VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2016-2017

M. Tech. (Computer Science & Engineering)

I Semester **CREDIT BASED**

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment		I.A.	Exam		
16SCS11	Advances in Operating Systems	4	-	3	20	80	100	4
16SCS12	Cloud Computing	4	--	3	20	80	100	4
16SCS13	Advances in Data Base Management System	4	--	3	20	80	100	4
16SCS14	Probability Statistics and Queuing Theory	4	--	3	20	80	100	4
16SCS15x	Course Electives – I	3	--	3	20	80	100	3
16SCS16	Operating Systems and ADBMS Laboratory	--	**3(2 Hrs lab+ 1 Hr Instruction)**	3	20	80	100	2
16SCS17	Seminar	--	--	--	100	--	100	1
	Total	**20**	**3**	**18**	**220**	**480**	**700**	**22**

Course Electives 1	
16SCS151	Advances in Digital Image Processing
16SCS152	Embedded Computing Systems
16SCS153	Advances in Storage Area Networks
16SCS154	Advances in Computer Graphics

ADVANCES IN OPERATING SYSTEMS

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	**16SCS11**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define the fundamentals of Operating Systems.
- Explain distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- Illustrate distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- Identify the components and management aspects of Real time, Mobile operating Systems

Module 1	**Teaching Hours**
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, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues.	**10 Hours**
Module 2	
Threads, SMP, and Microkernel, Virtual Memory: Processes and Threads, Symmetric Multiprocessing (SMP), Micro Kernels, Windows Vista Thread and SMP Hours Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX Memory Management, Windows Vista Memory Management, Summary	**10 Hours**
Module 3	
Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSl) Scheduling, Windows Vista Hours Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock	**10 Hours**
Module 4	
Embedded Operating Systems: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.	**10 Hours**
Module 5	
Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine , Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management,Running Process Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual 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 system
- Modify existing open source kernels in terms of functionality or features used

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

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

CLOUD COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	**16SCS12**/16SCE12 16SIT22/16SSE254 16SCN22/16LNI151	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define and Cloud, models and Services.
- Compare and contrast programming for cloud and their applications
- Explain virtuaization, Task Scheduling algorithms.
- Apply ZooKeeper, Map-Reduce concept to applications.

Module 1	**Teaching Hours**
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 2	
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web 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 3	
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:	**10 Hours**

Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems	
Module 4	
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.	**10 Hours**
Module 5	
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.	**10 Hours**

Course Outcomes

The students should be able to:

- Compare the strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Apply suitable virtualization concept.
- Choose the appropriate cloud player
- Address the core issues of cloud computing such as security, privacy and interoperability
- Design Cloud Services
- Set a private cloud

Question paper pattern:

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

Text Books:

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

Reference Books:

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.

ADVANCES IN DATA BASE MANAGEMENT SYSTEMS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16SSE151/ 16SIT13/ **16SCS13**	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define parallel and distributed databases and its applications.
- Show applications of Object Oriented database
- Explain basic concepts, principles of intelligent databases.
- Utilize the advanced topics of data warehousing and mining .
- Infer emerging and advanced data models
- Extend knowledge in research topics of databases.

Module 1	**Teaching Hours**
Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations. Overview of Object-Oriented Concepts – Objects, Basic properties. Advantages, examples, Abstract data types, Encapsulation, class hierarchies, polymorphism, examples.	**10 Hours**
Module 2	
Object and Object-Relational Databases: Overview of OOP; Complex objects; Identity, structure etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL; 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; syntax and demo examples, The nested relational model. Overview of C++ language binding;	**10 Hours**
Module 3	
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 4	
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; ROC and CMC Curves; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks.	**10 Hours**
Module 5	
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**
Course Outcomes	
The students should be able to:	

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

Question paper pattern:
The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

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.

PROBABILITY STATISTICS AND QUEUING THEORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16LNI14 / 16SCN14/**16SCS14**/ 16SSE14 / 16SIT14 /16SCE14 / 16SFC14	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Develop analytical capability and to impart knowledge of Probability, Statistics and Queuing.
- Apply above concepts in Engineering and Technology.
- Acquire knowledge of Hypothesis testing and Queuing methods and their applications so as to enable them to apply them for solving real world problems

Module 1	**Teaching Hours**
Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable. Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables, Joint pdf / cdf and their properties	**10 Hours**
Module 2	
Probability Distributions / Discrete distributions: Binomial, Poisson Geometric and Hyper-geometric distributions and their properties. Continuous distributions: Uniform, Normal, exponential distributions and their properties.	**10 Hours**
Module 3	
Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Autocorrelation Function, Cross-correlation function and their properties, Ergodicity, Poisson process, Markov Process, Markov chain.	**10 Hours**
Module 4	
Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical	**10 Hours**

region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, F-distribution, its properties and uses, Chi-square distribution, its properties and uses, $\chi 2$ – test for goodness of fit, $\chi 2$ test for Independence	
Module 5	
Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.	**10 Hours**

Course Outcomes

The students should be able to:

- Demonstrate use of probability and characterize probability models using probability mass (density) functions & cumulative distribution functions.
- Explain the techniques of developing discrete & continuous probability distributions and its applications.
- Describe a random process in terms of its mean and correlation functions.
- Outline methods of Hypothesis testing for goodness of fit.
- Define the terminology &nomenclature appropriate queuing theory and also distinguish various queuing models.

Question paper pattern:

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

Text Books:

1. Probability, Statistics and Queuing Theory, V. Sundarapandian, Eastern Economy Edition, PHI Learning Pvt. Ltd, 2009.

Reference Books:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishor. S. Trivedi , Prentice Hall of India ,2004.
2. Probability, Statistics and Random Processes, 1st Edition by P Kausalya, Pearson Education, 2013.

ADVANCES IN DIGITAL IMAGE PROCESSING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	**16SCS151**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- Demonstrate the image segmentation and representation techniques.
- How image are analyzed to extract features of interest.
- Introduce the concepts of image registration and image fusion.
- Analyze the constraints in image processing when dealing with 3D data sets.

Module 1	**Teaching Hours**
Introduction: What is Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing,	**8 Hours**

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.	
Module 2	
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.	**8 Hours**
Module 3	
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.	**8 Hours**
Module 4	
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	**8 Hours**
Module 5	
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.	**8 Hours**
Course Outcomes	
The students should be able to: • Explain 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. • Explain 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.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Rafael C Gonzalez and Richard E. Woods: Digital Image Processing, PHI 2nd Edition 2005.	
Reference Books:	

1. S. Sridhar, Digital Image Processing, Oxford University Press India, 2011.
2. A. K. Jain: Fundamentals of Digital Image Processing, Pearson, 2004.
3. Scott E. Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.
4. S. Jayaraman, S. Esakkirajan, T. Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd., 2013.
5. Anthony Scime, "Web Mining Applications and Techniques", Idea Group Publishing,2005.

EMBEDDED COMPUTING SYSTEMS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16SCE13 **/16SCS152**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

- Explain a general overview of Embedded Systems
- Show current statistics of Embedded Systems
- Examine a complete microprocessor-based hardware system
- Design, code, compile, and test real-time software
- Integrate a fully functional system including hardware and software
- Make intelligent choices between hardware/software tradeoffs

Module 1	**Teaching Hours**
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.	**8 Hours**
Module 2	
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.	**8 Hours**
Module 3	
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.	**8 Hours**
Module 4	
Inter process 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,	**8 Hours**

Signal function, Semaphore functions, Message Queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.	
Module 5	
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.	**8 Hours**
Course Outcomes	
The students should be able to: • Distinguish the characteristics of embedded computer systems. • Examine the various vulnerabilities of embedded computer systems. • Design an embedded system. • Design and develop modules using RTOS. • Implement RPC, threads and tasks	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Text Books: 1. Raj Kamal, "Embedded Systems: Architecture, Programming, and Design" 2nd edition , Tata McGraw hill-2013.	
Reference Books: 1. Marilyn Wolf, "Computer as Components, Principles of Embedded Computing System Design" 3rd edition, Elsevier-2014.	

ADVANCES IN STORAGE AREA NETWORKS **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2016 -2017)** **SEMESTER – I**			
Subject Code	16SSE153 / 16LNI254 / **16SCS153**	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
Course objectives: This course will enable students to • Define and contrast storage centric and server centric systems • Define metrics used for Designing storage area networks • Illustrate RAID concepts • Demonstrate, how data centers maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems.			
Module 1			**Teaching Hours**
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			**8 Hours**

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.	
Module 2	
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.	**8 Hours**
Module 3	
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.	**8 Hours**
Module 4	
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.	**8 Hours**
Module 5	
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	**8 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 strong virtualization concepts
- Develop techniques for evaluating policies for LUN masking, file systems

Question paper pattern:

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

Text Books:

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 Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

ADVANCES IN COMPUTER GRAPHICS

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	**16SCS154** /16SIT422	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to

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

Module 1	**Teaching Hours**
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 T rees, Fractal-Geometry Methods, Shape Grammars and Others Procedural Methods, Particle Systems, Physically Based Modeling, Visualization Of Data Sets.	**8 Hours**
Module 2	
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 –De tection Functions	**8 Hours**
Module 3	
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 anddithering 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.	**8 Hours**
Module 4	
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.	**8 Hours**
Module 5	
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.	**8 Hours**

Course Outcomes

The students should be able to:

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

Question paper pattern:

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

Text Books:

1. Computer Graphics with openGL-Hearn Baker 4rd edition, Pearson publication.2010.
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: Tom Mc Reynolds-David Blythe. Elesvier.MK, 2005.

OPERATING SYSTEMS AND ADBMS LABORATORY

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	**16SCS16**	IA Marks	20
Number of Lecture Hours/Week	01+03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- To provide students with contemporary knowledge in Data Compression and Coding.
- To equip students with skills to analyze and evaluate different Data Compression and Coding methods
- To be instrumental to handle multi dimension data compression
- To acquire practical knowledge on advanced databases and its applications.
- To analyze and work on areas like Storage, Retrieval, Multi valued attributes, Triggers and other complex objects, Algorithms etc related to ADBMS.
- To design and implement recent applications database for better interoperability

PART – A OS LABORATORY WORK:

1. Design and Develop a UNIX/LINUX shell program that should support at least 10 commands(Assume suitable application). OR Design a front-end application upon click of a button corresponding shell command should be executed.
2.
3. 2.Design and develop a program to implement lazy buddy system algorithm.
4.
5. 3.Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber

class.

6.
7. 4.Create two process and demonstrate the usage of Shared segment by the above processes(use shmget, signal, fork etc. to simulate the working environment of the program).
8.
9. 5.Design and develop a program to realize the virus classification, such as boot sector infector, file infector and macro

PART – B ADBMS LABORATORY WORK

Note: The following experiments may be implemented on MySQL/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.**
   a. Write a binary large object (BLOB) to a database as either binary or character (CLOB) data, depending on the type of the field in your data source. To write a BLOB value to the database, issue the appropriate INSERT or UPDATE statement and pass the BLOB value as an input parameter. If your BLOB is stored as text, such as a SQL Server text field, pass the BLOB as a string parameter. If the BLOB is stored in binary format, such as a SQL Server image field, pass an array of type byte as a binary parameter.
   b. Once storing of BLOB and CLOB objects is done, retrieve them and display the results accordingly.

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

   Consider Purchase Order Example: This example is based on a typical business activity: managing customer orders. Need to demonstrate how the application might evolve from relational to object-relational, and how you could write it from scratch using a pure object-oriented approach.
   a. Show how to implement the schema -- Implementing the Application under the Relational Model -- using only Oracle's built-in data types. Build an object-oriented application on top of this relational schema using object views

3. **Design and develop a suitable Student Database application by considering appropriate attributes. Couple of attributes to be maintained is the Attendance of a student in each subject for which he/she has enrolled and Internal Assessment 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.

Use the following guidelines when designing triggers:

- Use triggers to guarantee that when a specific operation is performed, related actions are performed.
- Use database triggers only for centralized, global operations that should be fired for the triggering statement, regardless of which user or database application issues the statement.
- Do not define triggers that duplicate the functionality already built into Oracle. For example, do not define triggers to enforce data integrity rules that can be easily enforced using declarative integrity constraints.
- Limit the size of triggers (60 lines or fewer is a good guideline). If the logic for your trigger requires much more than 60 lines of PL/SQL code, it is better to include most of the code in

a stored procedure, and call the procedure from the trigger.

- Be careful not to create recursive triggers. For example, creating an AFTER UPDATE statement trigger on the EMP table that itself issues an UPDATE statement on EMP causes the trigger to fire recursively until it has run out of memory.

1. **Design, develop, and execute a program to implement specific Apriori algorithm for mining association rules. Run the program against any large database available in the public domain and discuss the results.**

   Association rules are if/then statements that help uncover relationships between seemingly unrelated data in a relational database or other information repository. An example of an association rule would be "If a customer buys a dozen eggs, he is 80% likely to also purchase milk."

Course Outcomes

The students should be able to:

- Work on the concepts of Software Testing and ADBMS at the practical level
- Compare and pick out the right type of software testing process for any given real world problem
- Carry out the software testing process in efficient way
- Establish a quality environment as specified in standards for developing quality software
- Model and represent the real world data using object oriented database
- Embed the rules set in the database to implement various features of ADBMS
- Choose, design and implement recent applications database for better interoperability

Conduction of Practical Examination:

1. All laboratory experiments (nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from **each part and execute both**
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
4. **PART –A**: Procedure + Conduction + Viva: **10 + 20 +10 (40)**
5. **PART –B**: Procedure + Conduction + Viva: **10 + 20 +10 (40)**
6. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

SEMINAR
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – I

Subject Code	16SCE17 / 16SCN17 / 16LNI17 / 16SIT17 / 16SSE17 / **16SCS17** / 16SFC17	IA Marks	100
Number of Lecture Hours/Week	----	Exam Marks	-
Total Number of Lecture Hours	----	Exam Hours	-

CREDITS – 01

Course objectives: This course will enable students to

- Motivate the students to read technical article
- Discover recent technology developments

Descriptions

The students should read a recent technical article (try to narrow down the topic as much as possible) from any of the leading reputed and refereed journals like:

1. IEEE Transactions, journals, magazines, etc.
2. ACM Transactions, journals, magazines, SIG series, etc.

3. Springer
4. Elsevier publications etc

In the area of (to name few and not limited to)

- Web Technology
- Cloud Computing
- Artificial Intelligent
- Networking
- Security
- Data mining

Course Outcomes

The students should be able to:

- Conduct survey on recent technologies
- Infer and interpret the information from the survey conducted
- Motivated towards research

Conduction:

The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.

Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).