

VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI



Scheme of Teaching and Examinations and Syllabus
M.Tech in Computer Network Engineering (SCN)
(Effective from Academic year 2020 - 21)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examinations – 2020 - 21 M.Tech in Computer Network Engineering (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE)											
I SEMESTER											
SL. No.	Course	Course Code	Course Title	Teaching Hours / Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activity	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	20SCN11	Mathematical Foundations of Computer Science	03	--	02	03	40	60	100	4
2	PCC	20SCN12	Advances in Computer Networks	03	--	02	03	40	60	100	4
3	PCC	20SCN13	Information and Network Security	03	--	02	03	40	60	100	4
4	PCC	20SCN14	Internet of Things and Applications	03	--	02	03	40	60	100	4
5	PCC	20SCN15	Blockchain Technology	03	--	02	03	40	60	100	4
6	PCC	20SCNL16	Computer Networks and IoT Laboratory	--	04	--	03	40	60	100	2
7	PCC	20RMI17	Research Methodology and IPR	01	--	02	03	40	60	100	2
TOTAL				16	04	12	21	280	420	700	24

Note: PCC: Profession Core

Skill development activities:

Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills. The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem. The students shall

1. Gain confidence in modelling of systems and algorithms.
2. Work on different software/s (tools) to Simulate, analyze and authenticate the output to interpret and conclude. Operate the simulated system under changed parameter conditions to study the system with respect to thermal study, transient and steady state operations, etc.
3. Handle advanced instruments to enhance technical talent.
4. Involve in case studies and field visits/ field work.
5. Accustom with the use of standards/codes etc., to narrow the gap between academia and industry.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

Note: (i) Four credit courses are designed for 50 hours Teaching – Learning process.
(ii) Three credit courses are designed for 40 hours Teaching – Learning process.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2020 - 21
M.Tech in Computer Network Engineering (SCN)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

II SEMESTER

SL. No.	Course	Course Code	Course Title	Teaching Hours / Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activity	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	20SCN21	Multimedia Communications	03	--	02	03	40	60	100	4
2	PCC	20SCN22	Network Programming	03	--	02	03	40	60	100	4
3	PCC	20SCN23	Wireless Ad hoc Networks	03	--	02	03	40	60	100	4
4	PEC	20SCN24X	Professional elective 1	04	--	--	03	40	60	100	4
5	PEC	20SCN25X	Professional elective 2	04	--	--	03	40	60	100	4
6	PCC	20SCNL26	Network Programming Laboratory	--	04	--	03	40	60	100	2
7	PCC	20SCN27	Technical Seminar	--	02	--	--	100	--	100	2
TOTAL				17	06	06	18	340	360	700	24

Note: PCC: Profession Core, PEC: Professional Elective Course

Professional Elective-1		Professional Elective-2	
Course Code 20SCN24X	Course Title	Course Code 20SCN25X	Course Title
20SCN241	Advances in Storage Area Network	20SCN251	Wireless Sensor Networks
20SCN242	Switching & Statistical Multiplexing in Telecommunications	20SCN252	Social Network Analysis
20SCN243	Software Defined Networks	20SCN253	Network Management
20SCN244	Mobile Application Development	20SCN254	Object Oriented Design

Note:

1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the program shall be mandatory.

The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examinations – 2020 - 21 M.Tech in Computer Network Engineering (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE)											
III SEMESTER											
SL. No.	Course	Course Code	Course Title	Teaching Hours / Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activity	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	20SCN31	Cloud Computing	03	--	02	03	40	60	100	4
2	PEC	20SCN32X	Professional elective 3	03	--	--	03	40	60	100	3
3	PEC	20SCN33X	Professional elective 4	03	--	--	03	40	60	100	3
4	Project	20SCN34	Project work phase - 1	--	02	--	--	100	--	100	2
5	PCC	20SCN35	Mini-Project	--	02	--	--	100	--	100	2
6	Internship	20SCNI36	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)			03	40	60	100	6
TOTAL				09	04	02	12	360	240	600	20
Note: PCC: Profession Core, PEC: Professional Elective Course											
Professional Elective-3				Professional Elective-4							
Course Code 20SCN32X		Course Title		Course Code 20SCN33X		Course Title					
20SCN321		Computer Systems Performance Analysis		20SCN331		Analysis of Computer Networks					
20SCN322		Network Routing Algorithm		20SCN332		Protocol Engineering					
20SCN323		Information Security Policies in Industry		20SCN333		Web Engineering					
20SCN324		Machine Learning Techniques		20SCN334		Web Mining					
Note:											
1. Project Work Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. SEE (University examination) shall be as per the University norms.											
2. Internship: Those, who have not pursued /completed the internship shall be declared as fail in internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.											

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examinations – 2020 - 21 M.Tech in Computer Network Engineering (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE)											
IV SEMESTER											
SL. No.	Course	Course Code	Course Title	Teaching Hours / Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	Project	20SCN41	Project work phase 2	--	04	03	03	40	60	100	20
TOTAL				--	04	03	03	40	60	100	20
Note: Project Work Phase-2: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25. SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.											



M.TECH IN NETWORK AND INTERNET ENGINEERING (LNI) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER -I				
MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE				
Course Code	20LNI11, 20SCS11, 20SCE11, 20SFC11, 20SCN11, 20SSE11, 20SIT11, 20SAM11, 20SIS11	CIE Marks	40	
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60	
Credits	04	Exam Hours	03	
Module-1				
Vector Spaces: Vector spaces; subspaces Linearly independent and dependent vectors Basis and dimension; coordinate vectors-Illustrative examples. Linear transformations, Representation of transformations by matrices; (RBT Levels: L1 & L2) (Textbook:1)				
Module-2				
Orthogonality and least squares: Inner product, orthogonal sets, orthogonal projections, orthogonal bases. Gram-Schmidt orthogonalization process. QR factorizations of a matrices, least square problems, applications to linear models (least square lines and least square fitting of other curves). (RBT Levels: L2 & L3) (Textbook:1)				
Module-3				
Symmetric and Quadratic Forms:Diagonalization, Quadratic forms, Constrained Optimization, The Singular value decomposition. Applications to image processing and statistics, Principal Component Analysis (RBT Levels: L2 & L3) (Textbook:1)				
Module-4				
Statistical Inference: Introduction to multivariate statistical models: Correlation and Regression analysis, Curve fitting (Linear and Non-linear) (RBT Levels: L2 & L3) (Textbook:3)				
Module-5				
ProbabilityTheory: Random variable (discrete and continuous), Probability mass function (pmf), Probability density function (pdf), Mathematical expectation, Sampling theory: testing of hypothesis by t -test, χ^2 - test. (RBT Levels: L1 & L2) (Textbook:3)				
Course Outcomes: On completion of this course, students are able to: 1. Understand the numerical methods to solve and find the roots of the equations. 2. Apply the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems 3. Understand vector spaces and related topics arising in magnification and rotation of images. 4. Utilize the statistical tools in multi variable distributions. 5. Use probability formulations for new predictions with discrete and continuous RV's.				
Question Paper Pattern: <ul style="list-style-type: none">The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.The question paper will have ten full questions carrying equal marks.Each full question consisting of 20 marks.There will be two full questions (with a maximum of four sub questions) from each module.Each full question will have sub question covering all the topics under a module.The students will have to answer five full questions, selecting one full question from each module.				
Textbooks:				
Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Linear Algebra and its Applications	David C. Lay, Steven R. Lay and J. J. McDonald	Pearson Education Ltd	5 th Edition 2015.
2	Numerical methods for Scientific and Engg. Computation	M K Jain, S.R.K Ivengar, R K. Jain	New Age International	6 th Ed., 2014

3	Probability, Statistics and Random Process	T. Veerarajan	Tata Mc-Graw Hill Co	3 rd Edition 2016
Reference books:				
Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Optimization: Theory & Applications Techniques	Rao. S.S	Wiley Eastern Ltd New Delhi.	
2	Signals, Systems, and Inference	Alan V. Oppenheim and George C. Verghese	Spring	2010.
3	Foundation Mathematics for Computer Science	John Vince	Springer International	
4	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44 th Ed., 2017

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education(OBE) SEMESTER – I			
ADVANCES IN COMPUTER NETWORKS			
Course Code	20SCN12, 20LNI321	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait, Sliding Window, Concurrent Logical Channels.			
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.			
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			
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			
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 (HTTP), Network Management (SNMP)			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to			

- 60.
- The question paper will have ten full questions carrying equal marks.
 - Each full question is for 20 marks.
 - There will be two full questions (with a maximum of four sub questions) from each module.
 - Each full question will have sub question covering all the topics under a module.
 - The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Computer Networks: A System Approach	Larry Peterson and Bruce S Davis	Elsevier	5 th Edition 2014
2	Internetworking with TCP/IP, Principles, Protocols and Architecture	Douglas E Comer	PHI	6th Edition 2014

Reference Books

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

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – I

INFORMATION AND NETWORK SECURITY

Course Code	20SCN13, 20LNI13 , 20SIS333	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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

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 \mathbb{Z}_p , elliptic curves over $\text{GF}(2^m)$, 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.

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, Mutual Authentication, one way

Authentication, federated identity management, identity management, identity federation, personal identity verification.

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. **Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer: SSL** Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell(SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol

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.

Course outcomes:

At the end of the course the student will 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Cryptography and Network Security	William Stallings	Pearson	6 th edition

Reference Books

1	Cryptography and Information Security	V K Pachghare	PHI	2 nd
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**M.TECH IN COMPUTER NETWORK ENGINEERING (SCN)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - I**

INTERNET OF THINGS AND APPLICATIONS

Course Code	20SCN14, 20SCS15, 20LNI22, 20SCE23 , 20SAM323, 20SIS14	CIE Marks	20+20
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60

Credits	04	Exam Hours	03	
Module-1				
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation.Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples-Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.				
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				
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 Tunnelling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.				
Module-4				
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.				
Module-5				
Data Analytics for IoT – Introduction, Apache Hadoop, Using HadoopMapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.				
Note: Students may be encouraged to do Mini project (individual/Group)				
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none">Develop schemes for the applications of IOT in real time scenariosManage the Internet resourcesModel the Internet of things to businessUnderstand the practical knowledge through different case studies				
Understand data sets received through IoT devices and tools used for analysis				
Question paper pattern:				
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.				
<ul style="list-style-type: none">The question paper will have ten full questions carrying equal marks.Each full question is for 20 marks.There will be two full questions (with a maximum of four sub questions) from each module.Each full question will have sub question covering all the topics under a module.The students will have to answer five full questions, selecting one full question from each module.				
Textbook/ Textbooks				
SI No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Building the Internet of Things with IPV6 and MIPv6:The Evolving World of M2M Communications	Daniel Minoli	Wiley	2013
2	Internet of Things: A Hands on Approach	ArshdeepBahga, Vijay Madisetti	Universities Press	2015
Reference Books				
1	The Internet of Things	Michael Miller	Pearson	2015 First Edition
2	Designing Connected Products	Claire Rowland,Elizabeth Goodman et.al	O'Reilly	First Edition, 2015

**M.TECH IN COMPUTER NETWORK ENGINEERING (SCN),
COMPUTER SCIENCE & ENGINEERING(SCS)
ARTIFICIAL INTELLIGENCE & MACHINE
LEARNING(SAM)**

Choice Based Credit System (CBCS) and Outcome Based
Education (OBE) SEMESTER - I

BLOCKCHAIN TECHNOLOGY

Course Code	20SCN15, 20SCS23, 20SAM254,	CIE Marks	40
Teaching Hours/Wee(L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:

The blockchain technology course allows the students to explore the driving force behind the cryptocurrency Bitcoin. Along with the Decentralization, Cryptography, Bitcoins with its alternative coins, Smart contracts and outside of currencies.

Module-1

Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Module-2

Decentralization and Cryptography:

Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys

Module-3

Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments
B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

Module-4

Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

Module-5

Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media

Course outcomes:

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

1. Understand the types, benefits and limitation of blockchain.
2. Explore the blockchain decentralization and cryptography concepts.
3. Enumerate the Bitcoin features and its alternative options.

4. Describe and deploy the smart contracts
5. Summarize the blockchain features outside of currencies.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

- 1 Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017

Reference Books

- 1 Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
- 2 Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017
- 3 Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – I			
COMPUTER NETWORKS AND IOT LABORATORY			
Course Code	20SCSL16	CIE Marks	40
Teaching Hours/Week (L:P:S)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03
PART A: Computer Network Laboratory			
Note: Implement the following using C/C++ or equivalent with LINUX/Windows environment: <ol style="list-style-type: none"> 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

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

Reading Temperature and Relative Humidity value from the sensor

Course outcomes:

At the end of the course the student will 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.

Question paper pattern:

Conduction of Practical Examination:

All laboratory experiments (nos) are to be included for practical examination.

Students to pick one experiment from **each part and execute both (marks allocation: Part A: 50% + Part B : 50% of total marks allotted)**

Strictly follow the instructions as printed on the cover page of answer script for breakup of marks

- **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

RESEARCH METHODOLOGY AND IPR			
Course Code	20RMI17	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	1:0:2	SEE Marks	60
Credits	02	Exam Hours	03
Module-1			
<p>Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.</p> <p>Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. ☐</p>			
Module-2			
<p>Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.</p> <p>Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. ☐</p>			
Module-3			
<p>Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.</p> <p>Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.</p> <p>Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. ☐</p>			
Module-4			
<p>Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.</p> <p>Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests. ☐</p>			
Module-5			

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. ☐

Course outcomes:

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

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
- Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR. ☐

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ☐

Textbooks

(1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018.

(2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), Ranjit Kumar, SAGE Publications, 3rd Edition, 2011.

(3) Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

Reference Books

(1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.

(2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - II				
MULTIMEDIA COMMUNICATIONS				
Course Code	20SCN21, 20SCE322	CIE Marks	40	
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60	
Credits	04	Exam Hours	03	
Module-1				
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,Text, images, audio and video.				
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				
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.				
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.				
Module 5				
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.				
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none">• 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.				
<ul style="list-style-type: none">• The question paper will have ten full questions carrying equal marks.• Each full question is for 20 marks.• There will be two full questions (with a maximum of four sub questions) from each module.• Each full question will have sub question covering all the topics under a module.• The students will have to answer five full questions, selecting one full question from each module.				
Textbook/ Textbooks				
Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Multimedia Communications	Fred Halsall	Pearson education	2001
2	Multimedia: Computing, Communications and Applications	Raif Steinmetz, KlaraNahrstedt	Pearson education	2002
Reference Books				
1	Multimedia Communication Systems	K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic	Pearson education	2004
2	John Billamil, Louis Molina	Multimedia : An Introduction	PHI	2002.

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - II				
NETWORK PROGRAMMING				
Course Code	20SCN22, 20LNI14	CIE Marks	40	
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60	
Credits	04	Exam Hours	03	
Module-1				
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.				
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, getsockname 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				
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.				
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.				
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.				
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none">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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.				
<ul style="list-style-type: none">The question paper will have ten full questions carrying equal marks.Each full question is for 20 marks.There will be two full questions (with a maximum of four sub questions) from each module.Each full question will have sub question covering all the topics under a module.The students will have to answer five full questions, selecting one full question from each module.				
Textbook/ Textbooks				
Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	UNIX Network Programming	W. Richard Stevens, Bill Fenner, Andrew M. Rudoff	Pearson	Volume 1, Third Edition, 2004
Reference Books				
1	Network Programming in C	Barry Nance	PHI	2002
2	Windows Socket Network	Bob Quinn, Dave	Pearson	2003.

	Programming	Shute		
3	UNIX Network Programming	Richard Stevens		,Second Edition.

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - II			
WIRELESS AD HOC NETWORKS			
Course Code	20SCN23, 20LNI241	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
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.			
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.			
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.			
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.			
Module-5			
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none">• Design their own wireless network• Evaluate the existing network and improve its quality of service• Choose appropriate protocol for various applications• Examine security measures present at different level• Analyze energy consumption and management			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none">• The question paper will have ten full questions carrying equal marks.• Each full question is for 20 marks.• There will be two full questions (with a maximum of four sub questions) from each module.• Each full question will have sub question covering all the topics under a module.• The students will have to answer five full questions, selecting one full question from each			

module.				
Textbook/ Textbooks				
Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Ad-hoc Wireless Networks	C. Siva Ram Murthy & B. S. Manoj	Pearson Education	2 nd Edition, 2011
Reference Books				
1	Ad-hoc Wireless Networks,	Ozan K. Tonguz and Gianguigi Ferrari	John Wiley	2007
2	Ad-hoc Wireless Networking	Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du	Kluwer Academic Publishers,	2004
3	Ad-hoc Mobile Wireless Networks- Protocols and Systems	C.K. Toh	Pearson Education	2002

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - II ADVANCES IN STORAGE AREA NETWORK			
Course Code	20SCN241, 20LNI243, 20SCE323, 20SIT253	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
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.			
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.			
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.			
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.			
Module 5			
Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary			
Course outcomes:			
At the end of the course the student will be able to:			
The students should be able to:			
<ul style="list-style-type: none"> Identify the need for performance evaluation and the metrics used for it Apply the techniques used for data maintenance. Realize strong virtualization concepts 			

<ul style="list-style-type: none"> Develop techniques for evaluating policies for LUN masking, file systems 				
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module. 				
Textbook/ Textbooks				
SI No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Storage Networks Explained	Ulf Troppens, Rainer Erkens and Wolfgang Muller	Wiley India	2013
Reference Books				
1	Storage Networks the Complete Reference	Robert Spalding	Tata McGraw-Hill	2011
2	Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems	Marc Farley	Cisco Press,	2005
3	Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs	Richard Barker and Paul Massiglia	Wiley India,	2006

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - II			
SWITCHING & STATISTICAL MULTIPLEXING IN TELECOMMUNICATIONS			
Course Code	20SCN242	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
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			
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			
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			
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			
Module-5			
Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modelling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

SI No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Telecommunication Switching Systems and Networks	ThiagarajanViswana than	PHI	1992
2	Digital Telephony	John.C.Bellamy	John Wiley and Sons Inc.	3rd Edition, 2002

Reference Books

1	Computer Networks	By Andrew S Tanenbaum	Pearson	

**M.TECH IN COMPUTER NETWORK ENGINEERING (SCN)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - II**

SOFTWARE DEFINED NETWORKS

Course Code	20SCN243, 20LNI31, 20SCE333, 20SCS253, 20SAM324, 20SIS243	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction, Centralized and Distributed Control and Data Planes, OpenFlow

Module-2

SDN Controllers, Network Programmability,

Module-3

Data Centre Concepts and Constructs, Network Function Virtualization

Module-4

Network Topology and Topological Information Abstraction, Building an SDN Framework

Module-5

Use Cases for Bandwidth Scheduling, Manipulation, and Calendaring, Use Cases for Input Traffic Monitoring, Classification, and Triggered Actions

Course outcomes:

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

- Explain the fundamentals of SDN and make use of open flow tool
- Illustrate the concepts of controllers and network programmability
- Explain data center and NFV
- Build an SDN framework
- Report use case

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.

- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	SDN: Software Defined Networks	Ken Gray, Thomas D. Nadeau	O'Reilly	2013

Reference Books

2	Software Defined Networks	Paul Goransson Chuck Black Timothy Culver	Elsevier	2nd Edition 2016
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**M.TECH IN COMPUTER NETWORK ENGINEERING (SCN)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – II**

MOBILE APPLICATION DEVELOPMENT

Course Code	20SCN244 , 20LNI323, 20SFC332, 20SIT241, 20SIS252	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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.

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.

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.

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.

Module-5

Displaying web pages and maps, communicating with SMS and emails. Creating and using content providers: Creating and consuming services, publishing android applications

Course outcomes:

At the end of the course the student will 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 iPhone marketplace for distribution

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Mobile Computing: (technologies and Applications	N. N. Jani	S chand	
2	Android programming	B.M.Hirwani	Pearson publications	2013
3	Android in Action	W. Frank Ableson, RobiSen and C. E. Ortiz	DreamTech Publisher	Third Edition-2012

Reference Books

1.	Android Application development	James C. Sheusi	Cengage learning	2017

**M.TECH IN COMPUTER NETWORK ENGINEERING (SCN)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - II**

WIRELESS SENSOR NETWORKS

Course Code	20SCN251 , 20SCS334, 20LNI324, 20SCE251, 20SIS13	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1**CHARACTERISTICS OF WSN**

Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes – Imote, IRIS, Mica Mote, EYES nodes, BT nodes, TelosB, Sunspot - Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Module-2**MEDIUM ACCESS CONTROL PROTOCOLS**

Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Module-3**ROUTING AND DATA GATHERING PROTOCOLS**

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Module-4**EMBEDDED OPERATING SYSTEMS**

Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components - Programming in Tiny OS using NesC, Emulator TOSSIM.

Module-5**APPLICATIONS OF WSN**

WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

Course outcomes:

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

- Know the basics, characteristics and challenges of Wireless Sensor Network
- Apply the knowledge to identify appropriate physical and MAC layer protocol
- Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement
- Be familiar with the OS used in Wireless Sensor Networks and build basic modules
- Understand the applications of WSN in various fields

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Wireless Sensor Networks Technology, Protocols, and Applications	KazemSohraby, Daniel Minoli and TaiebZnati	John Wiley & Sons	2007
2	Protocols and Architectures for Wireless Sensor Network	Holger Karl and Andreas Willig	John Wiley & Sons, Ltd.	2005

Reference Books

1	A survey of routing protocols in wireless sensor networks	K. Akkaya and M. Younis	Elsevier Ad Hoc Network Journal	Vol. 3, no. 3, pp. 325--349
2	TinyOS Programming	Philip Levis		
3	Wireless Sensor Network Designs	Anna Ha'c	John Wiley & Sons Ltd.	

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – II

SOCIAL NETWORK ANALYSIS

Course Code	20SCN252, 20LNI332, 20SFC333	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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.

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.

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.				
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				
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.				
Course outcomes: At the end of the course the student will be able to:				
<ul style="list-style-type: none"> 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.				
<ul style="list-style-type: none"> The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module. 				
Textbook/ Textbooks				
Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Networks, Crowds, and Markets: Reasoning About a Highly Connected World	David Easley and John Kleinberg	Cambridge University Press	2010
2	Statistical Analysis of Network Data with R	Eric Kolaczyk, Gabor Csardi	Springer	2014
3	Social Network Analysis. Methods and Applications	Stanley Wasserman and Katherine Faust	Cambridge University Press	1994
Reference Books				
1	Social Network Analysis for Startups	Paperback, Alexander Kouznetsov, Maksim Tsvetovat	O'Reilly	

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - II NETWORK MANAGEMENT			
Course Code	20SCN253	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
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.
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.
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, RMON1- 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.
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 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 Channelling 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
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.
Course outcomes: At the end of the course the student will be able to:
<ul style="list-style-type: none"> 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
<ul style="list-style-type: none"> The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks				
SI No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Network Management- Principles and Practice	Mani Subramanian	Pearson Education	2nd, 2010
Reference Books				
1	Network management Concepts and Practices: a Hands-On Approach	J. Richard Burke	PHI	2008

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - II				
OBJECT ORIENTED DESIGN				
Course Code	20SCN254, 20SCS252, 20SIS242	CIE Marks	40	
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60	
Credits	04	Exam Hours	03	
Module-1				
The Motivation for Object-Oriented Programming, Classes and Objects: The Building Blocks of the Object-Oriented Paradigm Topologies of Action-Oriented Versus Object-Oriented Applications,				
Module-2				
The Relationships Between Classes and ObjectsThe Inheritance Relationship				
Module-3				
Multiple Inheritance, The Association Relationship,				
Module-4				
Class-Specific Data and Behaviour, Physical Object-Oriented Design,				
Module-5				
The Relationship Between Heuristics and Patterns. The Use of Heuristics in Object-Oriented Design				
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none">Identify the heuristics of the object-oriented programmingExplain the fundamentals of OOPExamine fine object-oriented relationsExplain the role of Physical Object-Oriented DesignMake use of Heuristics in The Use of Heuristics in Object-Oriented Design				
Question paper pattern:				
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.				
<ul style="list-style-type: none">The question paper will have ten full questions carrying equal marks.Each full question is for 20 marks.There will be two full questions (with a maximum of four sub questions) from each module.Each full question will have sub question covering all the topics under a module.The students will have to answer five full questions, selecting one full question from each module.				
Textbook/ Textbooks				
SI No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Object Oriented Design Heuristics	Arthur J Riel	Addison-Wesley	1996
Reference Books				
1.	Object Oriented Analysis & Design	Mike O'Docherty	Wiley	2011

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – II			
NETWORK SECURITY AND NETWORK PROGRAMMING LABORATORY			
Course Code	20SCNL26	CIE Marks	40
Teaching Hours/Week (L:P:S)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03
PART A: Network Security Laboratory			
List of Experiments			
<ol style="list-style-type: none"> 1. Apply the RSA algorithm on a text file to produce cipher text file. 2. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server. 3. 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 4. Write a TCP client/server program in which client sends three numbers to the server in a single message. Server returns sum, difference and product as a result single message. Client program should print the results appropriately. 			
Note: Python / JAVA as programming language			
Mini Project: Formulate a problem and develop a mini project using the skills learnt from the course and laboratory exercise solve.			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Implement various encryption techniques • Generate and test message digest • Perform inter-process communication between two machines in a network 			
Conduction of Practical Examination:			
All laboratory experiments (nos) are to be included for practical examination.(Evaluation: 50% of the total marks allocated for the lab + 50% for the mini project demonstration)			
Students to pick one experiment from the list			
Strictly follow the instructions as printed on the cover page of answer script for breakup of marks			
Change of experiment is allowed only once and marks allotted to the procedure part to be made zero. Demonstrate mini project in the examination.			

TECHNICAL SEMINAR			
Course Code	20SCN27	CIE Marks	100
Number of contact Hours/week (L:P:SDA)	0:0:2	SEE Marks	--
Credits	02	Exam Hours	--
<p>Course objectives:</p> <p>The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.</p> <p>Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization. Carryout literature survey, organize the Course topics in a systematic order. Prepare the report with own sentences. Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. Present the seminar topic orally and/or through power point slides. Answer the queries and involve in debate/discussion. Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p> <p>The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairperson.</p>			
<p>Marks distribution for CIE of the course 20XXX27 seminar:</p> <p>Seminar Report: 30 marks</p> <p>Presentation skill:50 marks</p> <p>Question and Answer:20 marks</p>			

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III CLOUD COMPUTING			
Course Code	20SCN31, 20LNI15, 20SCE14, 20SIT22, 20SSE251, 20SCS243, 20SIS12	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.			
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.			
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			
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.			
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.			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Cloud Computing Theory and Practice	Dan C Marinescu	Elsevier(MK)	2013.

Reference Books

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

**M.TECH IN COMPUTER NETWORK ENGINEERING (SCN)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III**

COMPUTER SYSTEMS PERFORMANCE ANALYSIS

Course Code	20SCN321, 20SIS323	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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.

Module 2

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, popular benchmarks. Workload Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. workload characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

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.

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.

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 Centres, Hierarchical Decomposition, Limitations of Queuing Theory.				
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.				
<ul style="list-style-type: none"> The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module. 				
Textbook/ Textbooks				
Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	The Art of Computer Systems Performance Analysis,	Raj Jain	John Wiley and Sons	2013
Reference Books				
1	Computer Systems Performance Evaluation and prediction	Paul J Fortier, Howard E Michel	Elsevier	2003
2	Probability and Statistics with Reliability, Queuing and Computer Science Applications	Trivedi K S	Wiley India	2nd Edition, ,2001

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
NETWORK ROUTING ALGORITHM			
Course Code	20SCN322, 20LNI334	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
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			

<p>Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm</p> <p>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</p>
<p>Module -2</p> <p>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</p> <p>OSPF and Integrated IS-IS: From a Protocol Family to an Instance of 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</p> <p>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</p>
<p>Module – 3</p> <p>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 for Dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions.</p>
<p>Module-4</p> <p>ADVANCED ROUTING PROTOCOLS FOR WIRELESS NETWORKS: Wireless networking basic aspects, Basic routing concepts, Ad hoc routing, Mesh routing, Vehicular routing, Sensor routing</p>
<p>Module-5</p> <p>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</p> <p>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.</p>
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> 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.
<p>Question paper pattern:</p> <p>The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.</p>

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Network Routing: Algorithms, Protocols, and Architectures	Deepankar Medhi and Karthikeyan Ramasamy	Elsevier	2007
2	Advanced Routing Protocols for Wireless Networks	Miguel Elias M. Campista and Marcelo G. Rubinstein	John Wiley & Sons, Inc	2014

Reference Books

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

**M.TECH IN COMPUTER NETWORK ENGINEERING (SCN)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III**

INFORMATION SECURITY POLICIES IN INDUSTRY

Course Code	20SCN323, 20SFC243	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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.

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.

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.

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 Generation considerations and Management, Software Development policies, Processes Testing and Documentation, Revision control and Configuration management, Third Party Development, Intellectual Property Issues.

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.

Course outcomes:

At the end of the course the student will 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Writing Information Security Policies	Scott Barman	Sams Publishing	2002
2	Information Policies Procedures and Standards	Thomas.R.Peltier	CRC Press	2004

Reference Books

1	Information Security Fundamentals	Thomas R Peltier, Justin Peltier, John Backley	CRC Press,	2005
2	Information Security Management Handbook	Harold F. Tipton and Micki Krause	Auerbach publications	5th Edition, 2005

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER – III

MACHINE LEARNING TECHNIQUES

Course Code	20SCN324, 20LNI322, 20SCE321, 20SFC254, 20SIT322, 20SSE334, 20SAM21	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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

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.

Module – 3

BAYESIAN AND COMPUTATIONAL LEARNING Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm –

Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

Module-4

INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbour Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution

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

Course outcomes:

At the end of the course the student 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Machine Learning	Tom M. Mitchell	McGraw-Hill Education	2013

Reference Books

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

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III

ANALYSIS OF COMPUTER NETWORKS

Course Code	20SCN331	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modelling in the Engineering of Telecommunication Networks.

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.

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).

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

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.

Course outcomes:

At the end of the course the 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 apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

SI No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Communication Networking An Analytical Approach	Anurag Kumar, D. Manjunath, Joy Kuri	Elsevier	2004

Reference Books

1	Broadband Integrated Networks	M. Schwartz	Prentice Hall	1996
2	High Performance Communication Networks	J. Walrand, P. Varaiya	Morgan Kaufmann	2nd Edition, 1999

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III

PROTOCOL ENGINEERING

Course Code	20SCN332, 20LNI23	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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

Module -2

SDL: Examples of SDL Based Protocol Specifications Introduction to Other Protocol Specification Languages.

Module – 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				
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.				
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.				
Course outcomes:				
At the end of the course the student will be able to:				
<ul style="list-style-type: none"> Describe the requirements for protocol engineering systems Explain the challenges in designing protocol engineering systems Implement the design using SDL 				
Question paper pattern:				
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.				
<ul style="list-style-type: none"> The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module. 				
Textbook/ Textbooks				
Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Communication Protocol Engineering	Venkataram&Manvi et. al.	PHI Learning Pvt. Ltd	2004
Reference Books				
1	Communication Protocol Engineering	MiroslavPopovic	CRC Press	2006
2	Protocol Engineering	Konig, Hartmut	Springer	2012

M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III WEB ENGINEERING			
Course Code	20SCN333, 20SIT324	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
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. Modelling Web Application: Introduction, Fundamentals, Modelling specifics in web engineering, Modelling requirements, Content modelling, Hypertext modelling, Presentation modelling, Customization modelling, Methods and tools, Outlook.			
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, clientside technologies, Document-specific technologies, Server-side technologies, Outlook.

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.

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.

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.

Course outcomes:

At the end of the course the student 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Web Engineering	GertiKappel, Birgit Proll, SiegfriedReich, Werner Retschitzegeer	Wiley India	2007

Reference Books

1	Web Engineering: A Practitioner's Approach	Roger Pressman, David Lowe	McGraw Hill	2008
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M.TECH IN COMPUTER NETWORK ENGINEERING (SCN) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III WEB MINING			
Course Code	20SCN334	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
INTRODUCTION: Crawling and Indexing, Topic Directories, Clustering and Classification, Hyperlink Analysis, Resource Discovery and Vertical Portals, Structured vs. Unstructured Data Mining. INFRASTRUCTURE and WEB SEARCH -- Crawling the web – HTML and HTTP Basics – Crawling Basics – Engineering Large Scale Crawlers- Putting together a Crawler- Boolean Queries and the Inverted Index – Relevance Ranking – Similarity Search.			
Module -2			
INFORMATION RETRIEVAL: Information Retrieval and Text Mining - Keyword Search - Nearest-Neighbour 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			
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 Neighbour Learners, Feature Selection.			
Module-4			
LEARNING II : SUPERVISED LEARNING – Bayesian Learners, Exploiting Hierarchy among Topics, Maximum Entropy Learners, Discriminative Classification, Hypertext Classification, SEMI SUPERVISED LEARNING -- Expectation Maximization, Labelling Hypertext Graphs and Co-training.			
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 Modelling 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.			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> Identify the application areas for web content mining, web structure mining and web usage mining. Design to retrieve 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 SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub questions) from each module. Each full question will have sub question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module. 			

Textbook/ Textbooks				
SI No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Text Mining: Predictive Methods for Analysing Unstructured Information	Sholom Weiss	Springer	2005
2	Mining the Web: Discovery Knowledge from Hypertext Data	SoumenChakrabarti	Elsevier Science	2003
Reference Books				
1	Handbook of Research on Text and Web Mining Technologies”, Vol I & II	Min Song, Yi-fang Brrok Wu	Information Science Reference (IGI),	2009
2	Insight into Data Mining Theory and Practice	K.P.Soman, ShyamDiwakar, V.Ajay	Prentice Hall of India	2006
3	Web Mining Applications and Techniques	Anthony Scime	Idea Group Publishing	2005
4	DATA MINING - Introductory and Advanced Concepts	Margret H.Dunham	PearsonEducation	2003

PROJECT WORK PHASE – 1			
Course Code	20SCN34	CIE Marks	100
Number of contact Hours/Week	2	SEE Marks	--
Credits	02	Exam Hours	--
Course objectives: <ul style="list-style-type: none"> • Support independent learning. • Guide to select and utilize adequate information from varied resources maintaining ethics. • Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • Develop interactive, communication, organisation, time management, and presentation skills. • Impart flexibility and adaptability. • Inspire independent and team working. • Expand intellectual capacity, credibility, judgement, intuition. • Adhere to punctuality, setting and meeting deadlines. • Instil responsibilities to oneself and others. • Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. 			
Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work. Seminar: Each student, under the guidance of a Faculty, is required to <ul style="list-style-type: none"> • Present the seminar on the selected project orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation, and solution. • Design engineering solutions to complex problems utilising a systems approach. • Communicate with engineers and the community at large in written and oral forms. • Demonstrate the knowledge, skills and attitudes of a professional engineer. 			

Continuous Internal Evaluation

CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

MINI PROJECT			
Course Code	20SCN35	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	02	Exam Hours/Batch	03
Course objectives: <ul style="list-style-type: none"> To support independent learning and innovative attitude. To guide to select and utilize adequate information from varied resources upholding ethics. To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. To develop interactive, communication, organisation, time management, and presentation skills. To impart flexibility and adaptability. To inspire independent and team working. To expand intellectual capacity, credibility, judgement, intuition. To adhere to punctuality, setting and meeting deadlines. To instil responsibilities to oneself and others. To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. 			
Mini-Project: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> Present the mini-project and be able to defend it. Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. Habituated to critical thinking and use problem solving skills. Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. Work in a team to achieve common goal. Learn on their own, reflect on their learning and take appropriate actions to improve it. 			
CIE procedure for Mini - Project: The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. The marks awarded for Mini - Project report shall be the same for all the batch mates.			
Semester End Examination SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.			

INTERNSHIP / PROFESSIONAL PRACTICE			
Course Code	20SCNI36	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	06	Exam Hours	03
Course objectives: Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further, To put theory into practice. To expand thinking and broaden the knowledge and skills acquired through course work in the field. To relate to, interact with, and learn from current professionals in the field. To gain a greater understanding of the duties and responsibilities of a professional. To understand and adhere to professional standards in the field. To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality. To identify personal strengths and weaknesses. To develop the initiative and motivation to be a self-starter and work independently.			
Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship. Seminar: Each student, is required to <ul style="list-style-type: none"> • Present the seminar on the internship orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit the report duly certified by the external guide. • The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. 			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Gain practical experience within industry in which the internship is done. • Acquire knowledge of the industry in which the internship is done. • Apply knowledge and skills learned to classroom work. • Develop a greater understanding about career options while more clearly defining personal career goals. • Experience the activities and functions of professionals. • Develop and refine oral and written communication skills. • Identify areas for future knowledge and skill development. • Expand intellectual capacity, credibility, judgment, intuition. • Acquire the knowledge of administration, marketing, finance and economics. 			
Continuous Internal Evaluation CIE marks for the Internship/Professional practice report (20 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.			
Semester End Examination SEE marks for the internship report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.			

PROJECT WORK PHASE -2			
Course Code	20SCN41	CIE Marks	40
Number of contact Hours/Week	4	SEE Marks	60
Credits	20	Exam Hours	03
Course objectives: <ul style="list-style-type: none"> To support independent learning. To guide to select and utilize adequate information from varied resources maintaining ethics. To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. To develop interactive, communication, organisation, time management, and presentation skills. To impart flexibility and adaptability. To inspire independent and team working. To expand intellectual capacity, credibility, judgement, intuition. To adhere to punctuality, setting and meeting deadlines. To instil responsibilities to oneself and others. To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. 			
Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism. ☐			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> Present the project and be able to defend it. Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. Habituated to critical thinking and use problem solving skills Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. Work in a team to achieve common goal. Learn on their own, reflect on their learning and take appropriate actions to improve it. ☐ 			
Continuous Internal Evaluation: Project Report: 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any. Project Presentation: 10 marks. The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson. Question and Answer: 10 marks. The student shall be evaluated based on the ability in the Question and Answer session for 10 marks. Semester End Examination SEE marks for the project report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ☐			