VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH(COMPUTER SCIENCE and ENGINEERING)

I Semester **Total Credits: 23**

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork / Assignment / Tutorials		I.A.	Exam		
14SCS11	Advances in Operating Systems	4	--	03	50	100	150	4
14SCS12	Cloud Computing	4	2 *	03	50	100	150	4
14SCS13	Advances in Data Base Management System	4	2 *	03	50	100	150	4
14SCS14	Multi Core Architecture and Programming	4	2	03	50	100	150	4
14SCS15x	Elective – I	4	2	03	50	100	150	4
14SCS16	Advances in Operating Systems Laboratory	0	3	03	25	50	75	2
14SCS17	Seminar #	0	3	--	25	--	25	1
Total		**20**	**13**	**18**	**300**	**550**	**850**	**23**

Elective I:
14SCS151 Advances in Digital Image Processing
14SCS152 Advances in Storage Area Networks
14SCS153 Embedded Computing Systems
14SCS154 Advances in Computer Graphics

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH(COMPUTER SCIENCE and ENGINEERING)

II Semester **Total Credits: 23**

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS21	Managing Big Data	4	2 *	03	50	100	150	4
14SCS22	Advances in Computer Networks	4	2 *	03	50	100	150	4
14SCS23	Advanced Algorithms	4	--	03	50	100	150	4
14SCS24	Artificial Intelligence and Agent Technology	4	2	03	50	100	150	44
14SCS25x	Elective – II	4	2	03	50	100	150	4
14SCS26	Advanced Algorithms Laboratory	0	3	03	25	50	75	2
14SCS27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	-- --	--	--	--	--	--
Total		**20**	**13**	**18**	**300**	**550**	**850**	**23**

ELECTIVE- II

14SCS251 Web Services
14SCS252 Information and Network Security
14SCS253 Pattern Recognition
14SCS254 Optical Networks

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

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III Semester: INTERNSHIP **Total Credits: 20**

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Fieldwork		I.A.	Exam		
14SCS31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement) *	--	--	--	25	--	25	1
14SCS32	Report on Internship **	--	--	--	--	75	75	15
14SCS33	Evaluation and Viva-voce	--	--	3	--	50	50	4
	Total	**--**	**--**	**3**	**25**	**125**	**150**	**20**

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

 # The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH(COMPUTER SCIENCE and ENGINEERING)

IV Semester **Total Credits: 28**

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Fieldwork/ Assignment / Tutorials		I.A.	Exam		
14SCS41	Machine Learning Techniques	4	2 *	03	50	100	150	4
14SCS42x	Elective-III	4	2	03	50	100	150	4
14SCS43	Evaluation of Project Phase-II	0	--	0	25	--	25	1
14SCS44	Evaluation of Project Phase-III	0	--	0	25	--	25	1
14SCS45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	200	18
Total		**08**	**07**	**09**	**150**	**400**	**550**	**28**
Grand Total (I to IV Sem.)		**Marks: 2400 ; Credits : 94**						

Elective – III

14SCS421 Computer Vision
14SCS422 Business Intelligence and its Applications
14SCS423 Agile Technologies
14SCS424 Wireless Network and Mobile Computing

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

 # Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or Technical paper.

1).Project Phase – I: 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) Internship:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).Project Work : 20 weeks duration in IV Semester carries total marks of 250.

4)Project Phase II: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).Project Phase – III: Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be 50+50+100=200 (50 Marks for Internal Guide,50 Marks for External and 100 for Viva-Voce).

Marks of Evaluation of Project:

I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.

II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:

a) Head of the Department (Chairman)

b) Guide

c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Semester: I **Year: 2014-2015**

Course Title: Advances In Operating Systems	Course Code: 14SCS11
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

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

TOPICS:

MODULE I

Operating System Overview, Process description & control

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.

10 Hours

Module II

Threads, SMP, and Microkernel, Virtual Memory.

Processes and Threads, Symmetric Multiprocessing (SMP), Microkernels, 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.

10 Hours

Module III

Multiprocessor and Real-Time Scheduling

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

10 Hours

Module IV

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.

10 Hours

MODULEV

Kernel Organization

Using Kernel Services, Daemons, Starting the Kernel , Control in the Machine , 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 Address Space, 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 Memory Manager, I/o Manager, The cache Manager , Kernel local procedure calls and IPC, The native API, subsystems.

10 Hours

Course Outcomes:

The students should 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.

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, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

Semester: I **Year: 2014-2015**

Course Title: Cloud Computing	**Course Code: 14SCS12**
Credits(L:T:P):3:0:1	**Core/Elective: Core**
Type of Course: Lecture & Practical	**Total Contact Hours: 50 Hrs**

COURSE OBJECTIVES

-To learn how to use Cloud Services.
-To implement Virtualization
- To implement Task Scheduling algorithms.
-Apply Map-Reduce concept to applications.
-To build Private Cloud.

Topics:

Module I

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.

10 Hours

Module II

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.

10 Hours

Module III

Cloud Resource Virtualization.

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

10 Hours

Module IV

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.

10 Hours

Module V

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.

10 Hours

LAB EXPERIMENTS

NOTE: Simulate using object oriented programming, any available cloud environment **(Eg; Amazon cloud) and VM ware for resource virtualization.**

1. Create a Collaborative learning environment for a particular learning topic using Google Apps. Google Drive, Google Docs and Google Slides must be used for hosting e-books, important articles and presentations respectively. The instructor must use the Google Sheets to convey the timetable for different events and for analyzing the scores for individual assignment submission.

2. Modeling and simulation Cloud computing environments, including Data Centers, Hosts and Cloudlets and perform VM provisioning using CloudSim: Design a host with two CPU cores, which receives request for hosting two VMs, such that each one requires two cores and plans to host four tasks units. More specifically, tasks t1, t2, t3 and t4 to be hosted in VM1, while t5, t6, t7, and t8 to be hosted in VM2. Implement space-shared allocation policy and time-shared allocation policy. Compare the results.

3. Model a Cloud computing environment having Data center that had 100 hosts. The hosts are to be modeled to have a CPU core (1000 MIPS), 2 GB of RAM and 1 TB of storage. Consider the workload model for this evaluation included provisioning requests for 400 VMs, with each request demanding 1 CPU core (250 MIPS), 256 MB of RAM and 1 GB of storage. Each VM hosts a *web-hosting application service*, whose CPU utilization distribution was generated according to the uniform distribution. Each instance of a webhosting service required 150,000 MIPS or about 10 minutes to complete execution assuming 100% utilization. Simulate Energy-conscious model for power consumption and power management techniques such as Dynamic Voltage and Frequency Scaling (DVFS). Initially, VMs are to be allocated according to requested parameters (4 VMs on each host). The Cloud computing architecture that is to be considered for studying energy conscious resource management techniques/policies included a data center, CloudCoordinator, and Sensor component. The CloudCoordinator and Sensor perform their usual roles. Via the attached Sensors (which are connected with every host), CloudCoordinator must periodically monitor the performance status of active VMs such as load conditions, and processing share. This real time information is to be passed to VMM, which can use it for performing appropriate resizing of VMs and application of DVFS and soft scaling. CloudCoordinator continuously1 has to adapt allocation of VMs by issuing VM migration commands and changing power states of nodes according to its policy and current utilization of resources.

4. Model and simulate the environment consisting of a data center with 10,000 hosts where each host was modeled to have a single CPU core (1200MIPS), 4GB of RAM memory and 2TB of storage. Consider the provisioning policy for VMs as space-shared, which allows one VM to be active in a host at a given instance of time. Make a request from the end-user (through the Datacenter Broker) for creation and instantiation of 50 VMs that had following constraints: 1024MB of physical memory, 1 CPU core and 1GB of storage. The application granularity was modeled to be composed of 300 task units, with each task unit requiring 1,440,000 million instructions (20 minutes in the simulated hosts) to be executed on a host. Minimal data transfer (300 KB) overhead can be considered for the task units (to and from the data center). After the creation of VMs, task units were submitted in small groups of 50 (one for each VM) at inter-arrival delay of 10 minutes.

5. Implement Map Reduce concept for
a. Strassen's Matrix Multiplication for a huge matrix.
b. Computing the average number of citation index a researcher has according to age among some 1 billion journal articles. Consider a network of entities and relationships between them. It is required to calculate a state of each entity on

the basis of properties of the other entities in its neighborhood. This state can represent a distance to other nodes, indication that there is a neighbor
with the certain properties, characteristic of neighborhood density and so on. A network is stored as a set of nodes and each node contains a list of adjacent node IDs. Mapper emits messages for each node using ID of the adjacent node as a key. Reducer must re compute state and rewrite node with the new state. Implement this scenario.

Course Outcomes:

The students should 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.

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.

Semester: I **Year: 2014-2015**

Course Title: Advances in Database Management Systems	Course Code: 14SCS13
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES:

- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented database
- To understand the basic concepts, principles of intelligent databases.
- To understand the advanced topics of data warehousing and mining .
- To learn emerging and advanced data models
- To acquire inquisitive attitude towards research topics in databases.

Topics:

MODULE I

Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations.

Overview of Object-Oriented Concepts – Objects, Encapsulation, Polymorphism, Type and class hierarchies etc.

10 Hours

Module II

Object and Object-Relational Databases: Object Oriented Concepts: – Objects, complex objects; Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems; The nested relational model.

10 Hours

Module III

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

10 Hours

Module IV

Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.

10 Hours

Module V

Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management. **10 Hours**

LABORATORY WORK:

(The following tasks can be implemented on Oracle or any other suitable RDBMS with support for Object features)

1. Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.

2. Develop a database application to demonstrate the representation of multivalued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.

3. Design and develop a suitable Student Database application. One of the attributes to me maintained is the attendance of a student in each subject for which he/she has enrolled. Using TRIGGERS, write active rules to do the following:

a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned.

b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.

4. Design, develop, and execute a program in a language of your choice to implement any one algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.

COURSE OUTCOMES:

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

- Select the appropriate high performance database like parallel and distributed database
- Model and represent the real world data using object oriented database
- Embed the rule set in the database to implement data warehousing of mining
- Choose and design database for recent applications database for better interoperability

TEXT BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.

2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

Semester: I **Year: 2014-2015**

Course Title: Multi-Core Architecture and Programming	**Course Code: 14SCS14**
Credits(L:T:P):4:0:0	**Core/Elective: Core**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

Course Objectives:

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
-To appreciate the need for parallel processing
- To expose the students to the problems related to multiprocessing
- To understand the different types of multicore architectures
- To understand the concepts of multi threading and OPENMP.

Topics:

MODULE I

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing 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, Threading above 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. **10 Hours**

Module II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, 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.

10 Hours

MODULE III

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

10 Hours

MODULE IV

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, Performance-oriented Programming, 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 to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance. **10 Hours**

MODULE V

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-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32,Data Organization for High Performance. **10 Hours**

Course Outcomes:

The students should be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Solve the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

Semester: I **Year: 2014-2015**

Course Title: Advances in Digital Image Processing	**Course Code: 14SCS151**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

Course objectives:

- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

Topics:

MODULE I

Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals:** Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

10 Hours

MODULE II

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. **Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.

10 Hours

MODULE III

Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering, Constrained Least Square Filtering, Geometric Mean Filter.

10 Hours

MODULE IV

Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. **Wavelets and Multiresolution Processing:** Image Pyramids, Subband coding, The Haar Transform, Multiresolution Expansions, Wavelet Transforms in one Dimension, Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. **Image Compression:** Fundamentals, Image Compression Models, Error-free (Lossless) compression, Lossy Compression.

10 Hours

MODULE V:

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

10 Hours

Course Outcomes:

The students will be able to:

- Understand image formation and the role human visual system plays in perception of gray and color image data.
- Apply image processing techniques in both the spatial and frequency (Fourier) domains.
- Design image analysis techniques in the form of image segmentation and to evaluate the
- Methodologies for segmentation.
- Conduct independent study and analysis of feature extraction techniques.
- Understand the concepts of image registration and image fusion.
- Analyze the constraints in image processing when dealing with 3D data sets and to apply image
- Apply algorithms in practical applications.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005

REFERENCES:

1. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
2. Scott.E.Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar: Digital Image Procesing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.

Semester: I **Year: 2014-2015**

Course Title: Advances in Storage Area Networks	**Course Code: 14SCS152**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre's maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems

Topics:

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. **Intelligent Disk Subsystems:** Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

10 Hours

MODULE II

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **Network Attached Storage:** The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. **File System and NAS**: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

10 Hours

MODULE III

Storage Virtualization: Definition of Storage virtualization ; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management,

Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary

10 Hours

Course Outcomes:

The students should be able to:

- Identify the need for performance evaluation and the metrics used for it
- Apply the techniques used for data maintenance.
- Realize storage virtualization concept,
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A CompleteGuide to understanding and Implementing SANs”, Wiley India, 2006.

Semester: I **Year: 2014-2015**

Course Title: Embedded Computing Systems	**Course Code: 14SCS153**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

COURSE

OBJECTIVES

- Provide a general overview of Embedded Systems
- Show current statistics of Embedded Systems
- Design a complete microprocessor-based hardware system
- Design, code, compile, and test real-time software
- Integrate a fully functional system including hardware and software
- Gain the ability to make intelligent choices between hardware/software tradeoffs.

Topics:

MODULE I

Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.

` **7 Hours**

MODULE II

Devices and communication buses for devices network :IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems-network protocols, Wireless and mobile system protocols.

13 Hours

MODULE III

Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.

10 Hours

MODULE IV

Interprocesses communication and synchronization of processes, Threads and tasks: Multiple process in an application, Multiple threads in an application, Tasks, Task states, Task and Data, Clear-cut distinction between functions. ISRS and tasks by their characteristics, concept and semaphores, Shared data, Inter-process communication, Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions. **10 Hours**

MODULE V

Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues**. Introduction to embedded**

software development process and tools, Host and target machines, Linking and location software.

10 Hours

Course Outcomes:

The students should be able to:

- Knowledge to distinguish the characteristics of embedded computer systems.
- Ability examines the various vulnerabilities of embedded computer systems.
- Ability to design embedded systems.
- Awareness of the changing landscape in embedded systems

Text Books:

1. **Raj Kamal**, "Embedded Systems: Architecture, Programming, and Design" 2nd edition , Tata McGraw hill-2013

Chapters: Chapter 1.1 to 1.5, 1.8 to 1.12, Chapter 3, 4, 7, 8 and 13.1 to 13.3.

References:

2. **Marilyn Wolf** ,"Computer as Components, Principles of Embedded Computing System Design" 3rd edition , Elsevier-2014 .

Semester: I **Year: 2014-2015**

Course Title: Advances in Computer Graphics	**Course Code: 14SCS154**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

Course Objectives:

- Learn basic and fundamental computer graphics techniques.
- Learn image synthesis techniques;
- Examine applications of modeling, design and visualization.
- Learn different color modeling and computer animation
- Learn hierarchical modeling and graphing file formats.

Topics:

MODULE I

Three-Dimensional Object Representations: Polyhedra, OpenGL Polyhedron Functions, Curved Surfaces, Quadric Surfaces, Super quadrics, OpenGL Quadric-Surface and Cubic-Surface Functions, Blobby Objects, Spline Representations, Cubic-Spline Interpolation Methods, Bezier Spline Curves, Bazier Surfaces B-Spline Curves, B-Spline Surfaces, Beta- Splines, Retional Splines, Conversion Between Spline Representations, Displaying Spline Curves and rfaces, OpenGL Approximation-Spline Functions, Sweep Representations, Constructive Solid –Geometry Method, Octrees, BSP Trees, Fractal-Geometry Methods, Shape Grammars and Others Procedural Methods, Particle Systems, Physically Based Modeling, Visualization Of Data Sets.

10 Hours

MODULE II

Visible-Surface Detection Methods: Classification Of Visible –Surface Detection Algorithms, Back-Face Method, Depth-Buffer Method, A-Buffer Method, Scan-Line Method, BSP-Tree Method, Area-Subdivision Method, Octree Methods, Ray-Casting Method, Comparison of Visibility –Detection Methods, Curved Surfaces, Wire-Frame Visibility –Detection Functions.

10 Hours

MODULE III

Illumination Models and Surface- Rendering Methods: Light Sources, Surface Lighting Effects, Basic Illumination Models, Transparent Surfaces, Atmospheric Effects, Shadows, Camera parameters, Displaying light intensities, Halftone patterns and dithering techniques, polygon rendering methods, ray-tracing methods, Radiosity lighting model, Environment mapping, Photon mapping, Adding surface details, Modeling surface details with polygons, Texture mapping, Bump mapping, OpenGL Illumination and surface-rendering functions, openGL texture functions.

10 Hours

MODULE IV

Color models, color applications and Computer animation: Properties of light, Color models, Standard primaries and the chromaticity diagram, The RGB color model, The YIQ and related color models, The CMY and CMYK color models, The HSV color model, The HLS color model, Color Selection and applications. Raster methods for computer animation, Design of animations sequences, Traditional animation techniques,

General computer-animation functions, Computer-animation languages, Key-frame systems, Motion specification, Articulated figure animation, Periodic motions, OpenGL animation procedures.

10 Hours

MODULE V

Hierarchical modeling and Graphics file formats: Basic modeling concepts, Modeling packages, General hierarchical modeling methods, Hierarchical modeling using openGL display list, Image-File configurations, Color-reduction methods, File-compression techniques, Composition of the major file formats.

10 Hours

COURSE OUTCOMES:

The students are able to :

- Represent and implement images and objects using 3D representation and openGL methodologies.
- Design develop surface detection using various detection methods
- Choose various illumination models for provides effective standards of objects.
- Design of develop effective computer animations.

Text Books:

1. Computer Graphics with openGL-Hearn Baker 4rd edition, Pearson publication.2010 (Chapter 8,9,10.12.13.14,15)
2. James D Foley,Andries van dam,Steven K Feiner,John F Hughes, Computer graphics, Pearson Education 3rd edition, 2013

Reference Books:

1. Edward Angel: Interactive Computer graphics a top-down approach with openGL, Addison Wesley, 6th edition 2012
2. Advanced graphics programming using openGL: TomMcReynolds-David Blythe. Elesvier.MK, 2005

Semester: I **Year: 2014-2015**

Course Title: Advances in Operating Systems Laboratory	Course Code: 14SCS16
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES:

- To implement the shell of Operating System.
- To implement distributed operating system concepts.
- To implement virus detection techniques.

LABORATORY WORK:

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

01. Design and Develop a shell that should support at least 20 commands.
02. Design and develop a program to implement lazy buddy system algorithm.
03. 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.
04. Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.
05. Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro virus.

Course Outcomes:

The students should be able to:
-Demonstrate the shell.
-Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
- Understand the various virus detection techniques.

Semester: II **Year: 2014-2015**

Course Title: Managing Big Data	Course Code: 14SCS21
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To Understand big data for business intelligence
- To Learn business case studies for big data analytics
- To Understand Nosql big data management
- To manage Big data without SQL
- To understanding map-reduce analytics using Hadoop and related tools

TOPICS:

MODULE I

UNDERSTANDING BIG DATA **10 Hours**

What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

MODULE II

NOSQL DATA MANAGEMENT **10 Hours**

Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – sharding — version – Map reduce – partitioning and combining – composing map-reduce calculations

MODULE III

BASICS OF HADOOP **10 Hours**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures

MODULE IV

MAPREDUCE APPLICATIONS **10 Hours**

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

MODULE V

HADOOP RELATED TOOLS **10 Hours**

Hbase – data model and implementations – Hbase clients – Hbase examples –praxis. Cassandra – Cassandra data model – cassandra examples – cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

LAB Experiments

Exercise 1 --- HDFS

Start by reviewing HDFS. You will find that its composition is similar to your local Linux file system. You will use the hadoop fs command when interacting with HDFS.

1. Review the commands available for the Hadoop Distributed File System:
2. Copy file foo.txt from local disk to the user's directory in HDFS
3. Get a directory listing of the user's home directory in HDFS
4. Get a directory listing of the HDFS root directory
5. Display the contents of the HDFS file user/fred/bar.txt
6. Move that file to the local disk, named as baz.txt
7. Create a directory called input under the user's home directory
8. Delete the directory input old and all its contents
9. Verify the copy by listing the directory contents in HDFS:

Exercise 2 --- MapReduce

1. Create a JOB and submit to cluster
2. Track the job information
3. Terminate the job
4. Counters in MR Jobs with example
5. Map only Jobs and generic map examples
6. Distributed cache example
7. Combiners, Secondary sorting and Job chain examples

Exercise 3 --- MapReduce (Programs)

Using movie lens data

1. List all the movies and the number of ratings
2. List all the users and the number of ratings they have done for a movie
3. List all the Movie IDs which have been rated (Movie Id with at least one user rating it)
4. List all the Users who have rated the movies (Users who have rated at least one movie)
5. List of all the User with the max, min, average ratings they have given against any movie
6. List all the Movies with the max, min, average ratings given by any user

Exercise4 – Extract facts using Hive

Hive allows for the manipulation of data in HDFS using a variant of SQL. This makes it excellent for transforming and consolidating data for load into a relational database. In this exercise you will use HiveQL to filter and aggregate click data to build facts about user's movie preferences. The query results will be saved in a staging table used to populate the Oracle Database.

The moveapp_log_json table contains an activity column. Activity states are as follows:

1. RATE_MOVIE
2. COMPLETED_MOVIE
3. PAUSE_MOVIE
4. START_MOVIE
5. BROWSE_MOVIE
6. LIST_MOVIE
7. SEARCH_MOVIE
8. LOGIN
9. LOGOUT
10. INCOMPLETE_MOVIE

```
hive> SELECT * FROM movieapp_log_json LIMIT 5;
hive> drop table movieapp_log_json;
hive> CREATE EXTERNAL TABLE movieapp_log_json (
custId INT,
movieId INT,
genreId INT,
time STRING,
recommended STRING,
activity INT,
rating INT,
price FLOAT
)
ROW FORMAT SERDE 'org.apache.hadoop.hive.contrib.serde2.JsonSerde'
LOCATION '/user/oracle/moviework/applog/';

hive> SELECT * FROM movieapp_log_json LIMIT 20;

hive> SELECT MIN(time), MAX(time) FROM movieapp_log_json
```

1. PURCHASE_MOVIE

Hive maps queries into Map Reduce jobs, simplifying the process of querying large datasets in HDFS. HiveQL statements can be mapped to phases of the Map Reduce framework. As illustrated in the following figure, selection and transformation operations occur in map tasks, while aggregation is handled by reducers. Join operations are flexible: they can be performed in the reducer or mappers depending on the size of the leftmost table.

1. Write a query to select only those clicks which correspond to starting, browsing, completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows.

2. Write a query to select the customer ID, movie ID, recommended state and most recent rating for each movie.

3. Load the results of the previous two queries into a staging table. First, create the staging table:

4. Next, load the results of the queries into the staging table.

Exercise 5 Extract sessions using Pig

While the SQL semantics of HiveQL are useful for aggregation and projection, some analysis is better described as the flow of data through a series of sequential operations. For these situations, Pig Latin provides a convenient way of implementing data flows over data stored in HDFS. Pig Latin statements are translated into a sequence of Map Reduce jobs on the execution of any STORE or DUMP command. Job construction is optimized to exploit as much parallelism as possible, and much like Hive, temporary storage is used to hold intermediate results. As with Hive, aggregation occurs largely in the reduce
tasks. Map tasks handle Pig's FOREACH and LOAD, and GENERATE statements. The EXPLAIN command will show the execution plan for any Pig Latin script. As of Pig 0.10, the ILLUSTRATE command will provide sample results for each stage of the execution plan.

In this exercise you will learn basic Pig Latin semantics and about the fundamental types in Pig Latin, Data Bags and Tuples.

1. Start the Grunt shell and execute the following statements to set up a dataflow with the click stream data. Note: Pig Latin statements are assembled into Map Reduce jobs which are launched at execution of a DUMP or STORE statement.

2. Group the log sample by movie and dump the resulting bag.

3. Add a GROUP BY statement to the sessionize.pig script to process the click stream data into user sessions.

Course Outcomes:

The students should be able to:

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

REFERENCES:

1.Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

Semester: II **Year: 2014-2015**

Course Title: Advances in Computer Networks	Course Code: 14SCS22
Credits(L:T:P):3:0:1	Core/Elective: Core
Type of Course: Lecture & Practical	Total Contact Hours: 50 Hrs

Course Objectives:

- To become familiar with the basics of Computer Networks
- To understand various Network architectures
- Concepts of fundamental protocols
- To understand the network traffic, congestion, controlling and resource allocation.

Topics:

MODULE I

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.

T1: **Chapter 1.1, 1.2, 1.5.1, 1.5.2**., **2.1, 2.5** **T2**: **Chapter 4** **10 Hours**

MODULE II

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.

T1: Chapter 3.1, 3.2, **10 Hours**

MODULE III

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

T1: Chapter 3.3, 4.1.1,4.1.3 **T2**:Chapter 13.1 to 13.18 , Ch 18. **10 Hours**

MODULE IV

End-to-End Protocols

Simple Demultiplexer (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.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3 **10 Hours**

MODULE V

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) .

T1: Chapter 6.4 **T2**: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8 **10 Hours**

Laboratory Work:

PART A: Implement the following using C/C++:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP
3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

Course Outcomes:

The students should be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- 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.
- Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Explain various congestion control techniques.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** "Computer Networks :A System Approach" 5th Edition , Elsevier -2014
2. **T2: Douglas E Comer, "**Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI - 2014

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

Semester: II **Year: 2014-2015**

Course Title: Advanced Algorithms	Course Code: 14SCS23
Credits(L:T:P):4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours: 50 Hrs

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To study network flow and linear programming problems.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.

Topics:

MODULE I

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, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours

MODULE II

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.

10 Hours

MODULE III

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.

10 Hours

MODULE IV

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

10 Hours

MODULE V

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

10 Hours

Course Outcomes:

Upon completion of the course, the students 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.

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, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007.

Semester: II **Year: 2014-2015**

Course Title: Artificial Intelligence and Agent Technology	**Course Code: 14SCS24**
Credits(L:T:P):4:0:0	**Core/Elective: Core**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

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.

TOPICS:

MODULE I

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.

Text Book 1: Chapter 1 & 2 Text Book 2: Chapter 2 10 Hours

MODULE II

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.

Text Book 1: Chapter 3, 4 & 5 Text Book 2: Chapter 6 10 Hours

MODULE III

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, Dempster-Shafer 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.

Text Book 1: Chapter 7 & 8 Text Book 2: Chapter 13 10Hours

MODULE IV

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

Text Book 1: Chapter 9 & 10 Text Book 2: Chapter 5 **10 Hours**

MODULE V

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.

Text Book 2: Chapter 18 & 20 **10 Hours**

COURSE OUTCOMES:

The students are able to:

- 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.

Text Books.

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

Reference Books:

3. Nils J. Nilsson: “Principles of Artificial Intelligence”, Elsevier, ISBN-13: 9780934613101

Semester: II **Year: 2014-2015**

Course Title: Web Services	**Course Code: 14SCS251**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

Course objectives:

- To provide an in-depth knowledge of Web Services.
- To understand the fundamental concepts of Web services.
- To understand the fundamental concepts of WSDL Web Services.
- To design Web service Architecture.
- To Study Building Blocks of Web services.

TOPICS:

MODULE I

Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware. **10 Hours**

MODULE II

Web Services: Web Services Technologies, Web Services Architecture. **10 Hours**

MODULE III

Basic Web Services Technology: WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards.

10 Hours

MODULE IV

Service Coordination Protocols: Infrastructure for Coordination Protocols, WS- Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols. **10 Hours**

MODULE V

Service Composition: Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution : AN Example.

10 Hours

Course Outcomes:

The students should be able to:

- Bind and unbind services in UDDI.
- Develop WSDL document
- Implement web service client to call public service.
- Implement a service and exposing it as public service.

Text Books:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.

Semester: II **Year: 2014-2015**

Course Title: Information And Network Security	Course Code: 14SCS252
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

TOPICS:

MODULE I

Classical Encryption Techniques

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours

MODULE II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA. **10 Hours**

MODULE III

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure .**User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours

MODULE IV

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, .

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer:** SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic

Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify And Finished Messages, Cryptographic Computations, Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **10 Hours**

Course Outcomes:

The students be able to

- Analyze the vulnerabilities in any computing system and hence be able to design a
- security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition. 2013

References

1. V k Pachghare: Cryptography and Information Security, PHE ,2013.

Semester: II **Year: 2014-2015**

Course Title : Pattern Recognition	Course Code: 14SCS253
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To study the mathematical morphology necessary for Pattern recognition.
- To introduce the student to various Pattern recognition techniques.
- To study the Representation and description and feature extraction.
- To study the principles of decision trees and clustering in pattern recognition.

TOPICS:

MODULE I

Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems. **10 Hours**

MODULE II

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation. **10 Hours**

MODULE III

Nearest Neighbor based classifiers & Bayes classifier: Nearest neighbor algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Basyessian belief network. **10 Hours**

MODULE IV

Decision Trees: Introduction, DT for PR, Construction of DT, Splitting at the nodes, Over-fitting & Pruning, Examples. **10 Hours**

MODULE V

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Iso-data), clustering large data sets, examples. **10 Hours**

COURSE OUTCOMES:

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

- Develop and analyze decision tress.
- Design the nearest neighbor classifier.
- Develop algorithms for Pattern Recognition.

Text Books:

1. Pattern Recognition (An Introduction) , V Susheela Devi, M Narsimha Murthy, Universities Press, ISBN 978-81-7371-725-3,2011.
2. Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost. PHI ISBN-81-203-1484-0, 1996.

References

1. Duda R. O., P.E. Hart, D.G. Stork., Pattern Classification, John Wiley and sons, 2000.

Semester: II **Year: 2014-2015**

Course Title: Optical Networks	**Course Code: 14SCS254**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

Course Objectives:

-To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
-To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
-To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
-To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
-To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM

Topics:

MODULE I

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer, Elements of a SONET/SDH Infrastructure**, Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area
Networks: Fiber Channel.

10 Hours

MODULE II

WDM Network Elements

Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects**: All-Optical OXC Configurations.

10 Hours

MODULE III

Control and Management

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management**: Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours

MODULE IV

Basic Concepts, Protection in SONET/SDH:

Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer**: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1: N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design:

Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum **Load Dimensioning Models**: Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES:

The students will be able to:

- Gain Knowledge on fundamentals of optical network.
- Explore optical network architectures ranging from optical access networks to backbone optical transport networks.
- Choose approaches and methodologies of optical network for design effective optimization;
- Apply Techniques of optical network survivability.
- Gain knowledge on Problem solving skills and critical thinking in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uyless Black, Optical Networks-Third generation transport system: Pearson 2013.

Semester: II **Year: 2014-2015**

Course Title: Advanced Algorithms Laboratory	Course Code: 14SCS26
Credits(2) (L:T:P):0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours: 42 Hrs

COURSE OBJECTIVES

- To implement the graph search algorithms.
- To implement the string matching algorithms.
- To implement the modular linear equation algorithms.

LABORATORY WORK:

Note: The following programs can be executed on Java/C#/any equivalent tool/langauge by adapting 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 **primality** of 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 algoritm and determine its performance.

Course Outcomes:

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

- Design and apply graph search algorithms.
- Design and implement string matching algorithms.
- Design modular linear equation algorithms.

Semester: IV **Year: 2014-2015**

Course Title: Machine Learning Techniques	**Course Code: 14SCS41**
Credits(L:T:P):3:0:1	**Core/Elective: Core**
Type of Course: Lecture & Practical	**Total Contact Hours: 50 Hrs**

COURSE OBJECTIVES:

- To understand the basic concepts of learning and decision trees.
- To understand the neural networks and genetic algorithms
- To understand the Bayesian techniques
- To understand the instant based learning
- To understand the analytical learning and reinforced learning

TOPICS:

MODULE I

INTRODUCTION, CONCEPT LEARNING AND DECISION TREES

Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search. **10 Hrs**

MODULE II

NEURAL NETWORKS AND GENETIC ALGORITHMS

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. **10 Hrs**

MODULE III

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. **10 Hrs**

MODULE IV

INSTANT BASED LEARNING AND LEARNING SET OF RULES

K- Nearest Neighbor 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 **10 Hrs**

MODULE V

ANALYTICAL LEARNING AND REINFORCED LEARNING

Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **10 Hrs**

LABORATORY WORK

(The following tasks can be implemented in a language of your choice or any tools available)

1) Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
2) Implement the FIND–S algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.

3) Implement the ID3 algorithm for learning Boolean–valued functions for classifying the training examples by searching through the space of a Decision Tree.
4) Design and implement the Back-propagation algorithm by applying it to a learning task involving an application like FACE RECOGNITION.
5) Design and implement Naïve Bayes Algorithm for learning and classifying TEXT DOCUMENTS.

COURSE OUTCOMES:

On Completion of the course, the students will be able to

- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

TEXT BOOK:

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

REFERENCES:

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

Semester: IV **Year: 2014-2015**

Course Title: Computer Vision	**Course Code: 14SCS421**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

Course Objectives:

- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

TOPICS:

MODULE I

CAMERAS: Pinhole Cameras**, Radiometry – Measuring Light:** Light in Space, Light Surfaces, Important Special Cases, **Sources, Shadows, And Shading:** Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, **Color:** The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

10 Hours

MODULE II

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, **Edge Detection:** Noise, Estimating Derivatives, Detecting Edges, **Texture:** Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

10 Hours

MODULE III

The Geometry of Multiple Views: Two Views, **Stereopsis:** Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras, **Segmentation by Clustering:** What Is Segmentation?, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

10 Hours

MODULE IV

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, **Segmentation and Fitting Using Probabilistic Methods:** Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples**.**

10 Hours

MODULE V

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, **Geometric Camera Calibration:** Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into

Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, **Model- Based Vision:** Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment. **10 Hours**

Course Outcomes:

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

- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

TEXT BOOKS

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

REFERENCES:

4. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

Semester: IV **Year: 2014-2015**

Course Title: Business Intelligence And Its Applications	Course Code: 14SCS422
Credits(L:T:P):4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours: 50 Hrs

Course Objectives:

- To Implement the key elements of a successful business intelligence (BI) program
- To Apply a BI meta model that turns outcomes into actions
- To Extract and transform data from an operational data to a data business data
- To Exploit business analytics and performance measurement tools

TOPICS:

MODULE I

Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation

10 Hours

MODULE II

Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process

10 Hours

MODULE III

Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery

10 Hours

MODULE IV

Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard

10 Hours

MODULE V

Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics f enterprise reporting, BI road ahead.

10 Hours

Course Outcomes:

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

- know the complete life cycle of BI/Analytical development
- Understand the technology and processes associated with Business Intelligence framework

- Given a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.

Text Books:

1. Larissa T Moss and ShakuAtre – Business Intelligence Roadmap : The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003.
2. R N Prasad, SeemaAcharya – Fundamentals of Business Analytics , Wiley India, 2011.

Reference Books:

3. David Loshin - Business Intelligence: The Savvy Manager's Guide, Publisher: Morgan Kaufmann, ISBN 1-55860-196-4.
4. Brian Larson - Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006.
5. Lynn Langit - Foundations of SQL Server 2008 Business Intelligence –Apress, ISBN13: 978-1-4302-3324-4, 2011

Semester: IV **Year: 2014-2015**

Course Title: Agile Technologies	**Course Code: 14SCS423**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

COURSE OBJECTIVES

- To understand how an iterative, incremental development process leads to faster delivery of more useful software
- To understand the essence of agile development methods
- To understand the principles and practices of extreme programming
- To understand the roles of prototyping in the software process
- To understand the concept of Mastering Agility

TOPICS:

MODULE I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor **10 Hours**

MODULE II

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility **10 Hours**

MODULE III

Practicing XP:

Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:**"Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

10 Hours

MODULE IV

Mastering Agility

Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

10 Hours

MODULE V

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence :**Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

10 Hours

COURSE OUTCOMES

Students should be able to

- Understand The XP Lifecycle, XP Concepts, Adopting XP
- Work on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Implement Concepts to Eliminate Waste

Text Books:

1. **The Art of Agile Development** (Pragmatic guide to agile software development), James shore, Chromatic, O'Reilly Media, Shroff Publishers & Distributors, 2007

Reference Books:

1. Agile Software Development, Principles, Patterns, and Practices, Robert C. Martin, Prentice Hall; 1st edition, 2002

2., "Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004.

Semester: IV **Year: 2014-2015**

Course Title: Wireless Networks And Mobile Computing	**Course Code: 14SCS424**
Credits(L:T:P):4:0:0	**Core/Elective: Elective**
Type of Course: Lecture	**Total Contact Hours: 50 Hrs**

COURSE OBJECTIVES

- To introduce the concepts of wireless communication.
- To understand various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To understand CDMA, GSM, Mobile IP, WImax
- To understand Different Mobile OS
- To learn various Markup Languages
- CDC, CLDC, MIDP; Programming for CLDC, MIDlet model and security concerns

TOPICS:

MODULE I

Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. **Wireless Networks** : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

10 Hours

MODULE II

Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. **10 Hours**

MODULE III

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux and Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

10 Hours

MODULE IV

Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

10 Hours

MODULE V

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

10 Hours

COURSE OUTCOMES:

The student should be able to:

- Work on state of art techniques in wireless communication.
- Explore CDMA, GSM, Mobile IP, WiMax
- Work on Different Mobile OS
- Develop program for CLDC, MIDP let model and security concerns

TEXT BOOKS:

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.

2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

REFERENCE BOOKS:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.

2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.