MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18SFC11 / 18LNI11 / 18SCE11 / 18SCS11 / **18SCN11** / 18SSE11 / 18SIT11	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- To acquaint the students with mathematical/logical fundamentals including numerical techniques,
- To understand probability, sampling and graph theory that serve as an essential tool for applications of computer and information sciences.

Module 1	**Contact Hours**
Numerical Methods: Significant figures, Error definitions, Approximations and round off errors, accuracy and precision. Roots of Equations: Bairstow-Lin's Method, Graeffe's Root Squaring Method. Computation of Eigen values of real symmetric matrices: Jacobi and Givensrotation method. **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Statistical Inference: Introduction to multivariate statistical models: Correlation and Regression analysis, Curve fitting (Linear and Non linear) **RBT: L1, L2, L3**	**10 Hours**
Module 3	
Probability Theory: Probability mass function (p.m.f), density function (p.d.f), Random variable: discrete and continuous, Mathematical expectation, Sampling theory: testing of hypothesis by t-test and chi - square distribution. **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycle. Specialized techniques to solve combinatorial enumeration problems. **RBT: L1, L2, L3**	**10 Hours**
Module 5	
Vector Spaces: Vector spaces; subspaces; Linearly independent and dependent vectors ; Bases and dimension; coordinate vectors-Illustrative examples. Linear transformations; Representation of transformations by matrices; linear functional; Non singular Linear transformations; inverse of a linear transformation- Problems. **RBT: L1, L2, L3**	**10 Hours**

Course Outcomes

- Emphasize the numerical methods to solve and find the roots of the equations.
- Utilize the statistical tools in multi variable distributions.
- Use probability formulations for new predictions with discrete and continuous RV's.
- To make use of graphs in different geometries related to edges.
- Apply vector spaces and related topics arising in magnification and rotation of images.

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. Steven C. Chapra and Raymond P Canale: "Numerical Methods for Engineers", 7th Edition, McGraw-Hill Publishers, 2015.
2. T.Veerarajan: "Probability, Statistics and Random Process",3rdEdition,Tata Mc-Graw Hill Co.,2016.
3. David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.

Reference Books:

1. **B.S. Grewal**: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
2. **John Vince :** "Foundation Mathematics for Computer Science", Springer International Publishing, Switzerland, 2015
3. **M.K.Jain, S.R.K.Iyengar and R.K.Jain:** Numerical Methods for Scientific and Engineering Computation. 6thEd.,New Age Int.Publishers.2012.
4. **Norman L.Biggs**: Discrete Mathematics, 2nd Ed., Oxford University Press, 2017.

Web links and Video Contacts:

1. *http://nptel.ac.in/courses.php?disciplineId=111*
2. *http://www.class-central.com/subject/math(MOOCs)*
3. *http://ocw.mit.edu/courses/mathematics/*

ADVANCES IN COMPUTER NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI321 / **18SCN12** / 18SCS151	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Discuss with the basics of Computer Networks.
- Compare various Network architectures.
- Discuss fundamental protocols.
- Define and analyze network traffic, congestion, controlling and resource allocation.

Module 1	**Contact Hours**
Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels. **T1**: **Chapter 1.1, 1.2, 1.5.1, 1.5.2**., **2.1, 2.5T2**: **Chapter 4** **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels. **T1:** Chapter 3.1, 3.2, **RBT: L1, L2, L3**	**10 Hours**
Module 3	
Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP **T1:** Chapter 3.3, 4.1.1,4.1.3**T2**:Chapter 13.1 to 13.18 , Ch 18. **RBT: L1, L2, L3**	**10 Hours**
Module 4	
End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery **T1:** Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3 **RBT: L1, L2, L3**	**10 Hours**
Module 5	
Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web	**10 Hours**

(HTTP), Network Management (SNMP) **T1:** Chapter 6.4 **T2**: Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8 **RBT: L1, L2, L3**	

Course Outcomes

The students should be able to:

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

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

Reference Books:

1. Uyless Black, "Computer Networks, Protocols , Standards and Interfaces" 2 nd Edition -PHI.
2. Behrouz A Forouzan, "TCP /IP Protocol Suite" 4th Edition – Tata McGraw-Hill.

INFORMATION AND NETWORK SECURITY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI13 / **18SCN13** / 18SCS322	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain standard algorithms used to provide confidentiality, integrity and authenticity.
- Distinguish key distribution and management schemes.
- Deploy encryption techniques to secure data in transit across data networks
- Implement security applications in the field of Information technology

Module 1	**Contact Hours**
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono-alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA. **RBT: L1, L2, L3**	**10 Hours**
Module 3	
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption,	**10 Hours**

Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification. **RBT: L1, L2, L3**	
Module 4	
Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function. W**eb Security Considerations:** Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer: SSL** Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell(SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol **RBT: L1, L2, L3**	**10 Hours**
Module 5	
Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **RBT: L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Analyze the vulnerabilities in any computing system and hence be able to design a security solution. • Identify the security issues in the network and resolve it. • Evaluate security mechanisms using rigorous approaches, including theoretical.	
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, Cryptography and Network Security, Pearson 6th edition.	
Reference Books: 1. V K Pachghare: Cryptography and Information Security.	

INTERNET OF THINGS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI22 / 18SCE23 / **18SCN14** / 18SCS14 / 18SSE321	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- 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	**Contact Hours**
What is The Internet of Things? Overview and Motivations, Examples of Apllications, 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 Apjplication 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. **RBT: L1, L2, L3**	**10 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 Low power WPAN, Zigbee IP(ZIP),IPSO **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 Hours**
Module-4	
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications. **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 Hours**

Course outcomes:

At the end of this course the students will be able to:

- 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. ArshdeepBahga, 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.

WIRELESS NETWORKS AND MOBILE COMPUTING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI331 / 18SCE241 / **18SCN151** / 18SCS323	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

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

Module -1	**Contact Hours**
Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX. **RBT: L1, L2, L3**	10Hours
Module -2	
Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6 **RBT: L1, L2, L3**	**10 Hours**
Module – 3	
Mobile OS and Computing Environment : Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators **RBT: L1, L2, L3**	**10 Hours**
Module-4	
Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML. **RBT: L1, L2, L3**	**10 Hours**
Module-5	

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP. **RBT: L1, L2, L3**	**10 Hours**
Course outcomes:	
The students shall able to: • Explain state of art techniques in wireless communication. • Discover CDMA, GSM. Mobile IP, WImax • Demonstrate program for CLDC, MIDP let model and security concerns	
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. Ashok Talukder, RoopaYavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010. 2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003	
Reference Books: 1. Raj kamal: Mobile Computing, Oxford University Press, 2007. 2. ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.	

MULTI-CORE ARCHITECTURE AND PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - I

Subject Code	18SCE22 / **18SCN152** / 18SCS152	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS - 04

Course objectives: This course will enable students to

- Define technologies of multicore architecture and performance measures
- Demonstrate problems related to multiprocessing
- Illustrate windows threading, posix threads, openmp programming
- Analyze the common problems in parallel programming

Module -1	**Contact Hours**
Introduction to Multi-core Architecture Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading : Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization. **RBT: L1, L2, L3**	**10 Hours**
Module -2	
Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features **RBT: L1, L2, L3**	**10 Hours**
Module – 3	
Threading APIs :ThreadingAPIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking. **RBT: L1, L2, L3**	**10 Hours**
Module-4	
OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions,	**10 Hours**

OpenMP Environment Variables, Compilation, Debugging, performance **RBT: L1, L2, L3**	
Module-5	
Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32,Data Organization for High Performance. **RBT: L1, L2, L3**	**10 Hours**
Course outcomes:	
The students shall able to: • Identify the limitations of ILP and the need for multicore architectures • Define fundamental concepts of parallel programming and its design issues • Solve the issues related to multiprocessing and suggest solutions • Make out the salient features of different multicore architectures and how they exploit parallelism • Demonstrate the role of OpenMP and programming concept	
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. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006	
Reference Books: NIL	

SOCIAL NETWORK ANALYSIS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI332 / **18SCN153** /18SFC333	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- The learning objective of the course Social Network Analysis is to discuss essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks.

Module 1	**Contact Hours**
Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores. **RBT: L1, L2**	**10 Hours**
Module 2	
Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS. **RBT: L1, L2**	**10 Hours**
Module 3	
Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems. **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections **RBT: L1, L2, L3**	**10 Hours**
Module 5	
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets. **RBT: L1, L2, L3**	**10 Hours**

Course Outcomes

The students should be able to:

- Define notation and terminology used in network science.
- Demonstrate, summarize and compare networks.
- Explain basic principles behind network analysis algorithms.
- Analyzing real world network.

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. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. “Statistical Analysis of Network Data with R (Use R!)”. Springer, 2014.
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.

Reference Books:

1. **NIL**

CLOUD SECURITY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	18LNI333 / 18SCE331 / **18SCN154** / 18SFC152	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Describe the fundamentals of Cloud Computing.
- Summarize the need of cloud compliance and existing cloud solutions.
- Explain the cloud security concepts.
- Demonstrate the operations of Data Centre.
- Distinguish the concepts of Identity management and virtualization.

Module 1	**Contact Hours**
Cloud Computing Architectural Framework: Cloud Benefits, Business scenarios, Cloud Computing Evolution, cloud vocabulary, Essential Characteristics of Cloud Computing, Cloud deployment models, Cloud Service Models, Multi- Tenancy, Approaches to create a barrier between the Tenants, cloud computing vendors, Cloud Computing threats, Cloud Reference Model, The Cloud Cube Model, Security for Cloud Computing, How Security Gets Integrated. **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Compliance and Audit: Cloud customer responsibilities, Compliance and Audit Security Recommendations. Portability and Interoperability: Changing providers reasons, Changing providers expectations, Recommendations all cloud solutions, IaaS Cloud Solutions, PaaS Cloud Solutions, SaaS Cloud Solutions. **RBT: L1, L2, L3**	**10 Hours**
Module 3	
Traditional Security, Business Continuity, Disaster Recovery, Risk of insider abuse, Security baseline, Customers actions, Contract, Documentation, Recovery Time Objectives (RTOs), Customers responsibility, Vendor Security Process (VSP). **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Data Center Operations: Data Center Operations, Security challenge, Implement Five Principal Characteristics of Cloud Computing, Data center Security Recommendations. Encryption and Key Management: Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards, Recommendations. **RBT: L1, L2, L3**	**10 Hours**
Module 5	
Identity and Access Management: Identity and Access Management in the cloud, Identity and Access Management functions, Identity and Access Management (IAM) Model, Identity Federation, Identity Provisioning Recommendations, Authentication for SaaS and Paas customers, Authentication for IaaS customers, Introducing Identity Services, Enterprise Architecture with IDaaS , IDaaS Security Recommendations. Virtualization: Hardware Virtualization, Software Virtualization, Memory Virtualization, Storage	**10 Hours**

Virtualization, Data Virtualization, Network Virtualization, Virtualization Security Recommendations. **RBT: L1, L2, L3**	

Course Outcomes

The students should be able to:

- Demonstrate the growth of Cloud computing, architecture and different modules of implementation.
- Evaluate the different types of cloud solutions among IaaS, PaaS, SaaS.
- Access the security implementation flow, actions and responsibilities of stake holders.
- Generalize the Data Centre operations, encryption methods and deployment details.
- Provide recommendations for using and managing the customer's identity and choose the type of virtualization to be 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. Tim Mather, SubraKumaraswamy, ShahedLatif, "Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance", Oreilly Media 2009.

Reference Books:

1. Vic (J.R.) Winkler, "Securing the Cloud, Cloud Computer Security Techniques and Tactics", Syngress, April 2011.

COMPUTER NETWORKS AND IOT LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – I

Subject Code	**18SCNL16**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Demonstrate Concepts of fundamental protocols.
- Illustrate internetworking concepts.
- Implement concepts in congestion control and error detections.
- Evaluate fundamentals of Cryptography through practical implementation.
- Implement standard algorithms used to provide confidentiality, integrity and authenticity.
- Design security applications in the field of Information technology.

PART – A Computer Network LABORATORY WORK

Note:
Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
2. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
3. Write a program to implement Link State Routing (Dijkstra Algorithm).
4. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
5. Write a program for encrypting 64 bit playing text using DES algorithm.
6. Apply the RSA algorithm on a text file to produce cipher text file.
7. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
8. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change in the input results in a substantial change in the output.

Simulation Programs using OPNET /NS2/NS3 or any other equivalent software

9. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
10. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

PART – B IOT LABORATORY WORK

1. Transmit a string using UART
2. Point-to-Point communication of two Motes over the radio frequency.
3. Multi-point to single point communication of Motes over the radio frequency.LAN (Sub-netting).
4. I2C protocol study
5. Reading Temperature and Relative Humidity value from the sensor

Course Outcomes

The students should be able to:

- Apply key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Design and evaluate application layer protocol
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Conduction of Practical Examination:

1. All laboratory experiments (nos) aretobeincludedforpracticalexamination.
2. Studentsare allowed to pick one experimentfrom **each part and execute both**
3. Strictlyfollow theinstructions as printed on the cover page of answer script for breakup of marks
4. **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

MULTIMEDIA COMMUNICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI152 / 18SCE322 / **18SCN21**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define the Multimedia Communication Models
- Explain Multimedia Transport in Wireless Networks
- Solve the Security issues in multimedia networks
- Illustrate real-time multimedia network applications.
- Explain different network layer based application.

Module 1	**Contact Hours**
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,.Text, images, audio and video. **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Text and image compression,, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG **RBT: L1, L2, L3**	**10 Hours**
Module 3	
Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles. **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework. **RBT: L1, L2, L3**	**10 Hours**
Module 5	
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques. **RBT: L1, L2, L3**	**10 Hours**

Course Outcomes

The students should be able to:

- Deploy the right multimedia communication models.
- Apply QoS to multimedia network applications with efficient routing techniques.
- Solve the security threats in the multimedia networks.
- Develop the real-time multimedia network 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. Fred Halsall, "Multimedia Communications", Pearson education, 2001.
2. Raif Steinmetz, KlaraNahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2002.

Reference Books:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.
2. John Billamil, Louis Molina, "Multimedia : An Introduction", PHI, 2002.

NETWORK PROGRAMMING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI14 / 18SCE333 / **18SCN22**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define Network Programming.
- Demonstrate programming with TCP and SCTP.
- Explain key management and routing sockets.
- Evaluate advanced Socket Programming APIs.

Module 1	**Contact Hours**
Introduction to network application, client/server communication, OSI Model, BSD Networking history, Test Networks and Hosts, Unix Standards, 64-bit architectures, Transport Layer: TCP, UDP and SCTP. **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Sockets Introduction – socket address structures, value-result arguments, byte ordering and manipulation functions, address conversion functions, Elementary TCP Sockets – socket, connect, bind, listen, accept , fork and concurrent server design, getcsockname and getpeername functions and TCP Client/Server Example- client/server programming through TCP sockets, Normal startup, termination, POSIX signal handling, Signal handling in server, Crashing, rebooting of server host, shutdown **RBT: L1, L2, L3**	**10 Hours**
Module 3	
I/O Multiplexing and Socket Options, Elementary SCTP Sockets- Interface Models, sctp_xx functions, shutdown function, Notifications, SCTP Client/Server Examples – One-to-Many, Head–of-Line Blocking, Controlling number of streams and Termination, IPv4 and IPv6 Interoperability–different interoperability scenarios. **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Daemon Processes, syslogd, daemonizing functions and the inetd super server, Advanced I/O functions- readv, writev, sendmsg and recvmsg, Ancillary data, Advanced polling, Unix domain protocols- socket address structure, functions and communication scenarios, Nonblocking I/O – connect and accept examples. **RBT: L1, L2, L3**	**10 Hours**
Module 5	
ioctl operations- socket, file, interface configuration information, ARP cache and routing table operations, Routing sockets- data link socket address structure, reading and writing, sysctl operations, interface name and index functions, Key Management functions – reading, writing, SADB, SA, Dynamically Maintaining SA's, Out-of-Band data, Threads-basic thread functions, TCP echo server using threads, Mutexes and Conditional variables. **RBT: L1, L2, L3**	**10 Hours**

Course Outcomes

The students should be able to:

- Develop applications that communicate with each other using TCP and SCTP.

- Identify the IPv4 and IPv6 compatibility.
- Evaluate socket programming APIs.

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. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: "UNIX Network Programming". Volume 1, Third Edition, Pearson 2004.

Reference Books:

1. Barry Nance: "Network Programming in C", PHI 2002 3.Bob Quinn, Dave Shute: "Windows Socket Network Programming", Pearson 2003.
2. Richard Stevens: "UNIX Network Programming". Volume 2, Second Edition.

WIRELESS AD-HOC NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - II

Subject Code	18LNI241 / **18SCN23**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- 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	**Contact 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 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. **RBT: L1, L2, L3**	**10 Hours**
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. **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 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,	**10 Hours**

Transmission Management Schemes, System Power Management Schemes. **RBT: L1, L2, L3**	

Course outcomes:

The students shall able to:

- 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, 2nd 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

ADVANCES IN STORAGE AREA NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI243 / 18SCE323 / **18SCN241** / 18SCS241 / 18SIT253 / 18SSE153	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

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	**Contact 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. **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 Hours**
Module 5	
Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized	**10 Hours**

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 **RBT: L1, L2, L3**	

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.

SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATIONS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	**18SCN242**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain switching and multiplexing.
- Analyze the transmission technology. And transmission control.
- Demonstrate basic knowledge on telecommunication

Module -1	**Contact Hours**
Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. Why Digital: Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks **RBT: L1, L2, L3**	**10 Hours**
Module -2	
Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization **RBT: L1, L2, L3**	**10 Hours**
Module – 3	
Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. Digital Transmission and Multiplexing: Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing **RBT: L1, L2, L3**	**10 Hours**
Module-4	
Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching **RBT: L1, L2, L3**	**10 Hours**
Module-5	
Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems **RBT: L1, L2, L3**	**10 Hours**

Course outcomes:

The student will be able to:

- Explain basics of telecommunications and digital form
- Elaborate switching and multiplexing, telecommunication.
- Illustrate transmission control in telecommunication
- Design and develop switching, multiplexing and traffic control.

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. ThiagarajanViswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Reference Books:

ETHERNET TECHNOLOGY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI153 / **18SCN243**	IA Marks	40
Number of Lecture Hours/Week	03	Exam Marks	60
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Define with the basics of Ethernet
- Explain concepts of different types of Ethernet
- Analyze building an Ethernet system
- Acquire knowledge of hubs and repeaters

Module 1	**Teaching Hours**
Introduction: Introduction to Ethernet, The Evolution of Ethernet, The Ethernet System, The Media Access Control Protocol The media Access Control Protocol Full Duplex Ethernet Auto-Negotiation **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Ethernet Media Systems: Ethernet Media Fundamentals Twisted-Pair Media System(10Base-T) Fiber Optic Media System(10Base-F) Fast Ethernet Twisted-Pair Media System(100Base-TX) **RBT: L1, L2, L3**	**10 Hours**
Module 3	
Fast Ethernet Fiber Optic Media System(100Base-FX) Gigabit Ethernet Twisted-Pair Media System(1000Base-T) Gigabit Ethernet Fiber Optic Media System (1000Base-X) **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Multi-Segment Configuration Guidelines **Building Your Ethernet System: s**tructured Cabling Twisted-Pair Cables and Connectors Fiber Optic Cables and Connectors **RBT: L1, L2, L3**	**10 Hours**
Module 5	

Ethernet Repeater Hubs Ethernet Switching Hubs **Performance and troubleshooting:** Ethernet Performance Troubleshooting. **RBT: L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Classify different types of Ethernet systems • Contrast Ethernet Media systems • Evaluate a complete Ethernet system	
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. Charles E. Spurgeon: "Ethernet – The Definitive Guide", O'Reilly 2004.	
Reference Books: 1. Rich Seifert: "Gigabit Ethernet", Addison-Wesley 1998.	

MOBILE APPLICATION DEVELOPMENT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI323/**18SCN244** 18SFC332 / 18SIT241	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Analyze system requirements for mobile applications.
- Apply of mobile development frameworks.
- Demonstrate mobile application design.
- Demonstrate and implement mobile application.

Module -1	**Contact 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. **RBT: L1, L2, L3**	**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. **RBT: L1, L2, L3**	**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. **RBT: L1, L2, L3**	**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, Entertainment, and Services. **RBT: L1, L2, L3**	**10 Hours**
Module-5	
Displaying web pages and maps, communicating with SMS and emails. Creating and using content providers: Creating and consuming services, publishing android applications **RBT: L1, L2, L3**	**10 Hours**

Course outcomes:

The students should be able to:

- 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:

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

WIRELESS SENSOR NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI324 /18SCE251 / **18SCN251**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain sensor networks for various application setups.
- Demonstrate the design space and conduct trade-off analysis between performance and resources.
- Assess coverage and conduct node deployment planning.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Illustrate sensor networks using commercial components.
- Discuss quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.

Module -1	**Contact Hours**
Introduction, Overview and Applications of Wireless Sensor Networks Introduction, Basic overview of the Technology, Applications of Wireless Sensor Networks: Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology. (Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6) **RBT: L1, L2, L3**	**10 Hours**
Module -2	
Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies (Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3) **RBT: L1, L2, L3**	**10 Hours**
Module – 3	
MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. Routing Protocols for Wireless Sensor Networks: Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs. (Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5) **RBT: L1, L2, L3**	**10 Hours**
Module-4	
Transport Control and Middleware for Wireless Sensor Networks: Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. Middleware for Wireless Sensor Networks: Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware. (Chapter 7: 7.1-7.4, Chap. 8: 8.1-8.4) **RBT: L1, L2, L3**	**10 Hours**
Module-5	

Network Management and Operating System for Wireless Sensor Networks: Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. Operating Systems for Wireless Sensor Networks: Introduction, Operating System Design Issues, Examples of Operating Systems. (Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3) **RBT: L1, L2, L3**	**10 Hours**

Course outcomes:

The students shall able to:

- Explain existing applications of wireless sensor actuator networks
- Apply in the context of wireless sensor networks and explain elements of distributed computing and network protocol design
- Contrast Various hardware, software platforms that exist for sensor networks
- Summarize various network level protocols for MAC, routing, time synchronization, aggregation, consensus and distributed tracking

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. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, "Wireless Sensor Networks: Technology, Protocols and Applications:, WILEY , Second Edition (Indian) , 2014

Reference Books:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

MANAGING BIG DATA
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI251 / 18SCE21 / **18SCN252** / 18SCS21 / 18SFC331 / 18SIT31 / 18SSE322	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- 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	**Contact 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. **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 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. **RBT: L1, L2, L3**	**10 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 **RBT: L1, L2, L3**	**10 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	**10 Hours**

definition – HiveQL data manipulation – HiveQL queries. **RBT: L1, L2, L3**	

Course outcomes:

The students shall able to:

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

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

Reference Books:

1. VigneshPrajapati, 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

NETWORK MANAGEMENT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – II

Subject Code	18LNI154 / **18SCN253**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Evaluate need for interoperable network management.
- Explain the concepts and architecture behind standards based network management.
- Illustrate the concepts and terminology associated with SNMP and TMN
- Demonstrate network management as a typical distributed application

Module 1	**Contact Hours**
Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management. **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model. **RBT: L1, L2, L3**	**10 Hours**
Module 3	
SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMONI1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC	**10 Hours**

Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles **RBT: L1, L2, L3**	
Module 5	
Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation 24 Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management. **RBT: L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. • Apply network management standards to manage practical networks • Formulate possible approaches for managing OSI network model. • Use on SNMP for managing the network • Use RMON for monitoring the behavior of the network • Identify the various components of network and formulate the scheme for the managing them	
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. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.	
Reference Books: 1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.	

ADVANCES IN OPERATING SYSTEMS **[As per Choice Based Credit System (CBCS) scheme]** **(Effective from the academic year 2018 -2019)** **SEMESTER – II**			
Subject Code	18SCS12 / **18SCN254**	IA Marks	40

Number of Lecture Hours/Week	04	Exam Marks	60
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. **RBT: L1, L2, L3**	**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 **RBT: L1, L2, L3**	**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 **RBT: L1, L2, L3**	**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. **RBT: L1, L2, L3**	**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. **RBT: L1, L2, L3**	**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 2018 -2019)
SEMESTER – III

Subject Code	18LNI151 / 18SCE14 / **18SCN31** / 18SCS23 / 18SIT22 / 18SSE251	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact 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	**Contact 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,	**10 Hours**

Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems. **RBT: L1, L2, L3**	
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. **RBT: L1, L2, L3**	**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: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems **RBT: L1, L2, L3**	**10 Hours**
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. **RBT: L1, L2, L3**	**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. **RBT: L1, L2, L3**	**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. RajkumarBuyya , 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.

COMPUTER SYSTEMS PERFORMANCE ANALYSIS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	18SCE151 / **18SCN321** / 18SCS154	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Discuss mathematical foundations needed for performance evaluation of computer systems
- Illustrate metrics used for performance evaluation
- Develop the analytical modeling of computer systems
- Develop new queuing analysis for both simple and complex systems
- Analyze techniques for evaluating scheduling policies

Module 1	**Contact Hours**
Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements. **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering. **RBT: L1, L2, L3**	**10 Hours**
Module 3	
Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions. **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE; Limitations of RTEs. Experimental Design and Analysis: Introduction: Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.	**10 Hours**

RBT: L1, L2, L3	
Module 5	
Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing G(N), Computing Performance using G(N), Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory. **RBT: L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Identify the need for performance evaluation and the metrics used for it • Implement Little's law and other operational laws • Apply the operational laws to open and closed systems • Use discrete-time and continuous-time Markov chains to model real world systems • Develop analytical techniques for evaluating scheduling policies	
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 Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013.	
Reference Books: 1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003. 2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.	

NETWORK ROUTING ALGORITHMS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - III

Subject Code	18LNI334 / **18SCN322**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS - 04

Course objectives: This course will enable students to

- Discuss layered architecture for communication networks and the specific functionality of the network layer.
- Explain the basic principles of routing and the manner, this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network.
- Compare and contrast different routing algorithms existing and their performance characteristics.

Module -1	**Contact Hours**
NETWORK ROUTING: BASICS AND FOUNDATIONS: Networking and Network Routing: An Introduction: Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Network Management Architecture, Public Switched Telephone Network, Communication Technologies, Standards Committees, Last Two Bits. **Routing Algorithms: Shortest Path and Widest Path:** Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra's Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra's Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm **Routing Protocols: Framework and Principles:** Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost **RBT: L1, L2, L3**	**10 Hours**
Module -2	
ROUTING IN IP NETWORKS: IP Routing and Distance Vector Protocol Family : Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol, Version 1 (RIPv1), Routing Information Protocol, Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution **OSPF and Integrated IS-IS :**From a Protocol Family to anInstanceof a Protocol, OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS, Similarities and Differences Between IS-IS and OSPF **Internet Routing Architectures:** Internet Routing Evolution, Addressing and Routing: Illustrations, Current Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability	**10 Hours**

RBT: L1, L2, L3	
Module – 3	
Router Architectures: Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures. **IP Address Lookup Algorithms:** Impact of Addressing on Lookup, Longest Prefix Matching, Naïve Algorithms, Binary Tries, Multibit Tries, Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches. **IP Packet Filtering and Classification:** Importance of Packet Classification, Packet Classification Problem, Packet Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches ford Dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions. **RBT: L1, L2, L3**	**10 Hours**
Module-4	
ADVANCED ROUTING PROTOCOLS FOR WIRELESS NETWORKS: Wireless networking basic aspects, Basic routing concepts, AD hoc routing, Mesh routing, Vehicular routing, Sensor routing **RBT: L1, L2, L3**	**10 Hours**
Module-5	
TOWARD NEXT GENERATION ROUTING: Quality of Service Routing: QoS Attributes, Adapting Shortest Path and Widest Path Routing: A Basic Framework, Update Frequency, Information Inaccuracy, and Impact on Routing, Lessons from Dynamic Call Routing in the Telephone Network, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing **MPLS and GMPLS:** Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching, Generalized MPLS, MPLS Virtual Private Networks. **Routing and Traffic Engineering with MPLS:** Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS. **VoIP Routing: Interoperability through IP and PSTN :** PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP-PSTN Interworking for VoIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment and All-IP Environment of VoIP Services. **RBT: L1, L2, L3**	**10 Hours**
Course outcomes:	
• Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance. • The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user 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. DeepankarMedhiandKarthikeyanRamasamy, "Network Routing: Algorithms, Protocols, and	

Architectures", (The Morgan Kaufmann Series in Networking), Elsevier Inc 2007
2. Miguel Elias M. Campista and Marcelo G. Rubinstein, "Advanced Routing Protocols for Wireless Networks", John Wiley & Sons, Inc, © ISTE Ltd 2014

Reference Books:

1. William Stallings, "High speed networks and Internets Performance and Quality of Service", 2nd Edition, Pearson Education Asia. Reprint India 2002.
2. M. Steen Strub, "Routing in Communication network," Prentice –Hall International, Newyork, 1995.
3. James D. McCabe, "Network Analysis, Architecture, and Design", 3rd Edition, 2007 Elsevier Inc.

INFORMATION SECURITY POLICIES IN INDUSTRY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER – III

Subject Code	**18SCN323** / 18SFC243	**IA Marks**	40
Number of Contact Hours/Week	04	**Exam Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03

CREDITS – 04

Course objectives: This course will enable students to

The objectives of this course is to make students to learn

- Explain management's responsibilities and role in the development, maintenance, and enforcement of information security policy, standards, practices, procedures, and guidelines.
- Illustrate the differences between the organization's general information security policy and the needs and objectives of the various issue-specific and system-specific policies the organization will create.
- Know what an information security blueprint is and what its major components are.
- How an organization institutionalizes its policies, standards, and practices using education, training and awareness programs.
- Become familiar with what viable information security architecture is, what it includes, and how it is used.

Module 1	**Contact Hours**
Introduction to Information Security Policies: About Policies, why Policies are Important, When policies should be developed, How Policy should be developed, Policy needs, Identify what and from whom it is being protected, Data security consideration, Backups, Archival storage and disposal of data, Intellectual Property rights and Policies, Incident Response and Forensics, Management Responsibilities, Role of Information Security Department, Security Management and Law Enforcement, Security awareness training and support. **RBT: L1, L2, L3**	**10 Hours**
Module 2	
Policy Definitions, Standards, Guidelines, Procedures with examples, Policy Key elements, Policy format and Basic Policy Components, Policy content considerations, Program Policy Examples, Business Goal Vs Security Goals, Computer Security Objectives, Mission statement Format, Examples, Key roles in Organization, Business Objectives, Standards: International Standards. **RBT: L1, L2, L3**	**10 Hours**
Module 3	
Writing The Security Policies: Computer location and Facility construction, Contingency Planning, Periodic System and Network Configuration Audits, Authentication and Network Security, Addressing and Architecture, Access Control, Login Security, Passwords, User Interface, Telecommuting and Remote Access, Internet Security Policies, Administrative and User Responsibilities, WWW Policies, Application Responsibilities, E-mail Security Policies. **RBT: L1, L2, L3**	**10 Hours**
Module 4	
Establishing Type of Viruses Protection: Rules for handling Third Party Software, User Involvement with Viruses, Legal Issues, Managing Encryption and Encrypted data, Key	**10 Hours**

Generation considerations and Management, Software Development policies, Processes Testing and Documentation, Revision control and Configuration management, Third Party Development, Intellectual Property Issues. **RBT: L1, L2, L3**	
Module 5	
Maintaining the Policies: Writing the AUP, User Login Responsibilities, Organization's responsibilities and Disclosures, Compliance and Enforcement, Testing and Effectiveness of Policies, Publishing and Notification Requirements of the Policies, Monitoring, Controls and Remedies, Administrator Responsibility, Login Considerations, Reporting of security Problems, Policy Review Process, The Review Committee, Sample Corporate Policies, Sample Security Policies. **RBT: L1, L2, L3**	**10 Hours**
Course Outcomes	
The students should be able to: • Explain the content, need, and responsibilities of information security policies. • Explain the standards, guidelines, Procedures, and key roles of the organization. • Able to write policy document for securing network connection and interfaces. • Explain the threats to the stored data or data in transit and able to write policy document. • Able to write, monitor, and review policy document.	
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. Scott Barman, Writing Information Security Policies, Sams Publishing, 2002. 2. Thomas.R.Peltier, Information Policies, Procedures and Standards, CRC Press, 2004.	
Reference Books: 1. Thomas R Peltier, Justin Peltier, John Backley, " Information Security Fundamentals", Auerbach publications, CRC Press, 2005. 2. Harold F. Tipton and Micki Krause "Information Security Management Handbook", Auerbach publications, 5th Edition, 2005.	

MACHINE LEARNING TECHNIQUES
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - III

Subject Code	18LNI322 / 18SCE321 / **18SCN324** / 18SCS31 / 18SFC254 / 18SIT322 / 18SSE334	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain basic concepts of learning and decision trees.
- Compare and contrast neural networks and genetic algorithms
- Apply the Bayesian techniques and instant based learning
- Examine analytical learning and reinforced learning

Module -1	**Contact Hours**
INTRODUCTION, CONCEPT LEARNING AND DECISION TREES Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search **RBT: L1, L2, L3**	**10Hours**
Module -2	
NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning. **RBT: L1, L2, L3**	**10 Hours**
Module – 3	
BAYESIAN AND COMPUTATIONAL LEARNINGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model. **RBT: L1, L2, L3**	**10 Hours**
Module-4	
INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution **RBT: L1, L2, L3**	**10 Hours**
Module-5	
ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning **RBT: L1, L2, L3**	**10 Hours**
Course outcomes:	
On Completion of the course, the students will be able to	

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

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

Reference Books:

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

ANALYSIS OF COMPUTER NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - III

Subject Code	**18SCN331**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Explain with the concepts of computer networks
- What is a computer network and what are the fundamental protocols.
- Analyze network architectures in stochastic and deterministic way.
- Illustrate RSVP, Principles of TCP
- Discover more on different network protocols.
- Explain multiplexing, streaming sessions in computer network.

Module -1	**Contact Hours**
Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks. **RBT: L1, L2, L3**	**10 Hours**
Module -2	
Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks. **RBT: L1, L2, L3**	**10 Hours**
Module – 3	
Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued). **RBT: L1, L2, L3**	**10 Hours**
Module-4	
Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic **RBT: L1, L2, L3**	**10 Hours**
Module-5	
Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.	**10 Hours**

RBT: L1, L2, L3	
Course outcomes:	
On completion, student will be able to: • List and classify network services, protocols and architectures, explain why they are layered. • Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.	
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. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.	
Reference Books: 1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996. 2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999	

PROTOCOL ENGINEERING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - III

Subject Code	18LNI23 / **18SCN332**	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS - 04

Course objectives: This course will enable students to

- Explain Protocol Engineering fundamentals
- Define SDL notations
- Demonstrate various protocol conformance testing schemes
- Explain Protocol Synthesis and Protocol Re-synthesis

Module -1	**Contact 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 **RBT: L1, L2, L3**	**10Hours**
Module -2	
SDL: Examples of SDL Based Protocol Specifications Introduction to Other Protocol Specification Languages. **RBT: L1, L2, L3**	**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 **RBT: L1, L2, L3**	**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. **RBT: L1, L2, L3**	**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. **RBT: L1, L2, L3**	**10 Hours**
Course outcomes:	
The students should be able to:	

- 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:

1. Venkataram&Manvi, PallapaVenkataramSunilkumar S. Manvi, "Communication Protocol Engineering", PHI Learning Pvt. Ltd., 2004.

Reference Books:

1. MiroslavPopovic, "Communication Protocol Engineering", CRC Press, 2006.
2. Konig, Hartmut, "Protocol Engineering", Springer, 2012.

WEB ENGINEERING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - III

Subject Code	**18SCN333** / 18SIT324	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS - 04

Course objectives: This course will enable students to

- Demonstrate modeling and requirements of a web application.
- Develop technology-Aware Web Application.
- Illustrate the web application development Process.
- Analyze the performances of web applications

Module -1	**Contact Hours**
Introduction: Motivation, Categories of web applications, Characteristics of web applications. Requirements Engineering: Introduction, Fundamentals, RE specifics in web engineering, Principles of RE for web applications, Adapting RE methods to web application development, Outlook. Modeling Web Application: Introduction, Fundamentals, Modeling specifics in web engineering, Modeling requirements, Content modeling, Hypertext modeling, Presentation modeling, Customization modeling, Methods and tools, Outlook. **RBT: L1, L2, L3**	**10 Hours**
Module -2	
Web Application Architectures: Introduction, Fundamentals, Specifics of web application architectures, Components of a generic web application architecture, Layered architectures, Data-aspect architectures. Technology-Aware Web Application Design: Introduction, Web design from an evolutionary perspective, Presentation design, Interaction design, Functional design, Outlook. Technologies for Web Applications: Introduction, Fundamentals, Client/Server communication on the web, Client side technologies, Document-specific technologies, Server-side technologies, Outlook. **RBT: L1, L2, L3**	**10 Hours**
Module – 3	
Testing Web Applications: Introduction, Fundamentals, Testing specifics in web engineering, Test approaches, Test scheme, Test methods and techniques, Test automation, Outlook. Operation and Maintenance of Web Applications: Introduction, Challenges following the launch of a web application, Content management, Usage analysis, Outlook. Web Project Management: From software project management to web project management, Challenges in web project management, Managing web teams, Managing the development process of a web application, Outlook. **RBT: L1, L2, L3**	**10 Hours**
Module-4	
The Web Application Development Process: Motivation, Fundamentals, Requirements for a web application development process, Analysis of the rational unified process, Analysis of extreme programming, Outlook. Usability of Web Applications: Motivation, What is usability? What characterizes the usability of web applications? Design guidelines, Web usability engineering methods, Web usability engineering trends, Outlook. **RBT: L1, L2, L3**	**10 Hours**
Module-5	

Performance of Web Applications: Introduction, What is performance? What characterizes performance of web applications, System definition and indicators, Characterizing the work load, Analytical techniques, Representing and interpreting results, Performance optimization methods, Outlook. Security for web Applications: Introduction, Aspects of security, Encryption, digital signatures, and certificates, Secure Client/Server interaction, Client security issues, Service provider security issues, Outlook. The Semantic Web: Fundamentals of the semantic web, Technological concepts, Specifics of semantic web applications, Tools, Outlook. **RBT: L1, L2, L3**	**10 Hours**
Course outcomes:	
Students will be able to • Ability to Model the requirements of a web application. • Contrast technology-aware Web Application. • Ability to analyze the performances of web 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. GertiKappel, Birgit Proll, SiegfriedReich, Werner Retschitzegeer (Editors): Web Engineering, Wiley India, 2007.	
Reference Books: 1. Roger Pressman, David Lowe: Web Engineering: A Practitioner's Approach, McGraw Hill, 2008.	

WEB MINING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2018 -2019)
SEMESTER - III

Subject Code	**18SCN334** / 18SSC331	IA Marks	40
Number of Contact Hours/Week	04	Exam Marks	60
Total Number of Contact Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable students to

- Compare and contrast different knowledge discovery issues in Web mining.
- Analyze the different algorithms commonly used by Web application.
- Apply the role played by Web mining in Information retrieval and extraction
- Demonstrate the documents structures and grouping,
- Use the probabilistic model for web mining
- Illustrate applications using Web mining

Module -1	**Contact Hours**
INTRODUCTION: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink Analysis, Resource Discovery and VerticalPortals, Structured vs. Unstructured DataMining .**INFRASTRUCTURE and WEB SEARCH** -- Crawling the web – HTML and HTTP Basics – Crawling Basics – Engineering Large ScaleCrawlers- Putting together a Crawler- Boolean Queries and the Inverted Index – RelevanceRanking – Similarity Search. **RBT: L1, L2, L3**	**10 Hours**
Module -2	
INFORMATION RETRIEVAL: Information Retrieval and Text Mining - Keyword Search - Nearest-Neighbor Methods -Measuring Similarity - Web-Based Document Search - Document–Matching - Inverted Lists -Evaluation of Performance - Structure in a Document Collection - Clustering Documents by Similarity- Evaluation of Performance - Information Extraction - Patterns and Entities from Text- Co reference and Relationship Extraction - Template Filling and Database Construction **RBT: L1, L2, L3**	**10 Hours**
Module – 3	
LEARNING I: Similarity and Clustering – Formulations and approaches- Bottom up and Top down Partitioning Paradigms – Clustering and Visualization via Embedding's – Probabilistic Approaches to clustering – Collaborative Filtering, **SUPERVISED LEARNING**: The Supervised Learning Scenario, Overview of Classification Strategies, Evaluating Text Classifiers, Nearest Neighbor Learners, Feature Selection. **RBT: L1, L2, L3**	**10 Hours**
Module-4	
LEARNING II : SUPERVISED LEARNING – Bayesian Learners, Exploiting Hierarchy among Topics, Maximum Entropy Learners, Discriminative Classification, Hypertext Classification, **SEMI SUPERVISEDLEARNING**-- Expectation Maximization, Labeling Hypertext Graphs and Co- training.	**10 Hours**

RBT: L1, L2, L3	
Module-5	
APPLICATIONS: Social Network Analysis- Social Sciences and Bibliometry – Page Rank and HITS – Shortcomings of coarse Grained Graph model- Enhanced Models and Techniques- Evaluation of Topic Distillation- Measuring and Modeling the Web – Resource Discovery – Collecting Important Pages Preferentially – Similarity Search Using Link Topology – Topical Locality and Focused Crawling – Discovering Communities- The Future of Web Mining. **RBT: L1, L2, L3**	**10 Hours**

Course outcomes:

At the end of the course the student should be able to:

- Identify the application areas for web content mining, web structure mining and webusage mining.
- Design to retrieval the web data
- Develop schemes to crawl the web data, organize and index
- Cluster the documents for fast access
- Develop algorithms used by web mining applications.
- Select between different approaches and techniques of web mining

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. Sholom Weiss, "Text Mining: Predictive Methods for Analyzing Unstructured Information", Springer, 2005
2. SoumenChakrabarti, "Mining the Web: Discovery Knowledge from Hypertext Data," Elsevier Science 2003

Reference Books:

1. Min Song, Yi-fang Brrok Wu, "Handbook of Research on Text and Web Mining Technologies", Vol I & II, Information Science Reference (IGI), 2009
2. K.P.Soman, ShyamDiwakar, V.Ajay, "Insight into Data Mining Theory and Practice ," Prentice Hall of India Private Ltd 2006
3. Anthony Scime, "Web Mining Applications and Techniques", Idea Group Publishing,2005
4. Margret H.Dunham "DATA MINING - Introductory and Advanced Concepts", PearsonEducation,2003.