

NETWORK PROTOCOL DESIGN [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI21	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 <ul style="list-style-type: none"> • Examine designing Network Protocols • Define Abstract Protocol Notation • Compare and contrast routing and congestion control protocols • Analyze working in the Internet 			
Module -1			Teaching Hours
How to specify network protocols? Semantics of traditional protocol specifications, syntax of traditional protocol. Network processes constants, inputs, and variables. Specifications in new protocol, A vending machine protocol, a request/reply protocol, a Manchester encoding protocol. Current internet			10Hours
Module -2			10 Hours
Protocol execution processes in the internet. Nondeterministic assignment process arrays, protocol process communication in the internet, Types of transmission errors. Error occurrence. Normal timeout actions implementing transmission errors in the internet connections: using timeouts connections, using identifiers full-duplex and half-duplex connections. Connections in the internet.			
Module – 3			10 Hours
Detection of message corruption. Detection of message loss, detection of message reorder, error detection in the internet. Error recovery-forward & backward error recovery. Cumulative acknowledgment, individual acknowledgment, blocks acknowledgment error recovery in the internet flow control. Window size control, rate control, circular buffer control, flow control in the internet.			
Module-4			10 Hours
Local and global topology information, maintaining local topology information, hierarchical topology information topology information in the internet, Abstraction of perfect channel in the internet, Hierarchical routing, random routing.			
Module-5			10 Hours
Asymmetric and symmetric keys authentication. Privacy and integrity non-repudiation authorization. Message digest security in the internet data compression. Huffman coding, static Huffman compression, dynamic Huffman compression. Context sensitive compression, lossy compression, data compression in the internet.			
Course outcomes:			
The students should be able to: <ul style="list-style-type: none"> • Evaluate networking protocols in AP notation • Compare and contrast on routing, security and compression protocols • Designing various error and congestion and multiplexing protocols 			
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. Mohamed G. Gouda, “ Elements of Network Protocol Design ”, John Wiley & Sons 2004.			

Reference Books:

1. Douglas E Comer, “Computer Networks and Internet with Internet Applications”, Fourth Edition, Pearson 2004

JAVA TECHNOLOGY [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16LNI22	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 <ul style="list-style-type: none"> • Developing Programs in Java • Adopt concepts of inheritance and polymorphism • Demonstration of generic programming and database programming • Illustrate applets, Swings and XML parsing 			
Module -1			Teaching Hours
Introduction to Java: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs. Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers. Operators and Expressions: Type casting; Strings Control Statements: Selection statements, iteration statements, Jump Statements. Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes. Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading			10Hours
Module -2			10 Hours
Exception handling: Exception handling in Java. The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface; Output to the Console			10 Hours
Module – 3			10 Hours
Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producerconsumer problems. Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes			10 Hours
Module-4			10 Hours
Swing and the Model-View-Controller Design Pattern Introduction to Layout Management, Text Input, Choice Components, Menus, Sophisticated Layout Management, Dialog Boxes, Why Generic Programming?, Definition of a Simple Generic Class, Generic Methods, Bounds for Type Variables, Generic Code and the Virtual Machine, Restrictions and Limitations Inheritance Rules for Generic Types, Wildcard Types, Reflection and Generics			10 Hours
Module-5			10 Hours
Introducing XML, Parsing an XML Document, Validating XML Documents, Locating Information with XPath, Using Namespaces, Streaming Parsers, Generating XML Documents, XSL Transformations, Connecting to a Server, Implementing Servers.			10 Hours

Course outcomes:
The students should be able to: <ul style="list-style-type: none"> • Develop applications using Java • Develop applets using Java • Design User Interfaces using Java swings and XML parsing programs
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. Cay S. Horstmann, “Core Java 2, Volume I and II, VII Edition”, Pearson 2005 2. Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
Reference Books: 1. Bruce Eckel, “Thinking in Java”, III Edition, Pearson 2004 2. Jim Keogh: J2EE - The Complete Reference, Tata McGraw Hill, 2007.

MOBILE APPLICATION DEVELOPMENT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI23/ 16SCE23 16SCN254 / 16SIT23	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03
CREDITS – 04			
Course objectives: This course will enable students to <ul style="list-style-type: none"> • Analyze system requirements for mobile applications. • Apply of mobile development frameworks. • Demonstrate mobile application design. • Demonstrate and implement mobile application. 			
Module -1			Teaching Hours
Introduction to mobile communication and computing: Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications.			10 Hours
Module -2			
Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator.			10 Hours
Module – 3			
The Intent of Android Development, Four kinds of Android Components: Activity, Service, Broadcast Receiver and Content Provider. Building Blocks for Android Application Design, Laying Out Controls in Containers. Graphics and Animation: Drawing graphics in Android, Creating Animation with Android’s Graphics API.			10 Hours
Module-4			
Creating the Activity, Working with views: Exploring common views, using a list view, creating custom views, understanding layout. Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Multimedia: Playing Audio, Playing Video and Capturing Media. Advanced Android Programming: Internet,			10 Hours

Entertainment, and Services.	
Module-5	
Displaying web pages and maps, communicating with SMS and emails. Creating and using content providers: Creating and consuming services, publishing android applications	10 Hours
Course outcomes:	
The students should be able to: <ul style="list-style-type: none"> • Describe the requirements for mobile applications • Explain the challenges in mobile application design and development • Develop design for mobile applications for specific requirements • Implement the design using Android SDK • Implement the design using Objective C and iOS • Deploy mobile applications in Android and iPone marketplace for distribution 	
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:	
<ol style="list-style-type: none"> 1. Mobile Computing: (technologies and Applications-N. N. Jani S chand 2. B.M.Hirwani- Android programming Pearson publications-2013 3. W. Frank Ableson, Robi Sen and C. E. Ortiz - Android in Action, Third Edition-2012 DreamTech Publisher 	

PROTOCOL ENGINEERING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16LNI24	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			
<ul style="list-style-type: none"> • Explain Protocol Engineering fundamentals • Define SDL notations • Demonstrate various protocol conformance testing schemes • Explain Protocol Synthesis and Protocol Re-synthesis 			
Module -1			Teaching Hours
Introduction: Communication Model, Communication Software, Communication Subsystems, Communication Protocol, Communication Protocol Development Methods, Protocol Engineering Process. Layered Architecture, Network Services and Interfaces, Protocol Function, OSI Model, TCP/IP Protocol Suite, Application Protocols, Protocol Specification: Components of Protocol to be Specified, Communication Service Specification, Protocol Entity Specification, Interface Specifications, Multimedia Protocol Specifications, Internet Protocol Specifications: Examples			10Hours
Module -2			
SDL: Examples of SDL Based Protocol Specifications Introduction to Other Protocol Specification Languages.			10 Hours
Modue – 3			

Protocol Verification/Validation: Protocol Verification, Verification of a Protocol Using Finite State Machines, Protocol Validation, Protocol Design Errors, Protocol Validation Approaches, and SDL based Protocol Verification, SDL based Protocol Validation	10 Hours
Module-4	
Protocol Conformance Testing: Conformance Testing, Conformance Testing Methodology and Framework, Conformance Test Architectures, Test Sequence Generation Methods, Distributed Architecture by Local Methods, Conformance Testing with TTCN, Conformance Testing in Systems with Semi-controllable Interfaces, Conformance Testing of RIP, Multimedia Applications Testing, SDL Based Tools for Conformance Testing, SDL Based Conformance Testing of MPLS.	10 Hours
Module-5	
Protocol Synthesis: Protocol Synthesis, Interactive Synthesis Algorithm, Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis. Protocol Implementation: Requirements of Protocol Implementation, Object based approach to Protocol Implementation, Protocol Compilers, and Tools for Protocol Engineering.	10 Hours
Course outcomes:	
The students should be able to: <ul style="list-style-type: none"> • Describe the requirements for protocol engineering systems • Explain the challenges in designing protocol engineering systems • Implement the design using SDL 	
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: <ol style="list-style-type: none"> 1. Venkataram & Manvi, Pallapa Venkataram Sunilkumar S. Manvi, "Communication Protocol Engineering", PHI Learning Pvt. Ltd., 2004. 	
Reference Books: <ol style="list-style-type: none"> 1. Miroslav Popovic, "Communication Protocol Engineering", CRC Press, 2006. 2. Konig, Hartmut, "Protocol Engineering", Springer, 2012. 	

WIRELESS AD-HOC NETWORKS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - II			
Subject Code	16LNI251 / 16SCE421 / 16SCN11	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 <ul style="list-style-type: none"> • Explain fundamental principles of Ad-hoc Networks • Discuss a comprehensive understanding of Ad-hoc network protocols • Outline current and emerging trends in Ad-hoc Wireless Networks. • Analyze energy management in ad-hoc wireless networks. 			
Module -1			Teaching Hours
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in			8 Hours

Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.	
Module -2	
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.	8 Hours
Module – 3	
Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.	8 Hours
Module-4	
Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.	8 Hours
Module-5	
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.	8 Hours
Course outcomes:	
The students shall able to: <ul style="list-style-type: none"> • Design their own wireless network • Evaluate the existing network and improve its quality of service • Choose appropriate protocol for various applications • Examine security measures present at different level • Analyze energy consumption and management 	
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. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2 nd Edition, Pearson Education, 2011	
Reference Books:	
1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007. 2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004. 3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002	

[As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SSE154 / 16LNI252 / 16SIT21 / 16SCS254	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			
<ul style="list-style-type: none"> • Define and explain Web Services. • Summarize WSDL Web Services. • Analyze Web service Architecture. • Explain Building Blocks of Web services. 			
Module 1			Teaching Hours
Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware.			8 Hours
Module 2			
Web Services: Web Services Technologies, Web Services Architecture.			8 Hours
Module 3			
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.			8 Hours
Module 4			
Service Coordination Protocols: Infrastructure for Coordination Protocols, WS-Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols.			8 Hours
Module 5			
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.			8 Hours
Course Outcomes			
The students should be able to:			
<ul style="list-style-type: none"> • 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. 			
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. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju: Web Services(Concepts ,Architectures and Applications), Springer International Edition 2009.			
Reference Books:			
NIL			

INTERNET OF THINGS

[As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16LNI253 /16SCE253 /16SCN151 /16SCS24 /16SIT251 /16SSE421	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			
<ul style="list-style-type: none"> • Define and explain basic issues, policy and challenges in the IoT • Illustrate Mechanism and Key Technologies in IoT • Explain the Standard of the IoT • Explain resources in the IoT and deploy of resources into business • Demonstrate data analytics for IoT 			
Module -1			Teaching Hours
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples- Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.			8 Hours
Module -2			
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards- Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Lowpower WPAN, Zigbee IP(ZIP), IPSO			8 Hours
Module – 3			
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.			8 Hours
Module-4			
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.			8 Hours
Module-5			
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.			8 Hours
Course outcomes:			
At the end of this course the students will be able to:			
<ul style="list-style-type: none"> • Develop schemes for the applications of IOT in real time scenarios • Manage the Internet resources • Model the Internet of things to business • Understand the practical knowledge through different case studies • Understand data sets received through IoT devices and tools used for analysis 			
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. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015

Reference Books:

1. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
2. Claire Rowland, Elizabeth Goodman et.al., "Designing Connected Products", First Edition, O'Reilly, 2015.

ADVANCES IN STORAGE AREA NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – II

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			
<ul style="list-style-type: none"> • 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 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.			8 Hours
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:			
<ul style="list-style-type: none"> • 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.

MINIPROJECT [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Laboratory Code	16LNI26/ 16SCE26 / 16SCN26 /16SCS26 /16SFC26 / 16SIT26 / 16SSE26	IA Marks	20
Number of Lecture Hours/Week	03 hours of lab	Exam Marks	80
Total Number of Lecture Hours	-----	Exam Hours	03
CREDITS – 02			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Enable the student to design, develop and analyze an application development 			
<p>The student will carry out a mini project relevant to the course. The project must be development of an application (Hardware/Software). It is preferable if the project is based on mobile application development.</p>			
<p>Course outcomes:</p> <ul style="list-style-type: none"> • Design, develop and to analyze an application development. • Prepare report of the project. 			
<p>Conduction of Practical Examination:</p> <p>The student shall prepare the report by including:</p> <ol style="list-style-type: none"> 1. Define project (Problem Definition) 2. Prepare requirements document <ol style="list-style-type: none"> a. Statement of work b. Functional requirements c. Software / Hardware requirements 3. Develop use cases 4. Research, analyze and evaluate existing learning materials on the application 5. Develop user interface and implement code 6. Prepare for final demo 			
<p>Evaluation:</p>			

Evaluation shall be taken up at the end of the semester. Project work evaluation and viva-voce examination shall be conducted. Internal evaluation shall be carried by the Guide and Head of the department for 20 marks. Final examination which includes demonstration of the project and viva-voce shall be conducted for 80 Marks viz report + Outputs of the project + presentation = 30+30+20 = 80 marks.

SEMINAR [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – II			
Subject Code	16SCE27 / 16SCN27 / 16LNI27 / 16SIT27 / 16SSE27 / 16SCS27 / 16SFC27	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			
<ul style="list-style-type: none"> • Motivate the students to read technical article • Discover recent technology developments 			
Descriptions			
<p>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:</p> <ol style="list-style-type: none"> 1. IEEE Transactions, journals, magazines, etc. 2. ACM Transactions, journals, magazines, SIG series, etc. 3. Springer 4. Elsevier publications etc <p>In the area of (to name few and not limited to)</p> <ul style="list-style-type: none"> • Web Technology • Cloud Computing • Artificial Intelligent • Networking • Security • Data mining 			
Course Outcomes			
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Conduct survey on recent technologies • Infer and interpret the information from the survey conducted • Motivated towards research 			
Conduction:			
<p>The students have to present at least ONE technical seminar on the selected topic and submit a report for internal evaluation.</p>			
Marks Distribution: Literature Survey + Presentation (PPT) + Report + Question & Answer + Paper: 20 + 30 + 30 + 20 (100).			

CLIENT SERVER PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	16SIT151 / 16LNI41 / 16SCN41	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			
<ul style="list-style-type: none"> • Explain Client-Server software, Context Switching and Protocol Software, I/o. • Define System Calls, Basic I/O Functions available in UNIX • Illustrate socket interface, TCP, UDP in detail. • Compare various client Software and various algorithms issue related to server software design. 			
Module 1			Teaching Hours
The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts. Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. Program Interface to Protocols: Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.			10 Hours
Module 2			10 Hours
The Socket Interface: Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.			
Module 3			10 Hours
Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.			
Module 4			10 Hours
Algorithms and Issues in Server Software Design: Introduction, The Conceptual			

<p>Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.</p>	
<p>Module 5</p>	
<p>Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. Iterative, Connection-Oriented Servers (TCP): Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability. Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.</p>	<p>10 Hours</p>
<p>Course Outcomes</p>	
<p>The students should be able to:</p> <ul style="list-style-type: none"> • Explain Client-Server software, Context Switching and Protocol Software, I/O. • Demonstrate programming System Calls, Basic I/O Functions available in UNIX • Implement Socket interface, TCP, UDP in detail. • Compare and contrast Client Software Various applications and their issues 	
<p>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.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. NIL 	

CYBER SECURITY AND CYBER LAW [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER –IV			
Subject Code	16LNI421 / 16SIT253 / 16SCE423	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 <ul style="list-style-type: none"> • Define the area of cybercrime and forensics. • Explain the motive and causes for cybercrime , detection and handling. • Investigate Areas affected by cybercrime. • Illustrate tools used in cyber forensic • Infer legal Perspectives in cyber security 			
Module -1			Teaching Hours
Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.			8 Hours
Module -2			
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops			8 Hours
Module – 3			
Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).			8 Hours
Module-4			
Understanding Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.			8 Hours
Module-5			

Introduction to Security Policies and Cyber Laws: Need for An Information Security Policy, Information Security Standards – Iso, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the it Act, 2000, Intellectual Property Issues, Overview of Intellectual - Property - Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License.	8 Hours
Course outcomes:	
<p>By the end of this course the student acquire</p> <ul style="list-style-type: none"> • Define cyber security, cyber law and their roles • Demonstrate cyber security cybercrime and forensics. • Infer legal issues in cybercrime, • Demonstrate tools and methods used in cybercrime and security. • Illustrate evidence collection and legal challenges 	
<p>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.</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013 2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. “Introduction to information security and cyber laws”. Dreamtech Press. ISBN: 9789351194736, 2015 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Thomas J. Mowbray, “Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions”, Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1-118 - 84965 -1 2. James Graham, Ryan Olson, Rick Howard, “Cyber Security Essentials”, CRC Press, 15-Dec-2010 	

MANAGING BIG DATA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV			
Subject Code	16LNI422 / 16SCE21 / 16SCN24 / 16SCS21 / 16SIT41 / 16SSE422	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 <ul style="list-style-type: none"> • Define big data for business intelligence • Analyze business case studies for big data analytics • Explain managing of Big data Without SQL • Develop map-reduce analytics using Hadoop and related tools 			
Module -1			Teaching Hours
UNDERSTANDING BIG DATA: 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.			8 Hours
Module -2			
NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations.			8 Hours
Module – 3			
BASICS OF HADOOP: 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.			8 Hours
Module-4			
MAPREDUCE APPLICATIONS: 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			8 Hours
Module-5			
HADOOP RELATED TOOLS: 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.			8 Hours
Course outcomes:			
The students shall able to: <ul style="list-style-type: none"> • Describe big data and use cases from selected business domains • Explain NoSQL big data management • Install, configure, and run Hadoop and HDFS 			

<ul style="list-style-type: none"> • Perform map-reduce analytics using Hadoop • Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics
<p>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.</p>
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012. 2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
<p>Reference Books:</p> <ol style="list-style-type: none"> 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

<p>SOFTWARE AGENTS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER - IV</p>			
Subject Code	16LNI423 / 16SCE153	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS – 03			
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Explain the principles and fundamentals of designing agents • Define the architecture design of different agents. • Demonstrate design of the agents • Illustrate user interaction with agents • Discover the role of agents in assisting the users in day to day activities 			
Module -1			Teaching Hours
An introduction to Software Agents Why Software Agents? Simplifying Computing, Barriers to Intelligent Interoperability, Incorporating Agents as Resource Managers, Overcoming user Interface Problems, Toward Agent-Enabled System Architectures. Agents: From Direct Manipulation to Delegation Introduction, Intelligent Interfaces, Digital Butlers, Personal Filters, Digital sisters-in-Law, Artificial Intelligence, Decentralization, Why Linking works, The Theatrical Metaphor, Conclusion: Direct Manipulation and Digital Butlers, Acknowledgements. Interfaces Agents Metaphors with Character Introduction, Objections to Agents, In Defense of Anthropomorphism, Key Characteristics of Interface Agents, Agency, Responsiveness, Competence, Accessibility, Design and Dramatic Character, An R & D Agenda			8 Hours
Module -2			8 Hours
Designing Agents as if People Mattered: What does “Agents” Mean?, Adaptive Functionality: Three Design Issues, The Agent Metaphor: Reactions and Expectations The Agent Conceptual Model. Direct Manipulation versus Agents: Paths to Predict able, Controllable, and Comprehensible Interfaces: Introduction, General Concerns About Intelligent Interfaces, Learning From History, What Is an Agent?, Looking at the Components, Realizing a New Vision, Tree Maps, Dynamic Queries, Back to a Scientific Approach, Acknowledgements. Agents for Information Sharing and Coordination: A History and some Reflections: Information, Lens: An Intelligent Tool for Managing Electronic Messages, Semiformal Systems an d Radical Tailorability, Oval: A Radically Tailorable Tool for Information Management and Cooperative Work, Examples of			8 Hours

Application and Agents in Oval, Conclusions: An Addendum: The Relationship between Oval and Objects Lens	
Module – 3	
Agents that Reduce Work and Information Overload Introduction, Approaches to Building Agents, Training a Personal Digital Assistant, Some Example of Existing Agents, Electronic Mail Agents, Meeting Scheduling Agent, News Filtering Agent, Entertainment Selection Agent, Discussion, Acknowledgements Software Agents for Cooperative Learning: Computer-Supported Cooperative Learning, Examples of Software Agents for Cooperative Learning, Examples of Software Agents for Cooperative Learning, Developing an Example, Discussion and Perspectives.	8 Hours
Module-4	
An Overview of Agent-Oriented Programming: Agent-Oriented Programming: Software with Mental State, Two Scenarios, On the Mental state of agents, Generic Agent Interpreter, AGENT-0: A Simple Language and its Interpreter, KQML as an Agent Communication Language: The approach of knowledge sharing effort(KSE), The Solution of the knowledge sharing efforts, knowledge Query Manipulation Language (KQML),Implementation, Application of KQML , Other Communication Language, The Approach of Knowledge-Sharing Effect,(KSE),The Solutions of the Sharing Effect.	8 Hours
Module-5	
Agent for Information Gathering: Agent Organization, The Knowledge of an Agent, The Domain Model of an Agent, Modeling other Agent, communication language and protocol, query processing, an information goal, information source selection, generating a query access plan, interleaving planning and execution , semantic query optimization, learning, caching retrieved data, related work, discursion, acknowledgement. Mobile Agents: Enabling Mobile Agents, Programming Mobile Agents, Using Mobile Agents.	8 Hours
Course outcomes:	
The students should be able to: <ul style="list-style-type: none"> • Identify and explore the advantages of agents and design the architecture for an agent • Analyze the agent in details in a view for the implementation • Analyze communicative actions with agents. • Analyze typical agents using a tool for different types of 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. Jeffrey M. Bradshaw: Software Agents, PHI (MIT Press) 2012.	
Reference Books:	
1. Lin Padgham and Michael Winikoff, “Developing Intelligent Agent Systems: A Practical Guide”, John Wiley & sons Publication, 2004.	
2. Steven F. RailsBack and Volker Grimm, “Agent-Based and Individual Based modeling: A Practical Introduction”, Princeton University Press, 2012.	
3. Peter Wayner, “Disappearing Cryptography – Information Hiding: Steganography & Watermarking”, Morgan Kaufmann Publishers, New York, 2002.	
4. Frank Y. Shih, “Multimedia Security, Watermarking, Steganography and Forensics”, CRC Press	

BIOINFORMATICS [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2016 -2017) SEMESTER – IV			
Subject Code	16LNI424 / 16SIT254	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			
<ul style="list-style-type: none"> • Explain domain of bioinformatics • Illustrate role of data warehousing and data mining for bioinformatics • Compare model bioinformatics based applications • Demonstrate how to deploy the pattern matching and visualization techniques in bioinformatics • Define the Microarray technologies for genome expression 			
Module -1			Teaching Hours
INTRODUCTION : Need for Bioinformatics technologies – Overview of Bioinformatics technologies – Structural bioinformatics – Data format and processing – secondary resources- Applications – Role of Structural bioinformatics - Biological Data Integration System.			8 Hours
Module -2			
DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS: Bioinformatics data – Data ware housing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture- Applications in bioinformatics.			8 Hours
Module – 3			
MODELING FOR BIOINFORMATICS : Hidden markov modeling for biological data analysis Sequence identification – Sequence classification – multiple alignment generation – Comparative modeling – Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.			8 Hours
Module-4			
PATTERN MATCHING AND VISUALIZATION: Gene regulation – motif recognition and motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.			8 Hours
Module-5			
MICROARRAY ANALYSIS: Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding, spot extraction, normalization, filtering – cluster analysis – gene network analysis			8 Hours
Course outcomes:			
The students should be able to:			
<ul style="list-style-type: none"> • Deploy the data warehousing and data mining techniques in Bioinformatics • Model bioinformatics based applications • Deploy the pattern matching and visualization techniques in bioinformatics • Work on the protein sequences • Use the Microarray technologies for genome expression . 			
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. Yi-Ping Phoebe Chen (Ed), "Bio Informatics Technologies", Springer Verlag, 2014.

Reference books : NIL