarks - Hadoop in the cloud **9 Hrs**

Module 5

FRAMEWORKS: Applications on Big Data Using Pig and Hive–Data processing operators inPig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphereBigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications **8 Hrs**

Text Books:

8) Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
9) Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
10) Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012
11) AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
12) Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", JohnWiley& sons, 2012.
13) Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications,2013
14) Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011

Reference Books:

6) Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007
7) PeteWarden, "Big Data Glossary", O'Reilly, 2011.
8) Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
9) Da Ruan, Guoquing Chen, Etienne E.Kerre, GeertWets, Intelligent Data Mining, Springer, 2007
10) Paul Zikopoulos, Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012

Expected Course Outcome:

At the end of the course graduate will be able to:

- Work with big data platform
- Analyze the big data analytic techniques for useful business applications.
- Design efficient algorithms for mining the data from large volumes.

ARTIFICIAL INTELLIGENCE

Course Code	: 15NHG253	Credits	: 04
L:P:T:S	: 3:0:0:1	CIE Marks	: 50
Exam Hours	: 03	SEE Marks	: 50

Course **Objectives:**

- To apply a given AI technique to a given concrete problem.
- To implement non-trivial AI techniques in a relatively large system.
- To understand uncertainty and problem solving techniques.
- To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
- To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
- To understand various learning techniques and agent technology.

Module 1

What is Artificial Intelligence: The AI problems, The underlying assumption, What is an AI technique?, The level of the model, Criteria for success, some general references, One final word and beyond. **Problems, problem spaces, and search:** Defining the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional problems. **Intelligent Agents:** Agents and environments, The nature of environments, The structure of agents. **8 Hrs**

Module 2

Heuristic search techniques: Generate and test, Hill climbing, Best first search, Problem reduction, Constraint satisfaction, Mean ends analysis. **Knowledge representation issues:** Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem. **Using predicate logic**: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural deduction. **Logical Agents**: Knowledge based agents, the Wumpus world, Logic propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic. **9 Hrs**

Module 3

Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation issues, Augmenting a problem solver, **Implementation:** Depth first search, Implementation: Breadth-first search. **Statistical Reasoning**: Probability and bayes theorem, Certainty factors and rule based systems, Bayesian networks, Dempstershafer theory, Fuzzy logic. **Quantifying Uncertainty**: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes' rule and its use,

The Wumpus world revisited. **9 Hrs**

Module 4

Weak Slot-and-filter structures: Semantic nets, Frames. **Strong slot-and – filler structures**: Conceptual dependency, scripts, CYC. **Adversarial Search**: Games, Optimal decision in games, Alpha beta pruning, Imperfect real-time decisions, Stochastic games, Partially observable games, State of the art game programs, Alternative approaches, Summary. **9 Hrs**

Module 5

Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and classification with linear models, Nonparametric models, Support vector machines, Ensemble learning. **Learning Probabilistic Models**: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.**9 Hrs**

TEXT BOOKS:

1. Artificial Intelligence ,Elaine Rich, Kevin Knight, Shivashanka B Nair, Tata CGraw Hill 3rd edition. 2013
2. Artificial Intelligence A Modern Approach, Stuart Russel, Peter Norvig:, Pearson 3rd edition 2013.

REFERENCE BOOKS:

1. Principles of Artificial Intelligence by Nils J. Nilsson: Elsevier
2. Computational Intelligence : a logical approach by David Poole, Alan Mackworth, Randy Goebel, Oxford University Press, 2004

Expected Course Outcome:

- Design intelligent agents for problem solving, reasoning, planning, decision making, and learning. specific design and performance constraints, and when needed, design variants of existing algorithms.

- Apply AI technique on current applications.
- Problem solving, knowledge representation, reasoning, and learning.

ADVANCES IN VLSI DESIGN

Course Code	**: 15NHG254**	**Credits**	**: 04**
L:P:T:S	**: 3:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

- This course deals with the new developments in the field of VLSI design.
- To understand the challenges faced in the present phase of design and technology.
- To apply the knowledge in overcoming the limitations with the help of new technologies.

Module 1

MIS Structures and MOSFETS: MIS systems in equilibrium, under bias, small signal operation of MESFETS and MOSFETS. **9Hrs**

Module 2

Transistors for high frequency, high power amplifiers: Transistor figures of merit for wireless systems, Heterostructures, MODFET devices, HBTs, Wide band gap semiconductors.

Short Channel Effects and Challenges to CMOS: Short channel effects, scaling theory, processing challenges to further CMOS miniaturization. **9Hrs**

Module 3

Beyond CMOS: Evolutionary advances beyond CMOS, carbon Nano tubes, conventional vs. tactile computing, molecular and biological computing, Mole electronics-molecular Diode and diode-diode logic, Defect tolerant computing. **9Hrs**

Module 4

Super Buffers, Bi-CMOS and Steering Logic: Introduction, RC delay lines, super buffers- An NMOS super buffer, tri state super buffer and pad drivers, CMOS super buffers, Dynamic ratio less inverters, large capacitive loads, pass logic, designing of transistor logic, General functional blocks -NMOS and CMOS functional blocks. **9Hrs**

Module 5

Special Circuit Layouts and Technology Mapping: Introduction, Talley circuits, NAND-NAND, NOR- NOR, AOI Logic, NMOS, CMOS Multiplexers, Barrel shifter, Wire routing and module layout. **8Hrs**

Reference Books:

1. Kevin F Brennan, "Introduction to Semiconductor Devices", Cambridge publications
2. Eugene D Fabricius, "Introduction to VLSI Design", McGraw-Hill International publications
3. Neil H.E. Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design – A circuits and systems perspective", Third edition, Pearson education, 2005.
4. Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design", PHI, 2005.

Course Outcomes:

- Ability to understand the limitations of the present techniques in VLSI design.
- Ability to design the new methods and techniques for the advancements.
- Ability to apply the new technologies into the present design concepts.

AD-HOC WIRELESS NETWORKS

Course Code : 15NHG255 | **Credits : 05**
L:P:T:S : 3:0:0:1 | **CIE Marks : 50**
Exam Hours : 03 | **SEE Marks : 50**

Course Objectives:

- To expose the students to the fundamentals of ad-hoc wireless network. To give an insight of various Mac Protocols.
- To understand the Route set up and maintenance through varied Routing Protocols.
- To understand Transport and Security Solutions for ad-hoc wireless networks.
- To introduce energy management for ad-hoc networks.
- To understand the concept of sensor networks.

Module 1

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, MAC Protocols that Use Directional Antennas. **10Hrs**

Module 2

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; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols **9Hrs**

Module 3

Transport Layer 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.
Security Protocols for Ad hoc Networks: Issues and Challenges in Security Provisioning, Network Security Attacks, Key management and secure routing adhoc wireless networks. **9Hrs**

Module 4

Energy Management in Ad hoc Wireless Networks Introduction, Need for Energy Management in Adhoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power ManagementSchemes. **8Hrs**

Module 5

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues. **\8Hrs**

Text Books / References:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, PearsonEducation, 2011.
2. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.
5. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – JagannathanSarangapani, CRC Press.

Course Outcomes:

- Able to understand the fundamental concepts of Ad-hoc wireless networks.
- Able to design suitable algorithms for ad-hoc networks.
- Able to optimize algorithms using energy management concepts.

MINIATURE AIRCRAFT SYSTEMS

Sub Code : 15NHG256
L: P: T: S : 3:0:0:1
Exam Hours : 03

Credits: 04
CIE Marks: 50
SEE Marks: 50

Objective:

- To provide exposure to principles of unmanned aircraft systems
- characterization of different types of systems
- To study the aerodynamics and aircraft configuration
- To understand the future trends of UAV

Module 1

Introduction to Unmanned Aircraft Systems (UAS): Definition,types,Some Applications of UAS,The Systemic Basis of UAS ,System Composition, **Introduction to Design and Selection of the System,** Conceptual Phase Preliminary Design ,Detail Design ,Selection of the System**10Hrs**

Module 2

Aerodynamics and Airframe Configurations: Lift-induced Drag , Parasitic Drag, Rotary-wing Aerodynamics ,Response to Air Turbulence , Airframe Configurations **8Hrs**

Module 3

Long-endurance, Long-range Role Aircraft, Medium-range, Tactical Aircraft ,Close-range/Battlefield Aircraft ,MUAV Types , MAV and NAV Types UCAV ,Novel Hybrid Aircraft Configurations Research UAV . **8Hrs**

Module 4

Aspects of Airframe Design Scale Effects,Packaging Density, Aerodynamics, Structures and Mechanisms Selection of power-plants, Modular Construction.

8Hrs

Module 5

Introduction to System Development and Certification , System Development ,Certification **System Ground Testing** UAV Component Testing UAV Sub-assembly and Sub-system Testing Testing Complete UAV Control Station Testing Catapult Launch System Tests **System In-flight Testing** Test Sites Preparation for In-flight Testing In-flight Testing. **10Hrs**

Text books:

- Reg Austin "Unmanned Aircraft Systems: UAVS Design, Development and Deployment", ISBN: 978-0-470-05819-0, john and wiley son's publication,2010.

- Paul Fahlstrom , Thomas Gleason **"Introduction to UAV Systems 4th Edition"**4th edition, john and wiley son's publication,2010

Reference:

- Douglas M. Marshall , Richard K. Barnhart , Stephen B. Hottman **"Introduction to Unmanned Aircraft Systems", 1st Edition, CRC press**

EXPECTED COURSE OUTCOME:

Students shall demonstrate knowledge associated with:

- Understanding of the concepts of unmanned aircraft sytems and its applications
- Understanding of the concepts of Aerodynamics and Airframe Configurations
- Different System Development and Certification,CertificationSystem Ground Testing

ASSESSEMENT METHOD:

CIE (THEORY)

- Two internal test of 40 marks each are conducted and the average of the two test marks will be considered
- Two Assignment topic is evaluated for 10 marks

SIE (THEORY)

- SEE shall be conducted for 100 for Theory, and shall be of 3 hours duration
- Two questions are to be set from each unit, carrying 20 marks each.
- Students have to answer 5 questions selecting one full question from each unit

RAPID PROTOTYPING

Sub Code	**: 15NHG257**	**Credits**	**: 04**
L: P: T: S	**: 3:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Objectives:

The main objectives of subjectare

- To understand the basics of rapid Prototyping.
- To gain the knowledge of Selective Laser Sintering.
- To learn about Laminated Object Manufacturing.
- Exposure to RP software.
- To learn about rapid tooling.

Module1

Introduction: Definition of Prototype, Types of prototype, Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems. **8 Hrs**

Module2

Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications, Fusion Deposition Modelling: Principle, Process parameter, Path generation, Applications. **6 Hrs**

Module3

Solid Ground Curing: Principle of operation, Machine details, Applications,

Laminated Object Manufacturing: Principle, of operation, LOM materials, process details, application

Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, GenisysXs printer HP system 5, object Quadra systems. **10 Hrs**

Module4

Rapid Tooling : Indirect Rapid tooling -Silicon rubber tooling —Aluminum filled epoxy tooling Spray metal tooling ,Cast kirksite ,3D keltool ,etc.Direct Rapid Tooling — Direct,

AIM, Quick cast process, Copper polyamide, Rapid Tool ,DMILS, ProMetal ,Sand casting tooling ,Laminate tooling soft Tooling vs. hard tooling. **08Hrs**

Module5

Software ForRp: Stl files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools,

RAPID Manufacturing Process Optimization: factors influencing accuracy, data preparationerrors, Part building errors, Error in finishing,

influence of build orientation. **12Hrs**

Text Books:

1. **Paul F. Jacobs,** "Stereo 1ithography and other RP & M Technologies"-SME NY, 1996
2. **Flham D.T &Dinjoy S.S** "Rapid Manufacturing"- Verlog London 2001

Reference Books:

1. **Terry Wohler's** "Wohler's Report 2000"- Wohler's Association 2000

Course Outcomes:

Students will be exposed to the concepts of

- Rapid prototyping.
- Solid ground curing in Rapid prototyping.
- The rapid tooling.
- The software for RP.
- The Rapid manufacturing process.

ASSESEMENT METHOD

CIE:

1. Two internal tests (each 40 marks) are conducted, average of two tests marks will be considered.
2. Self Study Report/ Minimum two assignments Average of two will be considered for 10 marks.

SEE:

1. SEE Conducted for 100 marks for Theory exams and shall be 3 hours duration
2. Two Questions are to be set from each module, carrying 20 marks each.
3. Students have to answer 5 questions selecting one full question from each module

ADVANCED MATERIALS TECHNOLOGY

Sub Code : 15NHG258
L: P: T: S : 3:0:0:1
Exam Hours : 03

Credits : 04
CIE Marks : 50
SEE Marks : 50

CourseObjectives:

Studentswill get

- An orientationintoNewerMaterials
- An idea of ProcessingCompositesandanalysisof composites
- Knowledge about NanoTechnologyandPowderMetallurgy.
- Exposure about Surface treatment processes.

Course content:

Module 1

STRUCTURE-PROPERTY RELATIONS Introduction,Atomicstructure,atomicbonds, secondary bonds, crystalstructure,Millerindices,packingefficiency,crystaldefects,grain structure,elasticandplasticdeformation insinglecrystals,dislocation theory,strain/work hardening,plasticdeformationinpolycrystalline metals,fractureofmetals,coldworking, re crystallizationandhotworking,graingrowth.

NEWERMATERIALS: Introduction, plastics, molecular structure, isomers, polymerization, thermosetting and thermoplastic materials, properties and applications of plastics. Ceramics, nature and structure, fine ceramics, properties and applications of ceramics. Composite materialsclassification, matrix and reinforcement materials, properties, rule of mixtures, longitudinal strength and modulus (iso strain model), transverse strength and modulus.

10Hrs

Module 2

PROCESSING OFCOMPOSITES: Liquid-stateprocess,solidstateprocessandinsitu processesofMMC's.Slurry infiltrationprocess,combinedhotpressingandreactionbonding method,meltinfiltrationprocess,directoxidation,isothermalchemicalimpregnationproces s andSol-Gelandpolymerpyrolysisof CMC's.Handlayupprocess,filamentwinding process, pultrusion process, pressure bag moulding, vacuum-bag moulding, autoclave moulding, injectionmouldingprocessandthermoformingprocessofPMC's.

METHODSOFANALYSISOFCOMPOSITES: Micromechanics-Mechanics ofmaterial approach,elasticityapproachtodeterminematerialproperties.Macromechanics- Stress-strain relationswithrespecttonaturalaxis,arbitrary axisanddeterminationofmaterial properties.Experimentalcharacterizationoflaminatesandparticulatecomposites.

10Hrs

Module 3

FAILUREANALYSISANDDESIGNOF COMPOSITES: Failurecriterionforparticulate andlaminatecomposites. Designoflaminatedandparticulatecomposites. Othermechanical designissues-Longtermenvironmentaleffects,inter laminar stresses,impactresistance,fracture resistanceandfatigue resistance.

NANOTECHNOLOGY: Introduction,conceptofnanotechnology ,nanoscience, nanomaterials (one, two and three dimensional), top down and bottom up constructions,fabricationofcarbonnanotubes(CNT),nanomaterialcharacterization– scanning probe microscopy,atomicforcemicroscopy,scanningtunneling microscopy

10Hrs

Module 4

SURFACE TREATMENT: Introduction, SurfaceEngineering,Surfacequality&integrity concepts,Mechanicaltreatment,Thermalspraying processesandapplications,Vapour depositionsprocessesandapplications,Ion-treatment. **7Hrs**

Module 5

POWDERMETALLURGY: Introduction,Stepsinpowdermetallurgy,Production of Powder, Characterization&Testing ofPowders, PowderConditioning,PowderCompaction, Sintering,Finishingoperations,ApplicationsofPMcomponents.

7Hrs

TEXTBOOKS:

1. E.PaulDegarmo, J.T.Black, Ronald A Kohser. , "Materials and Processing in Manufacturing"-8thEdition–PrenticeHall ndia.
2. K.K.Chawla, "Compositematerials" –ScienceEngineering,.Springer.
3. A.K.Sinha, "PowderMetallurgy"-2ndEdition,Dhanpat Rai publications.
4. **Dr.H.K.Shivanand**,"CompositeMaterials",Asian publication.
5. **AutarK.Kaw**,"Mechanicsof compositematerials" ,TaylorandFrancis group.

Reference Books:

1. **KrishanK. Chawla**, "CompositeMaterialsScience &Engg"-2nd edition, Springer publicat1on.
2. "ASMHandbookonMetalCasting"-Vol.15,9thedition,ASMpublication
3. "ASMHandbookonPowderMetallurgy"-Vol17,ASMpublications

4. **Mick Wilson, KamaliKannangara**, "Nanotechnology – Basic Science andEmerging Technologies", OverseasPressIndiaPrivateLimited,First IndianEdition2005.

5. V.S.R Murthy, A.K.Jena, K.P.Gupta, G.S.Murthy, "Structure and Properties of Engineering Materials" , Tata McGraw Hill.

6. M.M.Schwartz, "Composite Materials Hand book" –GrawHill.

7. RakeshRath, "Nanotechnology", S. Chand and company.

Course Outcomes:

Students willbeableto

- Decide the application of various newer materials to engineering applications
- Satisfyrequirementofmachinability, strengthand weightrequirements.
- Understand about composites, analysis of composites and failure in composites.
- Get introduced to Nanotechnology.
- Understand about surface treatment techniques and powder metallurgy.

ASSESEMENT METHOD

CIE:

- Two internal tests (each 40 marks) are conducted, average of two tests marks will be considered.
- Self Study Report/ Minimum two assignments Average of two will be considered for 10 marks.

SEE:

- SEE Conducted for 100 marks for Theory exams and shall be 3 hours duration
- Two Questions are to be set from each module, carrying 20 marks each.
  - Students have to answer 5 questions selecting one full question from each module.