NEW HORIZON
COLLEGE OF ENGINEERING
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

Department of
Computer Science and Engineering

M.TECH-CSE

Academic Year 2021-2022

Scheme & Syllabus

Semester: 1 & 2

Batch(2021-2023)

SCHEME OF MTECH FIRST SEMESTER

2021-2023

S. No	Course code	Course	BOS	Credit distribution			Overall credits	Contact Hours	Marks		
				L	T	P			CIE	SEE	TOTAL
1	19SCS11	ADVANCED OPERATING SYSTEMS	CSE	3	0	0	3	3	50	50	100
2	19SCS12	ARTIFICIAL INTELLIGENCE	CSE	3	0	0	3	3	50	50	100
3	19SCS13	ADVANCED COMPUTER NETWORKS&SECURITY	CSE	3	0	0	3	3	50	50	100
4	19SCS14x	SPECIALIZATION ELECTIVE-1	CSE	4	0	0	4	4	50	50	100
5	19SCS15	HUMAN COMPUTER INTERACTION	CSE	3	0	0	3	3	50	50	100
6	19SCS16	RESEARCH METHODOLOGY & IPR	CSE	2	0	0	2	2	25	25	50
7	19SCS17	MINI PROJECT IN ACN	CSE				2	4	25	25	50
8	19SCL18	ADVANCED OPERATING SYSTEMS LAB	CSE	0	0	2	2	4	25	25	50
Total							22	22	325	325	650

Specialization Elective-I	
Course code	**Course**
19SCS141	OBJECT ORIENTED SOFTWARE ENGINEERING
19SCS142	MULTI CORE ARCHITECTURE AND PROGRAMMING
19SCS143	DATAWAREHOUSING AND DATAMINING
19SCS144	PATTERN RECOGNITION AND IMAGE PROCESSING

SCHEME OF MTECH SECOND SEMESTER

2021-2023

S. No	Course code	Course	BOS	Credit distribution			Overall credits	Contact Hours	Marks		
				L	T	P			CIE	SEE	TOTAL
1	19SCS21	ADVANCED ALGORITHMS	CSE	3	0	0	3	3	50	50	100
2	19SCS22	CLOUD COMPUTING	CSE	3	0	0	3	3	50	50	100
3	19SCS23	BIG DATA ANALYTICS	CSE	4	0	0	4	4	50	50	100
4	19SCS24 x	SPECIALIZATION ELECTIVE-2	CSE	4	0	0	4	4	50	50	100
5	19SCS25	MACHINE LEARNING	CSE	4	0	0	4	4	50	50	100
6	19SCS26	MINI PROJECT ON CLOUD COMPUTING	CSE				2	4	25	25	50
7	19SCL27	ADVANCED ALGORITHMS LAB	CSE	0	0	2	2	4	25	25	50
Total							22	22	300	300	600

Specialization Elective-2	
Course code	**Course**
19SCS241	SOFTWARE TESTING AUTOMATION
19SCS242	MIDDLEWARE TECHNOLOGIES IN WEB AND MOBILE DOMAIN
19SCS243	SERVICE ORIENTED ARCHITECTURE
19SCS244	PARALLEL ALGORITHMS

SEMESTER 1

ADVANCED OPERATING SYSTEM

Course Code : 19SCS11 | **Credits : 03**
L:T:P : 3:0:0 | **CIE Marks : 50**
Exam Hours : 03 | **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Learn the various resource management techniques for distributed systems.
CO2	Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
CO3	Identify the different features of real time and mobile operating systems.
CO4	Understand the various virus detection techniques.
CO5	Distinguish existing open-source kernels in terms of functionality or features used.
CO6	Demonstrate the kernel and its organization.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	3	-	-	-	-	-	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	-	-	-	3	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	3	-	-	-	1	-	2
CO5	3	3	2	1	-	-	-	-	-	-	-	-	2	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-	-	-

Module No.	**Module Contents**	**Hours**	**Co's**
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**	**CO1**
2.	**Threads, SMP, and Microkernel, Virtual Memory**: Processes and Threads, Symmetric Multiprocessing (SMP), Micro kernels, Windows Vista Thread and SMP Management, 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**	**CO2**
3.	**Multiprocessor and Real-Time Scheduling:** Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX SVR4 Scheduling, Windows Vista Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.	**9**	**CO3**

4.	**Embedded Operating Systems**: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits	**9**	**CO4**
5.	**Kernel Organization**: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine, Modules and Device Management, MODULE Organization, MODULE Installation 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.	**9**	**CO5, CO6**

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

Assessment Pattern:

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests (25 Marks)**	**Assignments (15 Marks)**	**Quizzes (10 Marks)**
Remember	5	-	-
Understand	5	-	-
Apply	10	-	5
Analyze	5	7.5	5
Evaluate	-	7.5	-
Create	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's	**Questions (50 Marks)**

Category	
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	-
Create	-

ARTIFICIAL INTELLIGENCE

Course Code	**:19SCS12**	**Credits**	**: 03**
L:T:P	**: 3:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO #	COURSE OUTCOME
19SCS12.1	Identify the basic concepts of AI, intelligent agents, environment and its structure and nature. Analyze and solve the problem using uninformed search and different forms of learning
19SCS12.2	Identify and analyze different search strategies, logics to represent knowledge, reasoning patterns in propositional logic and derive the proof from the facts using inference.
19SCS12.3	Analyze the first order logics to represent knowledge, reasoning patterns in propositional logic and derive the proof from the facts using inference, unification, lifting, forward and backward chaining.
19SCS12.4	Analyse different techniques used in planning and reasoning and knowledge representation using ontology
19SCS12.5	Analyze different inference procedures
19SCS12.6	Analyze probabilistic reasoning under un certainty using Bayes theorem and Bayesian network

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19SCS12.1	3	3	3	-	-	-	-	-	-	-	-	3	-	-
19SCS12.2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
19SCS12.3	3	3	3	2	-	-	-	-	-	-	-	-	3	-
19SCS12.4	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19SCS12.5	3	3	3	2	-	-	-	-	-	-	-	-	3	-
19SCS12.6	3	3	3	2	-	-	-	-	-	-	-	-	3	1

Module No	Module Contents	Hours	Cos

1	**Introduction:** What is AI? Intelligent Agents: Agents and environment; Rationality; the nature 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	CO1
2	**Search strategies, Logical Agents:** Informed search strategies; Heuristic functions; On-line search 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	CO2
3	**First-Order Logic, Inference in First-Order Logic:** Representation revisited; Syntax and semantics 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	CO3
4	**Knowledge Representation and Planning:** Ontological engineering; Categories and objects; 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	CO4
5	**Uncertainty, Probabilistic Reasoning:** Uncertainty: Acting under certainty ;Inference using full 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.	8	CO5 CO6

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

Assessment Pattern:

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	-	-
Understand	5	-	-
Apply	10	-	5
Analyze	5	7.5	5
Evaluate	-	7.5	-
Create	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	-
Create	-

ADVANCED COMPUTER NETWORKS AND SECURITY

Course Code	**: 19SCS13**	**Credits**	**: 03**
L: T:P	**: 3:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

19SCS13.1	To become familiar with the basics of Computer Networks and learn Network architectures.
19SCS13.2	To learn Concepts of fundamental protocols.
19SCS13.3	To gain the knowledge of internetworking concepts.
19SCS13.4	To understand the knowledge of internetworking concepts in various applications.
19SCS13.5	To acquire knowledge of implementation concepts in congestion control and error detections.
19SCS13.6	To get an overview of security and firewalls.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	1
CO2	3	2	1	-	-	-	-	-	-	1	1	3	3	1
CO3	3	2	2	-	-	-	-	-	-	2	2	3	3	1
CO4	3	3	3	-	-	-	-	-	-	3	3	3	3	1
CO5	3	3	3	-	-	-	-	-	-	3	3	3	3	1
CO6	3	3	-	-	-	-	-	-	-	-	-	3	3	1

Course Contents

Module No	Module Contents	Hours	COs
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**	**CO1**
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**	**CO2**

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.	8	CO3
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, DEC bit, 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	CO4 &CO 5
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	9	CO6

Text Book:

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 Public World", Prentice-Hall, 2002.
4. Wong, Angus, Yeung, Alan "Network Infrastructure Security", Springer, 2009

REFERENCES:

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.

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	**Tests**	**Assignments**	**Quizzes**
Marks (Out of 50)	**25**	**15**	**10**
Remember	-	-	-
Understand	05	-	-
Apply	05	05	-
Analyze	05	05	05
Evaluate	05	-	05
Create	05	05	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	**Tests**
Marks (Out of 50)	**50**
Remember	05
Understand	05
Apply	15
Analyze	15
Evaluate	5
Create	5

OBJECT ORIENTED SOFTWARE ENGINEERING

Course Code	**: 19SCS141**	**Credits : 04**	
L:T:P	**: 4:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO#	Course Outcomes
19SCS141.1	Understand the fundamentals of OO Software Engineering
19SCS141.2	Apply the concepts of software prototyping, analysis and design
19SCS141.3	Analyse and apply the various OO Design models and Testing Objects
19SCS141.4	Evaluate the various design models
19SCS141.5	Apply the principles to case studies
19SCS141.6	Evaluate modelling with UML along with focussing on users and their tasks

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO6	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Sl. No	Module Contents	Hours	Cos
1	**INTRODUCTION-** The nature of software, software engineering and as branch of engineering profession, stakeholders in software engineering, software quality, software engineering projects. Software Engineering Paradigms, Software Development process models, Project and Process, Project management, Process and Project metrics, Object Oriented concepts and Principles	9	CO1
2	**PLANNING and SCHEDULING-** Software prototyping, Software project planning, Scope, Resources, Software Estimation, Empirical Estimation Models, Planning, Risk Management, Software Project Scheduling, Object Oriented Estimation and Scheduling.	9	CO2

3	**ANALYSIS and DESIGN**- Analysis Modelling, Data Modelling, Functional Modelling and Information Flow, Behavioural Modelling, Structured Analysis, Object Oriented Analysis, Domain Analysis, Object Oriented Analysis process, Object Relationship Model, Object Behaviour Model. Design Concepts and 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	CO3,CO4
4	**DESIGN MODELS and TESTING**- Top-Down, Bottom-Up, Object oriented product Implementation and Integration. Software testing methods, White Box, Basis Path-Control Structure, Black Box, Unit Testing, Integration testing, and Validation and System testing. Testing OOA and OOD models, Object oriented testing strategies. Maintenance process, System documentation, program evolution dynamics, Maintenance costs, Maintainability measurement, Case Studies	9	CO5
5	**UML-** Modelling with classes UML, essentials of UML class diagrams, associations and multiplicity, generalization, instance diagrams. **Focusing on users and their tasks** User-centred design, characteristics of users, developing use case models of systems, the basics of user interface design, usability principles, and evaluation users' interfaces	8	CO6

Text Books:

1. Timothy C. Lethbridge & Robert Langaniere, "Object-Oriented Software Engineering Practical software development using UML and Java", Mcgraw-Hill, 2007.
2. Bernd Bruegge & Allen H. Dutoit, "Object-Oriented Software Engineering", 3rd Edition, Prentice Hall, 2009
3. Ivar Jacobson, "Object-Oriented Software Engineering", Pearson Education, 2009.

Reference Books

1. Stephen R. Schach, "Object-Oriented Classical Software Engineering", Mc Graw Hill, 2010.
2. Yogesh Singh, "Object-Oriented Software Engineering", 2012.

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	Tests	Assignments	Quizzes
Marks (Out of 50)	25	15	10
L1: Remember		-	-
L2: Understand		-	-
L3: Apply	10	7.5	5
L4: Analyze	05	5	2.5
L5: Evaluate	10	2.5	2.5
L6: Create	-		-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	**Marks (Out of 50)**
L1: Remember	
L2: Understand	5
L3: Apply	20
L4: Analyze	10
L5: Evaluate	15
L6: Create	-

MULTI-CORE ARCHITECTURE AND PROGRAMMING

Course Code	**: 19SCS142**	**Credits**	**: 04**
L:T:P	**: 4:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Understand concepts of multicore processors and parallel computer architectures.
CO2	Understanding the challenges in shared memory architecture.
CO3	Explain various parallel programming challenges and solutions.
CO4	Develop shared memory programs using OpenMP.
CO5	Develop distributed memory programs using MPI.
CO6	Compare and contrast parallel programming with OpenMP and MPI.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	2	-	-	-	-
CO2	3	3	-	-	-	-	-	2	-	-	-	-
CO3	3	3	2	-	-	2	-	2	-	-	-	-
CO4	3	3	2	-	-	-	-	2	-	-	-	-
CO5	3	3	2	2	-	-	-	2	-	-	-	-
CO6	3	3	-	3	-	-	-	2	-	-	-	-

Module No.	Module Contents	Hours	Co's
1.	**MULTI-CORE PROCESSORS** Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design	**8**	**CO1 CO2**
2.	**PARALLEL PROGRAM CHALLENGES** Performance – Scalability – Synchronization and data sharing – Data races - Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes)	**9**	**CO3**

3.	**SHARED MEMORY PROGRAMMING WITH OpenMP** OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.	**9**	**CO4**
4.	**DISTRIBUTED MEMORY PROGRAMMING WITH MPI** MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived data types – Performance evaluation.	**9**	**CO5**
5.	**PARALLEL PROGRAM DEVELOPMENT** Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.	**9**	**CO6**

Text Books:

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011 (unit 2)

Reference Books:

1. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
2. John L. Hennessey and David A. Patterson, " Computer architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4th edition, 2007.
3. https://www.open-mpi.org/ and http://www.openmp.org/

Assessment Pattern:

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**Tests (25 Marks)**	**Assignments (15 Marks)**	**Quizzes (10 Marks)**
Remember	-	-	-
Understand	10	-	-
Apply	5	-	5
Analyze	5	-	5
Evaluate	5	7.5	-
Create	-	7.5	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 Marks)
Remember	
Understand	20
Apply	10
Analyze	10
Evaluate	10
Create	-

DATA WAREHOUSING & DATA MINING

Course Code	**: 19SCS143**	**Credits**	**: 04**
L:T:P	**: 4:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO #	COURSE OUTCOME
19SCS143.1	Understand various data pre-processing techniques to improve the quality of data
19SCS143.2	Outline the concept of Data warehousing and online analytical processing
19SCS143.3	Compare and contrast various classification models
19SCS143.4	Analyze rule based classification models
19SCS143.5	Examine the importance and suitable applications of various clustering algorithms
19SCS143.6	Identify the ways to mine complex data types and data mining applications

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19SCS143.1	3	3	-	-	-	-	-	-	-	-	-	3	3	-
19SCS143.2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
19SCS143.3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
19SCS143.4	3	3	3	-	-	-	-	-	-	-	-	3	3	-
19SCS143.5	3	3	3	-	-	-	-	-	-	-	-	3	3	-
19SCS143.6	3	3	-	-	-	-	-	-	-	-	-	3	3	-

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Module No	Module Contents	Hours	Cos
1	**Introduction and Data Pre-processing:** Why data mining, What is data mining, What kinds of 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	CO1

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	CO2
3	**Classification: Basic Concepts: Basic** Concepts, Decision tree induction, Bays Classification Methods, Rule-Based classification, Model evaluation and selection, Techniques to improve classification accuracy	9	CO3 CO4
4	**Cluster Analysis: Basic concepts and methods:** Cluster Analysis, Partitioning methods, Hierarchical Methods,Density-based methods, Grid-Based Methods, Evaluation of clustering. .	9	CO5
5	**Data mining trends and research frontiers:** Mining complex data types, other methodologies of data mining,Data mining applications, Data Mining and society.	8	CO6

Text Book:

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

Reference Books:

1. 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", Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, PrenticeHall of India, 2006.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", PearsonEducation, 2007.

Assessment Pattern:

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	-	-
Understand	5	-	-
Apply	10	-	5
Analyze	5	7.5	5
Evaluate	-	7.5	-
Create	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests (50 Marks)
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	-
Create	-

PATTERN RECOGNITION AND IMAGE PROCESSING

Course Code	**: 19SCS144**	**Credits**	**: 04**
L:T:P	**: 4:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

19SCS144.1	Able to process images and identify patterns from images
19SCS144.2	Apply various Feature selection techniques and Clustering techniques to identify significant patterns.
19SCS144.3	Classify large datasets with images using various classification techniques
19SCS144.4	Apply image processing techniques to enhance the quality of images.
19SCS144.5	To analyse various image transformation techniques to enhance images.
19SCS144.6	To create compressed patterns of images using image compression techniques.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-			-	3	3	-	3	-	2
CO2	3	3	3	-	3	2	-	-	3	3	-	3	-	2
CO3	3	3	3	-	3	2		-	3	3	-	3	-	2
CO4	3	3	3	-	3	2	-	-	3	3	-	3	-	2
CO5	3	3	3	-	3	-	-	-	3	3	-	3	-	2
CO6	3	3	3	-	3			-	3	3	-	3	-	2

Course Contents

Module No	Module Contents	Hours	COs
1	Introduction – Definitions, Pattern, image classification, Decision surfaces, Different Paradigms of Pattern Recognition, Representations of Patterns and Classes, Metric and non-metric proximity measures, Feature extraction, Different approaches to Feature Selection	**8**	**CO1**
2	**FEATURE SELECTION AND CLUSTERING** Feature selection: Divergence analysis, Bhattacharya and Mahalanobis distance, JM distance, and separability analysis. Clustering: K-means clustering, Clustering Large datasets, Combination of Classifiers, Applications – Document Recognition	**9**	**CO2**
3	**CLASSIFICATION** Nearest Neighbour Classifier and variants, Efficient algorithms for nearest neighbour classification, Different Approaches to Prototype Selection, Bayes Classifier, Decision Trees, Linear Discriminant	**9**	**CO3**

	Function, Support Vector Machines, Classification accuracy estimation, Naïve measure, Kappa, Tau indices.		
4	**IMAGE PROCESSING:** IMAGE ENHANCEMENT: Image histogram, point operations and look-up tables, False Color Composite (FCC), Density slicing, contrast enhancements, histogram equalization, and histogram specification. Spatial and frequency filtering, linear and nonlinear filters, smoothing, sharpening, High/Low pass filters. IMAGE SEGMENTATION : Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation	**9**	**CO4**
5	**IMAGE TRANSFORMATIONS:** Principal component analysis (standardized / unstandardized). Tasseled cap transformation, band ratios and vegetation indices, change detection. IMAGE COMPRESSION: fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards	**9**	**CO5 & CO6**

Text Books:

1. Devi V.S.; Murty, M.N.(2011) Pattern Recognition:An Introduction, Universities Press, Hyderabad.
2. R. O. Duda,P.E. Hart and D. G.Stork,Pattern Classification, Wiley, 2000.
3. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson

Reference Books:

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O., and Har P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	**Tests**	**Assignments**	**Quizzes**
Marks (Out of 50)	**25**	**15**	**10**
Remember	-	-	-
Understand	05	-	-
Apply	05	05	-
Analyze	05	05	05
Evaluate	05	-	05
Create	05	05	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	**Tests**
Marks (Out of 50)	**50**
Remember	05
Understand	05
Apply	20
Analyze	15
Evaluate	5
Create	5

HUMAN COMPUTER INTERACTION

Course Code	**: 19SCS15**	**Credits**	**: 03**
L:T:P	**: 3:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Analyze the need for computers and evaluate the use of computers
CO2	Design and Development Processes and life cycle of HCI.
CO3	Identify the stages in software engineering that need to be modified for effectiveness of interacting with computers
CO4	Discover the various models that can be used for designing systems
CO5	Evaluate the design techniques by applying the apt statistical approach
CO6	Design dialogue for representation to computers

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	-	3	-	-	-	-	-	-	-	-	-	-	2
CO5	3	-	3	1	-	-	-	-	-	-	-	-	-	-
CO6	3	3	3	-	-	-	-	-	-	-	-	-	-	-

Module No.	Module Contents	Hours	Co's
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**	**CO1**
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**	**CO2**

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	**CO3**
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	**CO4, CO5**
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	9	**CO6**

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.

Assessment Pattern:

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	-	-
Understand	5	-	-
Apply	10	-	5
Analyze	5	7.5	5
Evaluate	-	7.5	-
Create	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Tests (50 Marks)
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	-
Create	-

RESEARCH METHODOLOGY AND IPR

Course Code	**: 19SCS16**	**Credits**	**: 02**
L:T:P	**: 2:0:0**	**CIE Marks**	**: 25**
Exam Hours	**: 03**	**SEE Marks**	**: 25**

Course outcomes: At the end of the course the student will be able to:

19SCS16.1	Discuss research methodology and the technique of defining a research problem
19SCS16.2	Comprehend the concepts of literature review and formulate research problem using research methodology techniques
19SCS16.3	Explain various research designs, sampling designs, measurement and scaling techniques.
19SCS16.4	Choose an appropriate methodology to write a technical report and present a research paper
19SCS16.5	Comprehend concepts related to patents, trademark and copyright
19SCS16.6	Recognize the recent developments in IPR administration

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19SCS16.1	3	3	-	-	-	-	-	-	-	3	-	-	3	3
19SCS16.2	3	3	3	3	-	-	-	-	-	3	-	-	3	3
19SCS16.3	3	3	3	3	-	-	-	-	-	3	-	3	3	3
19SCS16.4	3	3	3	3	2	-	-	3	2	3	-	3	3	3
19scs16.5	3	3	3	-	2	-	-	3	2	3	-	-	3	3
19SCS16.6	3	3	-	-	-	-	-	3	-	3	-	3	3	3

Module No	Module Contents	Hours	COs
1	**Research Methodology:** Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India	**5**	**CO1**
2	**Defining the Research Problem:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration, **Reviewing the literature:** Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research	**5**	**CO2**

	area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.		
3	**Research Design:** Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. **Design of Sample Surveys:** Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.	**5**	**CO3**
4	**Data Collection**: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method, **Interpretation and Report Writing:** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	**5**	**CO4**
5	**Intellectual Property:** The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organization (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of	**5**	**CO5,CO6**

	Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.		

TEXT BOOKS:

1. C.R.Kothari, GauravGarg, Research Methodology: Methods and Techniques New Age International 4th Edition, 2018
2. Ranjit Kumar, Research Methodology: a step-by-stepguide for beginners. (For the topic Reviewing the literature under module 2) SAGE Publications Ltd 3rd Edition, 2011
3. Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

Reference Books:

1. Trochim: Research Methods: the concise knowledge base, Atomic Dog Publishing-2005
2. Fink A Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications 2009

CIE – Continuous Internal Evaluation: Theory (25 Marks)

Blooms Taxonomy	**Test (25)**	**Quiz**	**Assignment**
Marks (Out of 50)	**25**	**-**	**-**
L1: Remember	5	-	-
L2: Understand	10	-	-
L3: Apply	5	-	-
L4: Analyze	5	-	-
L5: Evaluate	-	-	-
L6: Create	-	-	-

SEE-Semester End Examination (25 Marks)

Bloom''s Category	**Marks**
L1:Remember	**5**
L2:Understand	**10**
L3:Apply	**5**
L4:Analyze	**5**
L5:Evaluate	**-**
L6:Create	**-**

MINI PROJECT in ACN

Course Code : 19SCS17 **Credits : 02**
L:T:P : 0:0:0 **CIE Marks: 25**
Exam Hours : 03 **SEE Marks: 25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Identify and Finalize problem statement by surveying variety of domains.
CO2	Implement algorithm in internetworking protocols.
CO3	Implement algorithm in end-to-end protocols.
CO4	Implement algorithm in congestion control, error detections and security.
CO5	Analyze and evaluate the algorithm performance metrics using the software solution.
CO6	Test, validate and communicate the identified solutions in a structured way.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	-	-	-	3	-	-	-	3	3	-	3	3	3
CO2	3	3	3	-	3	-	-	-	3	3	-	3	3	3
CO3	3	3	3	-	3	-	-	-	3	3	-	3	3	3
CO4	3	3	3	-	3	-	-	-	3	3	-	3	3	3
CO5	3	3	3	1	3	-	-	2	3	3	-	3	3	3
CO6	3	-	-	-	-	-	-	2	3	3	-	-	-	-

The student shall be capable of identifying a problem related to the stream of Advanced Computer Networks and Security and carry out a mini project on the problem defined. Each student is expected to do the mini project individually. The code developed towards the project will be reviewed by a panel of experts during the course of the semester. 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 will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category Marks (out of 25)	Mini Project
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	25
Create	-

SEE- Semester End Examination (25 Marks)

Blooms Category Marks (out of 25)	Tests
Remember	-
Understand	-
Apply	15
Analyze	-
Evaluate	10
Create	-

ADVANCED OPERATING SYSTEM LAB

Course Code	**: 19SCL18**	**Credits**	**: 02**
L:T:P	**: 0:0:2**	**CIE Marks**	**: 25**
Exam Hours	**: 03**	**SEE Marks**	**: 25**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Demonstrate and develop shell scripts for the commands of Unix Operating Systems.
CO2	Analyze Symmetric Multiprocessing (SMP) by implementing lazy buddy system algorithm.
CO3	Identify processes, threads and multithreading.
CO4	Apply ECOS operating system for controlling a pool of resources using mutexes and condition variables.
CO5	Analyze Computer Security Concepts of Threats and Attacks to classify the Virus.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	-	3
CO2	3	3	3	-	3	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	3	-	-	-	-	-	-	3	-	3
CO4	3	3	3	2	3	-	-	-	-	-	-	-	2	-
CO5	3	3	3	2	3	-	-	-	-	-	-	3	-	3

Exp No.	Module Contents	Hours	Co's
1.	Design and develop a shell that should support at least 20 commands.	**6**	**CO1**
2.	Design and develop a program to implement lazy buddy system algorithm.	**6**	**CO2**
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.	**6**	**CO3**
4.	Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.	**6**	**CO4**
5.	Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.	**6**	**CO5**

Text Books:

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

Reference Books:

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

Assessment Pattern:

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Tests (25 Marks)
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	10
Create	15

SEE- Semester End Examination (25 Marks)

Bloom's Category	Questions (50 Marks)
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	10
Create	15

SEMESTER 2

ADVANCED ALGORITHMS

Course Code	**: 19SCS21**	**Credits**	**: 03**
L: T: P	**: 3:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 3**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the course, students able

CO #	COURSE OUTCOME
19SCS21.1	Design and apply iterative and recursive algorithms
19SCS21.2	Design and apply graph search algorithms
19SCS21.3	Design modular linear equation algorithms
19SCS21.4	Design and implement string matching algorithms
19SCS21.5	Design and implement optimization algorithms in specific applications
19SCS21.6	Design efficient programming solutions to various problems

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSE71.1	3	3	3	3	-	-	-	-	3	-	-	3	3	3
CSE71.2	3	3	3	3	-	-	-	-	3	-	-	3	3	3
CSE71.3	3	3	3	3	-	-	-	-	3	-	-	3	3	3
CSE71.4	3	3	3	3	-	-	-	-	3	-	-	3	3	3
CSE71.5	3	3	3	3	-	-	-	-	3	-	-	3	3	3
CSE71.6	3	3	3	3	-	-	-	-	3	-	-	3	3	3

Module	Contents of the Module	COs	Hours
1	**Review of Analysis Techniques:** Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method,	**CO1**	**9**

	The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.		
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; Efficient implementation of FFT	**CO2**	**9**
3	**Number - Theoretic Algorithms:** Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.	**CO3**	**9**
4	**String-Matching Algorithms:** Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.	**CO4**	**9**
5	**Probabilistic and Randomized Algorithms:** Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.	**CO5, CO6**	**9**

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.

CIE- Continuous Internal Evaluation (50Marks)

Bloom's Category	**Tests**	**Assignments**	**Quizzes**
Marks (out of 50)	25	15	10
Remember	5	-	-
Understand	5	--	5
Apply	5	7.5	5
Analyze	10	7.5	-
Evaluate	-	-	-
Create	-	-	-

SEE- Semester End Examination: Theory (50 Marks)

Bloom's Category	Tests
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

CLOUD COMPUTING

Course Code	**: 19SCS22**	**Credits**	**: 03**
L:T:P	**: 3:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

19SCS22.1	To Demonstrate and experiment simple Cloud Applications.
19SCS22.2	To Apply Map-Reduce concept to applications.
19SCS22.3	To Create virtual machines from available physical resources
19SCS22.4	To Apply resource allocation and scheduling algorithms.
19SCS22.5	To analyse the security issues in cloud environment.
19SCS22.6	To create private cloud.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	2	2	-	3	3	-	3	3	-
CO2	3	3	3	-	3	-	-	-	3	3	-	3	3	2
CO3	3	3	-	-	3	2	2	-	3	3	-	3	3	2
CO4	3	3	3	-	3	-	-	-	3	3	-	3	3	-
CO5	3	3	3	-	3	-	-	-	3	3	-	3	3	-
CO6	3	3	3	-	3	2	2	-	3	3	-	3	3	2

Course Contents

Module No	Module Contents	Hours	COs
1	**Introduction, Cloud Infrastructure** Cloud computing, Cloud computing delivery models and 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	CO1
2	**Cloud Computing: Application Paradigms.** Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case 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	CO2
3	**Cloud Resource Virtualization.**	8	CO3

	Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.		
4	**Cloud Resource Management and Scheduling.** Policies and mechanisms for resource management, 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**	**CO4**
5	**Cloud Security, Cloud Application Development.** 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.	**9**	**CO5 & CO6**

Text Book:

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

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	Tests	Assignments	Quizzes
Marks (Out of 50)	**25**	**15**	**10**
Remember	-	-	-
Understand	05	-	-
Apply	05	05	-
Analyze	05	05	05
Evaluate	05	-	05
Create	05	05	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Tests
Marks (Out of 50)	**50**
Remember	05
Understand	05
Apply	15
Analyze	15
Evaluate	5
Create	5

BIG DATA ANALYTICS

Course Code	**: 19SCS23**	**Credits**	**: 04**
L: T:P	**: 4:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO #	**COURSE OUTCOME**
19SCS23.1	To explore the fundamental concepts of big data analytics
19SCS23.2	To learn to analyse the big data using intelligent techniques
19SCS23.3	To understand the various concepts of Big Data File System
19SCS23.4	To learn to use different Hadoop Environment
19SCS23.5	To understand the Application framework in Big Data
19SCS23.6	To understand the various search methods and visualization techniques.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19SCS23.1	3	3	-	-	-	-	-	-	-	-	-	2	2	-
19SCS23.2	3	3	3	3	-	-	-	-	-	-	-	2	2	-
19SCS23.3	3	3	3	3	-	-	-	-	-	-	-	2	2	-
19SCS23.4	3	3	2	2	-	-	-	-	-	-	-	2	2	-
19SCS23.5	3	3	2	2	-	-	-	-	-	-	-	2	2	-
19SCS23.6	3	3	3	2	-	-	-	-	-	-	-	2	2	-

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Module No	**Module Contents**	**Hours**	**COs**
1	**INTRODUCTION TO BIG DATA:** **Introduction to BigData Platform** – Challenges of Conventional 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	CO1

2	**MINING DATA STREAMS:** Introduction To Streams Concepts – Stream Data Model and Architecture - 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	CO2
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	CO3
4	**HADOOP ENVIRONMENT:** Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration - Security in Hadoop - Administering Hadoop – HDFS - Monitoring – Maintenance – Hadoop benchmarks - Hadoop in the cloud	9	CO4
5	**FRAMEWORKS:** Applications on Big Data Using Pig and Hive – Data processing operators in Pig – 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	CO5,CO6

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

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	**Tests**	**Assignments**	**Quizzes**
Marks (Out of 50)	25	15	10
Remember	5		
Understand	5		
Apply	5	7.5	5
Analyze			5
Evaluate			
Create	10	7.5	

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	**Tests**
Marks (Out of 50)	
Remember	10
Understand	10
Apply	20
Analyze	
Evaluate	
Create	10

SOFTWARE TESTING AUTOMATION

Course Code: 19SCS241 **Credits : 04**
L: T:P : 4:0:0 **CIE Marks : 50**
Exam Hours : 03 **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to do the following:

19SCS241.1	Identify the importance of software quality assurance and classify the software quality factors.
19SCS241.2	Analyze the contract reviews for project development and quality plan.
19SCS241.3	Summarize the various types of software testing and metrics for testing.
19SCS241.4	Design test cases using various testing techniques.
19SCS241.5	Evaluate test design process with combinatorial and fault model.
19SCS241.6	Apply regression testing for scalable algorithms.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19SCS241.1	3	3	-	-	-	-	-	-	-	-	-	3	3	3
19SCS241.2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
19SCS241.3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
19SCS241.4	3	3	2	-	-	-	-	-	-	-	-	3	3	3
19SCS241.5	3	3	2	-	-	-	-	-	-	-	-	3	3	3
19SCS241.6	3	3	-	-	-	-	-	-	-	-	-	3	3	3

Module No.	Module Contents	Hours	Co's
1.	**Introduction on software quality:** Software quality – definition, Software quality assurance – definition and objectives, Software quality assurance and software engineering, **Software quality factors:** Classifications of software requirements into software quality factors, Product operation, Product revision, Product transition, Alternative models of software quality factors, The components of the software quality assurance system – Overview	9	**CO1**
2.	**Contract Review:** The contract review process and its stages, Contra review objectives, Implementation of a contract review, Contra review **subjects**, Contract reviews for internal projects, Developme and quality plans, Reviews, Objectives, Formal design reviews, Pe reviews, A comparison of team review methods, Expert opinions.	**9**	**CO2**

3.	**Insight of Software Testing:** 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	**CO3**
4.	**Test Generation from Requirements:**Introduction, The test selection problem, Equivalence partitioning, Boundary value analysis and category partition method. **Test Generation from Finite State Models:**SW design and testing, Finite state model, Conformance testing, Fault model, Characterization test, W method and WP method.	9	**CO4**
5.	**Test Generation from Combinatorial Designs:** Combinatorial designs, A combinatorial test Design process, Fault model, Regression testing: What is RT? , RT process, RTS the problem, Selecting RT, Test selection using execution trace, TS using dynamic slice, Scalability of TS algorithms, Test minimization, Test prioritization, Tools for RT.		**CO5, CO6**

Text books:

1. Elisabeth Hendrickson,” Explore **It quality Assurance”,** -2015
2. Daniel Galin, Pearson**, ”Software quality assurance-from theory to implementation”,** 2009.(U1)
3. CemKaner, “**Lesson learned in Software Testing**”, James Beach-2015

Reference books:

1. Mordechei Ben – Menachem, Garry S. Marlis ,“**Software Quality**”, Thomson
2. Srinivasan D, GopalaswamyRamesh **,” Software Testing- Principles and practices”,** Pearson, 2006
3. Alan C Gillies, “**Software Quality Theory and Management**”, 2nd Edition, Cenagage Learning, 2003

Assessment Pattern:

CIE- Continuous Internal Evaluation (50 Marks)

Bloom’s Category	**Tests (25 Marks)**	**Assignments (15 Marks)**	**Quizzes (10 Marks)**
Remember	5		5
Understand	5	7.5	5
Apply	5	7.5	
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 Marks)
Remember	
Understand	**10**
Apply	**20**
Analyze	**10**
Evaluate	**10**
Create	-

MIDDLEWARE TECHNOLOGIES IN WEB AND MOBILE DOMAIN

Course Code	**: 19SCS242**	**Credits**	**: 04**
L:T:P	**: 4:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

19SCS242.1	To understand the Distributed systems design and implementation
19SCS242.2	To understand the technical details of the middleware
19SCS242.3	To Use the middleware to build distributed applications
19SCS242.4	To learn the middleware security concepts
19SCS242.5	To learn the middleware application design with middleware architecture
19SCS242.6	To learn the implementation of business processe

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19SCS242.1	3	3	-	-	-	-	-	-	-	-	-	-	2	-
19SCS242.2	3	3	-	-	-	-	-	-	-	-	-	-	2	-
19SCS242.3	3	3	2	2	-	-	-	-	-	-	-	-	2	-
19SCS242.4	3	3	2	2	1	-	-	-	-	-	-	-	2	2
19SCS242.5	3	3	-	-	1	-	-	-	-	-	-	-	2	2
19SCS242.6	3	3	-	-	-	-	2	-	-	-	-	3	2	2

Module No.	**Module contents**	**Hours**	**CO's**
1	**INTRODUCTION:** Moving to e-business, what is IT architecture? Why is this different from what we did before? Rewrite or evolve? , Who develops the architecture? Early days, Preliminaries, Remote procedure calls, Remote database access, Distributed transaction processing, Message queuing, Message queuing versus distributed transaction processing, what happened to all this technology? **OBJECTS, COMPONENTS, AND THE WEB:** Using object middleware, Transactional component middleware, COM, EJB, Final comments on TCM, Internet Applications, WEB SERVICES: Service concepts, Web services, and Using Webservices: A pragmatic approach	9	CO1
2	**A TECHNICAL SUMMARY OF MIDDLEWARE:** Middleware elements, The communications link, The middleware protocol, The programmatic interface, Data presentation, Server control, Naming	9	

	and directory services, Security, System management, Comments on Web services, Vendor architectures, Vendor platform architectures, Vendor-distributed architectures, Using vendor architectures, Positioning, Strawman for user target architecture, Marketing, Implicit architectures, Middleware interoperability		CO2
3	**USING MIDDLEWARE TO BUILD DISTRIBUTED APPLICATIONS:** What is middleware for? Support for business processes, Information retrieval, Collaboration, Tiers, The presentation tier, The processing tier, The data tier, Services versus tiers, Architectural choices, Middleware bus architectures, Hub architectures, Web services architectures, Loosely coupled versus tightly coupled	9	CO3
4	**SECURITY:** What security is needed, Traditional distributed system security, Web services security, Architecture and security. **APPLICATION DESIGN AND IT ARCHITECTURE:** Problems with today's design approaches, Design up front or as needed?, The role of business rules, Existing systems, Reuse, Silo and monolithic development, The role of architecture, Levels of design, Reconciling design approaches.	9	CO4 CO5
5	**IMPLEMENTING BUSINESS PROCESSES:** What is a process? Business processes, Information and processes, Architecture process patterns, Clarification and analysis, Error Handling, Timing, Migration, Flexibility	9	CO6
	Total	**45**	

Text Books:

- Chris Britton and Peter Eye, *"IT Architectures and Middleware:Strategies for Building Large, Integrated Systems"*,2nd Edition, Pearson Education, 2004.

Reference Books:

- Qusay H. Mahmoud, *"Middleware for Communications"*, 1st Edition, John Wiley and Sons,2004.
- Michah Lerner, *"Middleware Networks: Concept, Designand Deployment of Internet Infrastructure"*, 1stEdition,Kluwer Academic Publishers, 2000.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5		5
Understand	5	7.5	5
Apply	5	7.5	
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 Marks)
Remember	
Understand	**10**
Apply	**20**
Analyze	**10**
Evaluate	**10**
Create	**-**

SERVICE ORIENTED ARCHITECTURE

Course Code	**:19SCS243**	**Credits**	**: 04**
L:T:P	**: 4:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Understand the basic concepts of XML.
CO2	Be exposed to build applications based on XML
CO3	Understand the key principles behind SOA
CO4	Develop web services using technology elements
CO5	Learn the various web service standards.
CO6	Design and develop SOA based applications for intra-enterprise and inter-enterprise applications

Mapping of CO v/s PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	2	-	-	-	-	-	-	-	3	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	1	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	3	-	2	-	-	-	-	-	-	-	3	3

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Module No.	Module contents	Hours	CO's
1	**Introduction to XML:** XML document structure – Well-formed and valid documents – Namespaces – DTD – XML Schema – X-Files.	9	CO1
2	**Building XML- based Applications:** Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML	9	CO2
3	**Service Oriented Architecture:** Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA — Principles of Service orientation – Service layers.	9	CO3

4	**Web Services:** Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions	9	CO4
5	**Building SOA-Based Applications:** Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines — Composition– WS-BPEL –WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE	9	CO5, CO6
	Total	**45**	

Text books:

S.No.	Author(s)/Name of Books/Publishers	Year of Publication
1	Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2014	2014
2	Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2002.	2002

References:

1	Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education, 2005	2005
2	Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2004	2004
3	James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "Java Web Services Architecture", Morgan Kaufmann Publishers, 2003	2003

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5		5
Understand	5	7.5	5
Apply	5	7.5	
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 Marks)
Remember	
Understand	**10**
Apply	**20**
Analyze	**10**
Evaluate	**10**
Create	**-**

PARALLEL ALGORITHMS

Course Code	**: 19SCS244**	**Credits**	**: 04**
L: T: P	**: 4:0:0**	**CIE Marks**	**: 50**
Exam Hours	**: 3**	**SEE Marks**	**: 50**

Course Objectives:

CO1	Understand different parallel architectures and models of computation
CO2	Introduce the various classes of parallel algorithms
CO3	Study parallel algorithms for basic problems
CO4	Develop parallel algorithms for standard problems and applications.
CO5	Analyze efficiency of different parallel algorithms.
CO6	Understand the differences among several algorithms solving the same problem and recognize which one is better under different conditions

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE61.1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20CSE61.2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20CSE61.3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20CSE61.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20CSE61.5	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20CSE61.6	3	3	-	-	-	-	-	-	-	-	-	-	3	-

Module No	Module Contents	Hours
1	**INTRODUCTION :** Need for Parallel Processing – Data and Temporal Parallelism – Models of Computation – RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organisations – PRAM Algorithm – Analysis of PRAM Algorithms- Parallel Programming Languages	**9**
2	**PRAM ALGORITHMS :** Parallel Algorithms for Reduction – Prefix Sum – List Ranking –Preorder Tree Traversal – Searching -Sorting – Merging Two Sorted Lists – Matrix Multiplication – Graph Coloring – Graph Searching.	**9**

3	**SIMD ALGORITHMS:** 2D Mesh SIMD Model – Parallel Algorithms for Reduction – Prefix Computation – Selection – Odd-Even Merge Sorting – Matrix Multiplication.	9
4	**SIMD ALGORITHMS -II :** Hypercube SIMD Model – Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model – Parallel Algorithms for Reduction -Bitonic Merge Sort – Matrix Multiplication – Minimum Cost Spanning Tree	9
5	**MIMD ALGORITHMS :** UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer – Parallel Quick Sort – Mapping Data to Processors.	8

Text Books:

1. Michael J. Quinn, “Parallel Computing : Theory & Practice”, Tata McGraw Hill Edition, Second edition, 2017.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, University press, Second edition , 2011.
3. V Rajaraman, C Siva Ram Murthy, ” Parallel computers- Architecture and Programming “, PHI learning, 2016.

References Books:

1. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, “Introduction to Parallel Computing”, 2nd Edition, Addison Wesley, 2003.
2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , ” Introduction to Parallel Processing”, PHI learning , 2013.
3. S.G.Akl, “The Design and Analysis of Parallel Algorithms”, PHI, 1989.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom’s Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5		5
Understand	5	7.5	5
Apply	5	7.5	
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

SEE- Semester End Examination (50Marks)

Bloom's Category	Questions (50 Marks)
Remember	
Understand	**10**
Apply	**20**
Analyze	**10**
Evaluate	**10**
Create	**-**

MACHINE LEARNING

Course Code : 19SCS25 | **Credits : 04**
L:T:P : 4:0:0 | **CIE Marks : 50**
Exam Hours : 03 | **SEE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Apply the concepts of learning and decision trees.
CO2	Analyse the neural networks and genetic algorithms.
CO3	Apply Bayesian techniques.
CO4	Solve problems based on instant based learning.
CO5	Identify concepts of analytical learning.
CO6	Classify inputs based on reinforced learning.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO6	3	3	3	-	-	-	-	-	-	-	-	3	3	3

Module No	Module Contents	Hours	COs
1	**Introduction, Concept Learning and Decision Trees:** Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Find-S-finding a maximally specific hypothesis-Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning –Representation – Algorithm – Heuristic Space Search.	9	CO1
2	**Neural Networks and Genetic Algorithms:** Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms	9	CO2

	– Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.		
3	**Bayesian And Computational Learning:** Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	**9**	**CO3**
4	**Instant Based Learning and Learning Set of Rules:** K- Nearest Neighbour Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution	**9**	**CO4**
5	**Analytical Learning and Reinforced Learning:** Perfect Domain Theories – EBG Remarks on Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning-Relationship to Dynamic Programming	**9**	**CO5, CO6**

Text Books:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.
2. An Algorithmic Perspective, “Stephen Marsland, Taylor & Francis(CRC)

References Books:

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

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	**Tests**	**Assignments**	**Quizzes**
Marks (Out of 50)	**25**	**15**	**10**
L1: Remember	-	-	-
L2: Understand	05	-	-
L3: Apply	10	05	05
L4: Analyze	05	05	05
L5: Evaluate	05	05	-
L6: Create	-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	**Marks (Out of 50)**
L1: Remember	05

L2: Understand	10
L3: Apply	15
L4: Analyze	15
L5: Evaluate	05
L6: Create	-

MINI PROJECT in CLOUD COMPUTING

Course Code : 19SCS26 **Credits : 02**

L:T:P : 0:0:0 **CIE Marks: 25**

Exam Hours : 03 **SEE Marks: 25**

Course Outcomes: At the end of the Course, the Student will be able to

CO1	Identify and Finalize problem statement by surveying variety of domains.
CO2	Implement various cloud services and virtualization techniques.
CO3	Implement Task Scheduling algorithms.
CO4	Implement cloud security and to build a private cloud.
CO5	Analyze and evaluate the algorithm performance metrics using the software solution.
CO6	Test, validate and communicate the identified solutions in a structured way.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	3	3	-	3	3	3
CO2	3	3	3	-	3	-	-	-	3	3	-	3	3	3
CO3	3	3	3	-	3	-	-	-	3	3	-	3	3	3
CO4	3	3	3	-	3	-	-	-	3	3	-	3	3	3
CO5	3	3	3	1	3	-	-	2	3	3	-	3	3	3
CO6	3	-	-	-	-	-	-	2	3	3	-	-	-	-

The student shall be capable of identifying a problem related to the stream of Cloud Computing and carry out a mini project on the problem defined. Each student is expected to do the mini project individually. The code developed towards the project will be reviewed by a panel of experts during the course of the semester. 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 will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category Marks (out of 25)	**Mini Project**
Remember	-
Understand	-
Apply	-
Analyze	-
Evaluate	25
Create	-

SEE- Semester End Examination (25 Marks)

Blooms Category Marks (out of 25)	Tests
Remember	-
Understand	-
Apply	15
Analyze	-
Evaluate	10
Create	-

ADVANCED ALGORITHMS LAB

Course Code : 19SCL27 **Credits : 02**
L:T:P : 0:0:2 **CIE Marks : 25**
Exam Hours : 3 **SEE Marks : 25**

Course Outcomes: At the end of the Course, the Student will be able to

19SCL27.1	Apply basic principles of graph algorithms for an application program.
19SCL27.2	Apply randomizing deterministic algorithm for developing programs to perform primality testing
19SCL27.3	Implement Naïve and Knuth-Morris-Pratt string matching algorithmic technique for an application program.
19SCL27.4	Build applications using string matching algorithmic technique with finite automata appropriately.
19SCL27.5	Apply Rabin Karp String matching principles and proper program structuring to develop programs.
19SCL27.6	Apply probabilistic and randomizing deterministic algorithm for developing application program

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19SCL27.1	3	3	-	3	3	-	3	3	3	3	3	3
19SCL27.2	3	3	-	3	3	-	3	3	3	3	3	3
19SCL27.3	3	3	-	3	3	-	3	3	3	3	3	3
19SCL27.4	3	3	-	3	3	-	3	3	3	3	3	3
19SCL27.5	3	3	-	3	3	-	3	3	3	3	3	3

Exp. No	Experiment	Hours	COs
1	Design, develop, and write a program to implement the Bellman-Ford algorithm anddetermine its performance. Give its applications.	**4**	**CO2**
2	Design, develop, and write a program to implement a Monte Carlo algorithm to testthe primality of a given integer and determine its performance.	**4**	**CO5, CO6**
3	Design, develop, and write a program to solve string matching problem using naiveapproach and the KMP algorithm. Compare their performances.	**4**	**CO4**
4	Design, develop, and write a program to solve String matching problem using FiniteAutomata and determine its performance.	**4**	**CO4**

5	Design, develop, and write a program to solve String matching problem using Rabin Karp algorithm and determine its performance.	**4**	**CO4**

Reference Material(s):

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

CIE – Continuous Internal Evaluation: Theory (25 Marks)

Blooms Taxonomy	**Tests**
Marks (Out of 25)	**25**
L1: Remember	-
L2: Understand	-
L3: Apply	10
L4: Analyze	5
L5: Evaluate	-
L6: Create	10

SEE – Semester End Examination: LAB (25 Marks)

Blooms Taxonomy	**Marks (Out of 50)**
L1: Remember	-
L2: Understand	-
L3: Apply	20
L4: Analyze	10
L5: Evaluate	-
L6: Create	20