



BMS COLLEGE OF ENGINEERING, BENGALURU - 19
Autonomous College under VTU

DEPARTMENT OF
INFORMATION SCIENCE & ENGINEERING

Scheme and Syllabus for M.Tech
in
Computer Network Engineering
2020-21



BMS COLLEGE OF ENGINEERING, BENGALURU-19
Autonomous College under VTU
Department of Information Science and Engineering

Vision

Promote Quality Human Resource Capital by inculcating in every student the art of Creativity and Productivity in the field of Information Technology.

Mission

Offer High Quality Graduate, Post Graduate programmes in the field of Information Technology to prepare students for higher studies and professional career in industry.

Provide Teaching and Research environment for Quality Education in the field of Information Technology.

Programme Educational Objectives (PEOs)

PEO 1: Excel in their professional career in computer network engineering and allied disciplines

PEO 2: Achieve Proficiency in Industry or Academia and Research & Development

PEO 3: Exhibit professionalism, team work and adapt to the latest technologies through continuous learning

Programme Educational Objectives

PEO 1: Excel in their professional career in computer network engineering and allied disciplines

PEO 2: Achieve Proficiency in Industry or Academia and Research & Development

PEO 3: Exhibit professionalism, team work and adapt to the latest technologies through continuous Learning

Program Outcomes

PO1	An ability to independently carry out research /investigation and development work to solve practical problems
P1A1	•Activity-I: Conducting experiments to investigate/validate/analyse the identified research work (Paper/Thesis);
P1A2	•Activity -II: Apply research methodologies/ techniques/modern tools to provide practical solution to benefit an identified community
P1A3	•Activity -III: Engage in critical analysis to arrive at a valid conclusion through research (theoretical/practical/ policy) to provide an alternate/optimal solution to an identified problem;
P1A4	•Activity -IV: Ability to independently carry out study and present results (expected or otherwise) for a defined problem

Program Outcomes

PO2	An ability to write and present a substantial technical report/document
P2A1	•Activity -I: Engage in independent study to prepare a Technical document/make an oral presentation to address engineering concepts
P2A2	•Activity -II: Engage in independent study to prepare a Poster presentation of the identified work/task;
P2A3	•Activity -III: Prepare a technical document for the identified product/ system;

Program Outcomes

PO3	An ability to demonstrate mastery in the domain of the specialization of the program
P3A1	•Activity -I: Ability to demonstrate In-depth knowledge/Scholarship of knowledge in the identified domain;
P3A2	•Activity -II: To demonstrate scholarship of knowledge through performing in a group to identify, formulate and solve a problem that requires multiple skills
P3A3	•Activity -III: To demonstrate scholarship of knowledge to arrive at a mathematical model to effectively represent the given system/device
P3A4	•Activity -IV: To demonstrate scholarship of knowledge through conducting experiments/ performing mathematical analysis/ simulation study to arrive at the operating range for various input parameters to ensure desired output/performance
P3A5	•Activity -V: Nurture analytical and critical thinking abilities for data-based decision making
P3A6	•Activity -VI: Comprehend management theories and practices to arrive at a business model for an engineering solution

Curriculum Structure

Semester	Institute Core	Professional Core+ Lab	Professional Elective + Lab	Open Elective	Management Elective	Project/ Mini Project	Seminar	Internship	Mandatory/ Audit Course	Total Credits
I	02	11	09							22
II		10	06	04		02				22
III					02	10		10	2 Units	22
IV						20	02		2 Units	22
Total: Credits	02	21	15	04	02	32	02	10	0	88

Semester-I

Course Type	Code	Course Title	Credits			Total Credits	Contact Hours	Marks		
			L	T	P			CIE	SEE	Total
Program Core-1	20ISCNBSMF	Mathematical Foundations of Computer Networks	3	0	0	3	3	50	50	100
Program Core-2	20ISCNPCCN	Advanced Computer Network	3	0	1	4	5	50	50	100
Program Core-3	20ISCNPCWN	Wireless Adhoc Network	3	0	1	4	5	50	50	100
Program Elective-1	20ISCNPENS	Cryptography and Network Security	2	0	1	3	4	50	50	100
	20ISCNPEBC	Block Chain Technology								
	20ISCNPESC	Secure Coding								
Program Elective-2	20ISCNPENP	Network Programming	2	0	1	3	4	50	50	100
	20ISCNPESD	Software Defined Network								
	20ISCNPEDS	Advanced Data Structures								
Program Elective-3	20ISCNPESN	Social Network Analysis	2	0	1	3	4	50	50	100
	20ISCNPEML	Advanced Machine Learning								
	20ISCNPEPR	Protocol Engineering								
Institute Core	20ALLPICRM	Research Methodology and IPR	2	0	0	2	2	50	50	100
	TOTAL		17	0	5	22	27	350	350	700

Semester-II

Course Type	Code	Course Title	Credits			Total Credits	Contact Hours	Marks		
			L	T	P			CIE	SEE	Total
Program Core-4	20ISCNPCCL	Cyber Security and Law	3	0	0	3	3	50	50	100
Program Core-5	20ISCNPCIT	Internet of Things	3	0	1	4	5	50	50	100
Program Core-6	20ISCNPCNM	Network Management	3	0	0	3	3	50	50	100
Program Elective-4	20ISCNPE5G	5G Technologies	2	0	1	3	4	50	50	100
	20ISCNPEAA	Advanced Algorithms								
	20ISCNPEHP	High Performance Communication Networks								
Program Elective-5	20ISCNPEBD	Big Data Analytics	2	0	1	3	5	50	50	100
	20ISCNPECC	Cloud Computing								
	20ISCNPEMD	Mobile Application Development								
Mini Project	20ISCNPWMP	Mini Project	0	0	2	2	4	50	50	100
Open Elective (Engineering)	20ISCNOECN	Computer Network	4	0	0	4	4	50	50	100
	20ISCNOEWT	Web Technologies								
	TOTAL		17	0	5	22	28	350	350	700

Semester-III

Course Type	Code	Course Title	Credits			Total Credits	Contact Hours	Marks		
			L	T	P			CIE	SEE	Total
Industrial Internship	20ISCNININ	Internship	-	-	-	10	0	50	50	100
Project Work - 1	20ISCNPWP1	Project Phase - I	-	-	10	10	18	50	50	100
Program Elective-6 (Management Stream)	20ISCNPEBM	Business Models and Entrepreneurship	2	0	0	2	2	50	50	100
	20ISCNPEBA	Business Analytics								
Audit Course 1	20ISCNACPW	English for Research Paper Writing	2	0	0		2			
	TOTAL		4	0	10	22	22	150	150	300

Semester-IV

Course Type	Code	Course Title	Credits			Total Credits	Contact Hours	Marks		
			L	T	P			CIE	SEE	Total
Project Work - 2	20ISCNPWP2	Project Phase - II	0	0	20	20	20	50	50	100
Seminar	20ISCNSRTS	Technical Seminar	0	0	2	2	4	50	50	100
Audit Course 2	20ISCNACSM	Stress Management by Yoga	2	0	0		2			
	TOTAL		2	0	22	22	26	100	100	200



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Course Title	MATHEMATICAL FOUNDATIONS OF COMPUTER NETWORKS				
Course Code	20ISCNBSMF	Credits	3	L-T-P	3-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours			36

UNIT – 1		7 Hrs
Probability: Probability Axioms, Subjective & Objective Probability, Law of Large Numbers, Joint & Conditional Probability, Reliability		
UNIT – 2		8 Hrs
Random Variables & Probability Distributions: Random Variables, Discrete & Continuous Random Variables, Expectation & Variance, two dimensional random variables, Poisson, Exponential, Normal distribution characteristics		
UNIT – 3		7 Hrs
Statistics: Population & Samples, Hypothesis testing, Null Hypotheses, and Tests of Hypotheses (Small and Large samples). Tests of fit: Chi-Squared.		
UNIT – 4		7 Hrs
Random Processes: Analytical Representation of Random Process, Stochastic Process, Markov Process, Markov Chains.		
UNIT – 5		7 Hrs
Queuing Theory: General Queuing Systems, Little's Law, Pure death-Birth Process, Probability of a birth-death process, M/M/1 Queuing.		



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TEXT BOOKS:

1. ROSS, introduction to probability and statistics for engineers and scientists, Elsevier, 2014.
2. Srinivasan Keshav, Mathematical Foundations of Computer Networking, Addison-Wesley Professional, 2012.
3. John Vince, Foundation Mathematics for Computer Science, Springer, 2015.

REFERENCE BOOKS:

1. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications, 2008.
2. Kenneth Rosen, Discrete Mathematics and Its Applications, McGraw Hill Education; 7th Edition, 2017.

MOOC COURSE:

1. Mine Cetinkaya, Inferential Statistics offered by Duke University.
<https://www.coursera.org/learn/inferential-statistics-intro>
2. MIT Open Course, <https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/>

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Apply the knowledge of probability theory, Random variables, Queuing models and Radom processes to solve real world problems.			P3A1
2. Analyze and solve problems using Statistics, and stochastic concepts.			P3A1 P3A3
3. Conduct experiments/simulations using computer programs to facilitate the analysis and representation of data using statistical measures.	P1A4	P2A1	



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Course Title	ADVANCED COMPUTER NETWORK				
Course Code	20ISCNPCCN	Credits	4	L-T-P	3-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			36

UNIT – 1	7 Hrs
<p>Data Forwarding and Routing: Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks, Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, , The Internet Protocol (IP): Forwarding and Addressing in the Internet, Datagram Format, IPv4, Addressing, Internet Control Message Protocol (ICMP), IPv6, A Brief Foray into IP-Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet: Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP, Broadcast and Multicast Routing: Broadcast Routing Algorithms, Multicast.</p>	
UNIT – 2	7 Hrs
<p>Links, Access Networks and LANs: Introduction to the Link Layer: The Services Provided by the Link Layer, Error-Detection and –Correction Techniques: Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols,: The Link-Layer Protocol for Cable Internet Access, Switched Local Area Networks: Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs), Link Virtualization: A Network as a Link Layer, Multiprotocol Label Switching (MPLS), Data Center Networking, DHCP,UDP,IP, and Ethernet, Still Getting Started: DNS and ARP, Intra-Domain Routing to the DNS Server, Web Client-Server Interaction: TCP and HTTP.</p>	
UNIT – 3	7 Hrs
<p>Transport Layer: Introduction and Transport-Layer Services, Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and De-multiplexing, Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer, Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR), Connection-Oriented Transport: TCP, The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control, The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-Assisted Congestion-Control Example: ATM ABR Congestion Control, TCP Congestion Control.</p>	



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UNIT – 4	8 Hrs
Wireless and Mobile Networks: Introduction, Wireless Links and Network Characteristics: CDMA, WiFi:802.11Wireless LANs: The802.11Architecture, The 802.11 MAC Protocol, The IEEE 802.11 Frame, Mobility in the Same IPSubnet, Advanced Features in 802.11, Personal Area Networks: Bluetooth and Zigbee, Cellular Internet Access,,: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, Onto4G:LTE, Mobility Management: Principles: Addressing, Routing to a Mobile Node, Mobile IP, Managing Mobility in Cellular Networks: Routing Calls to a Mobile User, Handoffs in GSM, Wireless and Mobility: Impact on Higher-Layer Protocols.	
UNIT – 5	7 Hrs
Network Management: The Infrastructure for Network Management, The Internet-Standard Management Framework, Structure of Management Information: SMI, Management Information Base: MIB, SNMP Protocol Operations and Transport Mappings, Security and Administration, ASN.1, Conclusion.	
TEXT BOOKS: 1. James F. Kurose, Keith W. Ross, Computer Networking A Top down Approach, 7th Edition, Pearson, 2001.	
REFERENCE BOOKS: 1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5 th Edition , Elsevier -2014 2. Douglas E Comer, “ Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014 3. A Practical Guide to Advanced Networking (paperback), 3rd Edition By Jeffrey S. Beasley, PiyasatNilkaew Published Dec 17, 2015 by Pearson IT Certification. 4. The Internet Book: Everything You Need to Know about Computer Networking and how the Internet Works Douglas Comer Prentice Hall, 2007 - Computers	



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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Demonstrate in-depth knowledge in the area of Computer Networking.			P3A1
2. To demonstrate scholarship of knowledge through performing in a group to identify, formulate and solve a problem related to Computer Networks			P3A2
3. Prepare a technical document for the identified Networking System		P2A3	
4. Conducting experiments to analyse the identified research work in building Computer Networks	P1A1		

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Course Title	WIRELESS ADHOC NETWORKS				
Course Code	20ISCNPCWN	Credits	4	L-T-P	3-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			36

UNIT – 1					6 Hrs
Cellular and Adhoc Wireless Networks, Applications of Adhoc wireless networks, Issues in Adhoc wireless networks					
UNIT – 2					7 Hrs
Hidden and exposed terminal problems, Error prone shared broadcast channel, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms. Routing Protocols for Ad-hoc Wireless Networks: Table Driven Routing Protocols.					
UNIT – 3					7 Hrs
On-Demand Routing Protocols, Hybrid Routing Protocols. Multicast Routing in Ad-hoc Wireless Networks: Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols. Tree-Based Multicast Routing Protocols: BEMRP, MZRP, MCEDAR, ABAM, WBM, PLBM					
UNIT – 4					8 Hrs
Mesh based Multicast Routing protocols: ODMRP, DCMP, FGMP, MSMP, CAMP. Transport Layer and Security Protocols for Ad-hoc Networks: Feedback based TCP, TCP bus, Adhoc TCP and Split TCP.					
UNIT – 5					8 Hrs
Security in Ad-hoc Wireless Networks, Network Security Attacks: Network layer attacks, Transport layer attacks, Application layer attacks, Key Management: Approaches in adhoc					



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networks, Secure Routing Ad-hoc Wireless Networks: SAR, SEAD, ARAN, AODV.

LABORATORY WORK:

Simulations in On-Demand Routing Protocols, Tree-Based Multicast Routing Protocols: BEMRP, MZRP, MCEDAR, ABAM, WBM, PLBM, Mesh based Multicast Routing protocols: ODMRP, DCMP, FGMP, MSMP, CAMP, Feedback based TCP, Adhoc TCP and Split TCP.

TEXT BOOK:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011.

REFERENCE BOOKS:

1. Onyemelukwe Soke, On-Demand Routing and Security in Mobile Ad-Hoc Networks, LAP Lambert Academic Publishing, 2013.
2. Chai K Toh, Adhoc Mobile Wireless Networks: Protocols and Systems, Pearson Publications, 2015.
3. Subir Kumar Sarkar, T.G. Basavaraju and Puttamadappa, Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications, Second Edition, CRC Press, 2016.

E-BOOKS:

1. Magnus Frodigh, Per Johansson and Peter Larsson, Wireless ad hoc networking—The art of networking without a network.
2. Mohammed Ilyas, The Handbook of Adhoc Wireless Networks.

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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Enumerate the concept of wireless ad-hoc networks and issues in different layers of protocols in network.			P3A1
2. Articulate routing protocols of ad-hoc networks.			P3A2
3. Prioritize table-driven, on-demand and hybrid protocols and identify appropriate attributes for routing.			P3A3
4. Infer performance of various unicast and multicast routing protocols.			P3A4
5. Evaluate on security attacks and secure routing.			P3A5
6. Investigate the measurements of protocol performance in wireless ad-hoc networks.			P3A4



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Course Title	CRYPTOGRAPHY AND NETWORK SECURITY				
Course Code	20ISCNPENS	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	4	Total Lecture Hours			24

UNIT – 1	5 Hrs
<p>Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.</p> <p>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</p>	
UNIT – 2	5 Hrs
<p>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.</p> <p>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.</p>	
UNIT – 3	5 Hrs
<p>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 Z_p, elliptic curves over $GF(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom</p>	



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number generation based on an asymmetric cipher, PRNG based on RSA.	
UNIT – 4	5 Hrs
Web Security: Web Security Threats, Web Traffic Security Approaches. Secure Sockets Layer: SSL Architecture, SSL Record Protocol, and Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. Block Chain: Introduction to block chain, block chain technologies & its application	
UNIT – 5	4 Hrs
Transport Layer Security: Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, Padding HTTPS Connection Initiation, and Connection Closure. Secure Shell (SSH) Transport Layer Protocol, User Authentication Protocol, Connection Protocol.	
LABORATORY WORK: Students must write and execute programs on classical and public key cryptographic problems on unit 2 and 3.	
TEXT BOOK: 1. William Stallings: Cryptography and Network Security, Pearson 6 th edition. 2013	
REFERENCE BOOK: 1. V K Pachghare: Cryptography and Information Security, PHE ,2013.	



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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Apply knowledge of classical encryption technique to analyse, solve, and evaluate crypto problems.			P3A1
2. Evaluate and analysis public key crypto systems.			P3A3
3. Demonstrate knowledge on advanced public key crypto problems.			P3A2
4. Critically analyse web security threats and counter measures			P3A5
5. Apply knowledge of classical encryption technique to analyse, solve, and evaluate crypto problems.			P3A1



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Course Title	BLOCKCHAIN TECHNOLOGY				
Course Code	20ISCNPEBC	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5 Hours	Total Lecture Hours			24

UNIT – 1	4 Hrs
Introduction to Block Chain: What is Blockchain?, Structure of Blockchain, Why Blockchain is a Distributed P2P network? Benefits of using Blockchain Technology, Bitcoin & Blockchain: relation? Block chain operation.	
UNIT – 2	5 Hrs
Block Chain Eco System: Considering the usecase, Blockchain Architecture, Components of Blockchain Ecosystem, Blocks, Wallets and Addresses, Public and Private Key cryptography, Digital signature, Merkle Tree and Hashing, Cryptography and Blockchain Algorithms, Transaction execution & distribution, Types of Blockchain.	
UNIT – 3	5 Hrs
Blockchain mining- Proof of work: Blockchain mining?, Types of mining, What are Miners? Mining in Bitcoin and Ethereum	
UNIT – 4	5 Hrs
Security and Privacy: Smart Contracts, Consensus, Types of Consensus Algorithms, Ethereum and Hyperledger frameworks, creation of network with its components, writing smart contract, Consensus algorithms used in Bitcoin, Ethereum and Hyperledger read write sets, updating the blockchain.	
UNIT – 5	5 Hrs
BlockChain creation: Building your own blockchain solution for various use cases like Healthcare, Land registry, KYC, Supply chain, Cyber Security, Automobiles, etc using Ethereum or Hyperledger	



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TEXT BOOKS :

1. BlockChain by Example, Development guide for creating decentralized applications using Bitcoin, Etereum and Hyperledger, Bellaj Badr. Richard Horrocks & Xun(Brion) Wu. Packt>
2. Mastering Blockchain, Imran Bashir, Packt
3. Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer by Nitin Gaur (Author), Luc Desrosiers, Venkatraman Ramakrishna, Petr Novotny, Salman A. Baset.

REFERENCE BOOKS :

1. Blockchain for Business with Hyperledger Fabric, Nakul Shah, Enterprice Blockchain implementation for business using Hyperledger, BPB Publications
2. The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them (Cryptography, Crypto Trading, Digital Assets), Antony Lewis

E – BOOKS :

1. Hyperledger Fabric In-Depth: Learn, Build and Deploy Blockchain Applications Using Hyperledger Fabric (English Edition) Kindle Edition, <https://www.amazon.in/Hyperledger-Fabric-Depth-Blockchain-Applications-ebook/dp/B08CRMLV99?source=ps-sl-shoppingads-lpcontext&psc=1> : Code-bundle <https://rebrand.ly/cbgt5m>
2. Mastering Hyperledger Fabric: Master The Art of Hyperledger Fabric on docker, docker swarm and Kubernetes by Narendranath Reddy

MOOCs:

1. Courseera-link <https://www.coursera.org/programs/bms-college-of-engineering-on-coursera-jcigy?Currenttab=CATALOG>
2. Blockchain Basics <https://www.coursera.org/programs/bms-college-of-engineering-on-coursera-jcigy?Collectionid=6ccyf¤ttab=CATALOG&productid=flsycyzjeetabkjlshmc&producttype=course&showminimodal=true>
3. Transacting on Block-chain https://www.coursera.org/programs/bms-college-of-engineering-on-coursera-jcigy?Collectionid=6ccyf¤ttab=CATALOG&productid=inwjmyykeembxqoer_juha&producttype=course&showminimodal=true



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COURSE OUTCOMES

At the end of the Course Student will be able to:

COURSE OUTCOMES	POs		
	1	2	3
1. Understand the structure and key components of Blockchain technology towards creating a transparent and secure blockchain solution for a specific problem.			P3A1
2. Demonstrate in-depth knowledge of Blockchain technology for analyzing the given problem and arriving at solution model.			P3A2
3. Apply Modern tools and techniques to build a blockchain based solution to benefit an identified community.	P1A2		
4. Prepare a technical document on the Blockchain solution model developed.		P2A3	



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Course Title	SECURE CODING				
Course Code	20ISCNPESC	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1		5 Hrs
<p>Foundation of Secure Coding: Introduction, Software Security and Risk Principles Overview, Secure Coding Practices Checklist, Input Validation, Output Encoding, Authentication and Password Management, Session Management, Access Control, Cryptographic Practices, Error Handling and logging, Data protection, Communication Security, System Configuration, Database Security, General Coding Practices.</p>		
UNIT – 2		5 Hrs
<p>Programming language concepts using Python: Values and types, variables, operators, expression, conditionals, statements, functions, iterations, strings, lists, dictionary, tuples, classes and objects.</p>		
UNIT – 3		5 Hrs
<p>Secure Webapps using Python: Basic Application Structure, Templates, Web Forms, Cross-Site Request Forgery (CSRF) Protection, Form, Classes, HTML Rendering of Forms, Form Handling in View Functions, Redirects and User Sessions, Message Flashing, Databases</p>		
UNIT – 4		5 Hrs
<p>Secure Network Programming using Python: TLS Fails to Protect, Generating Certificates, Offloading TLS, Python 3.4 Default Contexts, Variations on Socket Wrapping, Hand-Picked Ciphers and Perfect Forward Security, Protocol Support for TLS</p>		
UNIT – 5		4 Hrs
<p>Case studies on latest real examples of securing the code.</p>		



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LABORATORY WORK:

Develop programs to check all the vulnerabilities exist in the source code. Also develop real time software without vulnerabilities.

REFERENCE BOOKS:

1. Allen Downey, Think Python, Green Tea Press, 2012.
2. Miguel Grinberg. Flask Web Development, O'Reilly, 2014
3. Brandon Rhodes, John Goerzen , Foundations of Python Network Programming Third Edition Apress 2014
4. OWASP Secure Coding Practices Quick Reference Guide

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Apply the principles of secure coding in practice.			P3A1
2. Evaluate the core Python programming to secure the code			P3A2
3. Develop and deploy secured web applications.			P3A3
4. Create secured network programs.			P3A4
5. Design and develop secured code using modern tools.			P3A5



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Course Title	NETWORK PROGRAMMING				
Course Code	20ISCNPENP	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT - 1	4 Hrs
<p>The Client Server Model and Software Design: Concurrent Processing in Client-Server software: Concurrent Processing in Client-Server software: Program Interface to Protocols.</p> <p>The Socket Interface: Introduction, Berkley Sockets, A Generic Address Structure, Major System Calls used with Sockets, Algorithms and Issues in Client Software Design Algorithms and Issues in Client Software Design</p>	
UNIT – 2	5 Hrs
<p>Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.</p>	
UNIT – 3	5 Hrs
<p>Client Software: Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service</p>	
UNIT – 4	5 Hrs
<p>Algorithms and Issues in Server Software Design: The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Four Basic Types of Servers.</p> <p>Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. Iterative, Connection-Oriented Servers(TCP): Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability. Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Servers (TCP): Introduction, Concurrent ECHO, Iterative</p>	



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Vs Concurrent Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent.	
UNIT – 5	5 Hrs
Web socket Programming: Duplex Communication, Functionalities, Implementation, Web Services, Web Components, SOAP Web Service, RESTful Web Service, SOAP vs REST.	
TEXT BOOKS:	
<ol style="list-style-type: none"> 1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001. 2. http://freecomputerbooks.com/specialWebServicesBooks.html 3. WebSocket, Lightweight Client-Server Communications, Andrew Lombardi, OREILLY 4. The Definitive Guide to HTML5 WebSocket, Vanessa Wang, Frank Salim, Peter Moskovits, APress. 	
REFERENCE BOOKS:	
<ol style="list-style-type: none"> 1. James F. Kurose, Keith W. Ross, Computer Networking A Top down Approach, 7th Edition, Pearson, 2001. 2. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: UNIX Network Programming Volume 1 3rd edition The Sockets Networking, Addison Wesley, 2003 ISBN: 0-13-141155-1 Pages: 1024 	

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	Mapping to POs		
	1	2	3
1. Apply the Client and Server design practices towards designing efficient Servers and Clients.			P3A1
2. Demonstrate the programming knowledge in designing and developing service specific Server with Clients.			P3A4
3. Perform independently/team to carry out study and Develop a Web Client and Server applications for providing specified service using appropriate tools.	P1A2		
4. Prepare a technical document for the Client-Server software developed		P2A1	



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Course Title	SOFTWARE DEFINED NETWORK				
Course Code	20ISCNPESD	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1	4 Hrs
Control plane, Data plane, Moving information between planes, Why can separation be important? Distributed control planes: IP and MPLS, Creating the IP underlay, Convergence time, Load balancing, High availability, Creating the MPLS overlay, Replication. Centralized control planes: Logical versus Literal, Route servers.	
UNIT – 2	5 Hrs
OpenFlow: Wire protocol, Replication, FAWG, Config and Extensibility, Architecture, Hybrid approaches: Ships in the night, SDN Controllers: General concepts-VMware.	
UNIT – 3	5 Hrs
Network Programmability: Management interface, Application-Network divide: Command line interface, NETCONF & NETMOD, SNMP, Modern programmatic interfaces: Publish and Subscribe interfaces, XMPP, Modern orchestration: Openstack.	
UNIT – 4	5 Hrs
Network Function Virtualization: Virtualization and data plane I/O, Services engineered path, Service locations and chaining: Metadata, NFV at ETSI, Non-ETSI NFV Work: Middlebox studies.	
UNIT – 5	5 Hrs
Data Center concepts and constructs: Multitenant Data center, Virtualized multitenant data center: Orchestration, Connecting a tenant to the internet/VPN, Virtual machine migration and elasticity, Data center Interconnect, SDN solutions for the data center network, Building an SDN Framework: Open Daylight Controller/Framework.	



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LABORATORY WORK:

Setting up the environment and implementation of OpenFlow, execution of controllers, configuration and development of network applications such as building the learning switch, simple firewall, forwarding in OpenDaylight, FlowVisor slicing and OpenStack services. Mininet or any similar simulator can be used.

TEXT BOOK:

1. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, O'Reilly Media Publishers, 2013.

REFERENCE BOOKS:

1. Paul Goransson, Chuck Black and Timothy Culver, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, 2nd Edition, 2016.
2. William Stallings, Foundations of Modern Networking, Pearson, 2016.
3. Jim Doherty, SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization, Addison Wesley, 2016.

E-BOOKS:

1. Open Networking Foundation (ONF) Documents, <https://www.opennetworking.org>
2. Siamak Azodolmolky, Software Defined Networking with OpenFlow, Packt Publishing.
3. Carlos Fernandez Jose L. Muñoz, Software Defined Networking (SDN) with OpenFlow 1.3, Open vSwitch and Ryu, UPC Telematics Department.



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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Conceptualize on data and control plane separation, Openflow, network programmability, virtualization, data center constructs and SDN Framework.			P3A1
2. Apply plane-models, protocols, programmatic interfaces and framework notion for engineering deployments.			P3A1
3. Analyze paradigm shift in the functionality of network models, controllers and constructs.			P3A5
4. Assess the strategies used for development of software defined operations and infrastructure.			P3A4
5. Possess knowledge on industry-scale operations for network virtualization, data center design and modern orchestration.			P3A5
6. Ascertain practical implementation of SDN and learn controller application programs.			P3A4



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Course Title	ADVANCES DATA STRUCTURES				
Course Code	20ISCNPEDS	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1	5 Hrs
Hashing: Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.	
UNIT – 2	5 Hrs
Trees: Binary Search Trees, AVL Trees, Red Black Trees	
UNIT – 3	5 Hrs
Trees (Contd.): 2-3 Trees, B-Trees, Splay Trees	
UNIT – 4	4 Hrs
Dictionaries and Maps: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries	
UNIT – 5	5 Hrs
Heaps: Operations on Binary Heaps, Binomial Heaps, Fibonacci Heaps	
LABORATORY WORK: Lab involves implementation of various operations of advanced data structures in any programming language C/C++/Java or Python. The focus is to acquire coding skills through appropriate choice of data structure and algorithm.	
TEXT BOOKS: 1. Mark Allen Weiss, Data Structures and Algorithms Analysis in C++ , 4th Edition, Pears 2014 2. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms , 3rd Edition, Prentice-Hall of India, 2010.	



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REFERENCE BOOKS:

1. Horowitz, Sahni, Anderson-Freed: **Fundamentals of Data Structures in C**, 2nd Edition, Universities Press, 2007.
2. Yedidyah, Augenstein, Tannenbaum: **Data Structures Using C and C++**, 2nd Edition, Pearson Education, 2003

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Analyse and develop operations on linear and non-linear data structures			P3A1
2. Design solutions for applications using appropriate data structures for efficient management of data			P3A3
3. Carry out independent investigations of operations on various advanced data structures through experiments			P3A4



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Course Title	SOCIAL NETWORK ANALYSIS				
Course Code	20ISCNPESN	Credits	03	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1	5 Hrs
Introduction to Social Media and Social Networks, Social Media: New Technologies of Collaboration, Social Network Analysis: Measuring, Mapping, and Modeling Collections of Connections	
UNIT – 2	5 Hrs
Getting Started with NodeXL, Layout, Visual Design, and Labeling, Calculating and Visualizing Network Metrics, Preparing Data and Filtering, Clustering and Grouping	
UNIT – 3	5 Hrs
Email: The Lifeblood of Modern Communication, Thread Networks: Mapping Message Boards and Email Lists, Twitter: Conversation, Entertainment, and Information, All in One Network, WWW Hyperlink Networks	
UNIT – 4	5 Hrs
Visualizing and Interpreting Facebook Networks, Photos: Linking People, Photos, and Tags, YouTube: Contrasting Patterns of Content, Interaction, and Prominence, Wiki Networks: Connections of Creativity and Collaboration	
UNIT – 5	4 Hrs
Social Media Network Analysis Case Studies: Email, YouTube, Facebook, Twitter, Photos, WWW, WhatsApp.	



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TEXT BOOK:

1. Derek Hansen Ben Shneiderman Marc Smith: Analyzing Social Media Networks with NodeXL, Elsevier, 1th edition. 2010

TUTORIALS ON SOCIAL MEDIA CASE STUDIES:

1. GMAIL.COM
2. FACEBOOK.COM
3. TWITTER.COM
4. GOOGLE PHOTOS
5. YOUTUBE.COM
6. WHATSAPP.COM

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Mastery the notations and terminologies of social network			P3A1
2. Visualize, Measure and Compare social network problems			P3A2
3. Analyse data connectivity problems by using social network algorithms			P3A3
4. Analyse multimedia connectivity problems by using social network algorithms			P3A4
5. Apply algorithms on a real world social media problems	P1A3		



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Course Title	ADVANCED MACHINE LEARNING				
Course Code	20ISCNPEML	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5 Hours	Total Lecture Hours			24

UNIT – 1				5 Hrs
A concept learning task, Concept learning as search, Find-S: Finding a maximally specific hypothesis, Version spaces and candidate-elimination algorithm. Principal Component Analysis, Singular Value Decomposition.				
UNIT – 2				4 Hrs
Decision tree learning: Representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, Random Forest algorithm				
UNIT – 3				5 Hrs
Bayes theorem, Concept learning, Maximum likelihood and Least-Squared error hypotheses, Bayes Optimal Classifier, Naïve Bayes Classifier, Hidden Markov Models.				
UNIT – 4				5 Hrs
Instance based learning: k-nearest neighbor learning, K-means clustering, Apriori algorithm. Introduction to Analytical learning, Reinforcement Learning.				
UNIT – 5				5 Hrs
Artificial Neural Networks: Representation, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Backpropagation algorithm, Deep learning				



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LABORATORY WORK:

Design and implementation of Machine learning algorithms such as Decision tree, Neural networks, Support Vector machine, Hidden Markov Model, Naïve Bayes classifier, Principal Component Analysis and k-Nearest neighbour learning using Matlab.

TEXT BOOKS:

1. Machine Learning, Tom M Mitchell, McGrawHill education, Indian Edition, 2016.
2. Introduction to Machine Learning, 3rd Edition, Ethem Alpaydin, PHI, 2015.
3. Machine Learning in Action, Peter Harrington, Manning Publications, 2012.

REFERENCE BOOKS:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2011.
2. Applied Machine Learning, Madan Gopal, Tata MacGraw Hill Publishing, 2018.
3. Mastering Machine Learning Algorithms, Giuseppe Bonaccorso, Packt Publishing, 2018

E-BOOKS:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press.
2. A Course in Machine Learning, Hal Daumé III, CIML.
3. What You Need to Know about Machine Learning, Gabriel Cánepa, Packt Publishers.
4. Bayesian Reasoning and Machine Learning, David Barber, 2016.

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Explore machine learning algorithms based on concept learning, decision trees, neural networks, hypothesis and classifiers			P3A1
2. Analyze classification and stochastic approaches for training intelligent systems			P3A3
3. Conduct experiments to demonstrate applicable techniques in machine learning.			P3A4
4. Independently study and prepare poster presentation of the identified real time application of machine learning			P2A2



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Course Title	PROTOCOL ENGINEERING				
Course Code	20ISCNPEPR	Credits	03	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1	5 Hrs
Introduction, Communication Model, Software, Subsystems, Protocol, Communication protocol development methods, Protocol Engineering Process, Layered Architecture, Network services and interfaces, Protocol functions, OSI, TCP/IP, Wireless Protocol Challenges, Application Protocols.	
UNIT – 2	5 Hrs
Protocol Specification, Components, Services, Protocol Entity, Interface, Interactions, Multimedia, Internet. Protocol Specification Languages, SDL, SPIN, Estelle, E-Lotus, CPN, Uppal, UML.	
UNIT – 3	5 Hrs
Protocol Verification and Validation, Finite State Machines, Design Errors, Approaches, SDL based, Communication Protocol Conformance Test Principle, Test Execution, Methodology and Framework, Architectures, Generation Methods	
UNIT – 4	5 Hrs
Protocol Performance Testing, SDL based TCP and OSPF, Interoperability, SDL based CSMA/CD and CSMA/CA, Scalability, Protocol Synthesis, Interactive and Automatic, SDL from MSC, Re-synthesis.	
UNIT – 5	4 Hrs
Protocol implementation, requirement, Object based, compilers, Tool for Protocol Engineering	



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LABORATORY WORK:

Use modern tools for the verification and validation of protocol stack.

TEXT BOOK:

1. Pallapa Venkataram, Sunil Kumar S Manvi, B. Sathish Babu “ Communication Protocol Engineering, PHI, Learning, 2014.

REFERENCE BOOK:

1. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004.

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Compare the communication protocol development methods			P3A1
2. Apply protocol specification languages for the given Problems			P3A2
3. Validate and verify using methods			P3A4
4. Perform protocol verification and validation testing			P3A4
5. Implement tools for protocol engineering			P3A1

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Course Title	RESEARCH METHODOLOGY AND IPR				
Course Code	20ALLPICRM	Credits	2	L-T-P	2-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	2 Hours	Total Lecture Hours			24

UNIT – 1	5 Hrs
Meaning and sources of research problem, , Objectives and Characteristics of research – Errors in selecting research problem, Research methods Vs Methodology - Types of research-Criteria of good research – Developing a research plan.	
UNIT – 2	5 Hrs
Investigations of a research problem - Selecting the problem - Necessity of defining the problem – Data collections-analysis- Importance of literature review in defining a problem - Survey of literature -Necessary instrumentations.	
UNIT – 3	5 Hrs
How to write paper-conference articles-poster preparation, thesis report writing, inclusion of references, journal reviewing process, journal selection process, filling about journal template, developing effective research proposal-plagiarism-research ethics.	
UNIT – 4	5 Hrs
Nature of Intellectual property, IPRs- Invention and Creativity - Importance and Protection of Intellectual Property Rights (IPRs) – procedure for grant of patents and patenting under PCT-types of patents-technological research and innovation- international cooperation on IP.	
UNIT – 5	4 Hrs
A brief summary of : Patents-Copyrights-Trademarks, patent rights-licensing and transfer of technology-patent databases-case studies on IPR-Geographical indications-new developments in IPR-protection of IPR rights.	



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REFERENCE BOOKS:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Anderson, T. W., An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi
4. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications.
5. Subbarau NR-Handbook of Intellectual property law and practise- S Viswanathan Printers and Publishing Private Limited 1998.

COURSE OUTCOMES (COs):

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

CO		PO
CO1	Ability to write and present a substantial technical report/document	PO2
CO2	Able to demonstrate a degree of mastery over the area of specialization	PO3

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Course Title	CYBER SECURITY AND LAW				
Course Code	20ISCNPCCL	Credits	3	L-T-P	3-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours			36

UNIT – 1	7 Hrs
<p>Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Cyber stalking Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.</p>	
UNIT – 2	7 Hrs
<p>Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.</p>	
UNIT – 3	7 Hrs
<p>Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).</p>	
UNIT – 4	7 Hrs
<p>Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance</p>	



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of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti forensics.	
UNIT – 5	8 Hrs
The Legal Perspectives on Cybercrimes and Cyber security: The legal landscape around the world. Need of Cyber laws in the Indian context. The Indian IT Act. Digital signatures and The Indian IT Act. Amendments to The Indian IT Act. Cybercrime and Punishment.	
TEXT BOOKS:	
1. Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013	
2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. “Introduction to information security and cyber laws”. Dreamtech Pre ss. ISBN: 9789351194736, 2015	
REFERENCE BOOKS:	
1. Thomas J. Mowbray, “Cybersecurity: Managing Systems , Conducting Testing, and Investigating Intrusions”, Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 91-118 - 84965 -1	
2. James Graham, Ryan Olson, Rick Howard, “Cyber Security Essentials”, CRC Press, 15-Dec-2010	



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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Discriminate and analyze problems involved in cybercrime			P3A1
2. Synthesis cybercrime issues on wireless and mobile devices			P3A2
3. Use and apply modern cyber forensics tools			P3A4
4. Analyze the computer forensic problems for a feasible solution			P3A3
5. Apply cyber law for a given type of cyber issues			P3A5

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Course Title	INTERNET OF THINGS				
Course Code	20ISCNPCIT	Credits	4	L-T-P	3-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			36

UNIT – 1	7 Hrs
<p>Introduction to Internet of Things: Introduction: Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT: IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication protocols, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates.</p> <p>IoT Applications: Introduction, Home Automation, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Smart Cards, Tracking, Surveillance system, Environment, Energy, Retail, Logistics, Agriculture, Industry and Health care and Lifestyle.</p>	
UNIT – 2	7 Hrs
<p>Prototyping IoT Objects Using Microprocessor/Microcontroller. Working principles and types of sensors and actuators – Setting up the board - Programming for IOT – Reading from Sensors, Communication: Connecting microcontroller with mobile devices – communication through Bluetooth, Wi-Fi, Ethernet, Zigbee, RFID, NFC.</p>	
UNIT – 3	7 Hrs
<p>Writing Code: building a program and deploying to a device, writing to Actuators, Blinking Led, Reading from Sensors, Light Switch, Voltage Reader, Device as HTTP Client, Push Versus Pull Pachube, Netduino, Sending HTTP Requests—The Simple Way, Sending HTTP Requests—The Efficient Way HTTP: Device as HTTP Server, Relaying Messages to and from the devices, Request Handlers, Web Html, Handling Sensor Requests, Handling Actuator Requests</p>	
UNIT – 4	7 Hrs
<p>Security and Privacy in IoT: Need for IoT security, IoT vulnerabilities – Features and Threats, Role of Cryptography, IoT Security Best practices, Securing the IoT, Integration of Blockchain into IoT</p>	
UNIT – 5	8 Hrs
<p>Case Study and IoT Application Development: IoT applications in home- infrastructures-security-Industries- IoT electronic equipment.. Use of Big Data and Visualization in IoT- Industry 4.0 concepts - Sensors and sensor Node –Interfacing using Raspberry Pi/Arduino- Web</p>	



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Enabled Constrained Devices,

TEXT BOOKS:

1. Adrian McEwen and Hakim Cassimally, —Designing the Internet of Things||, John, Wiley & Sons, 2013.
2. Arshdeep Bahga, Vijay Madiseti, “Internet of Things (A Hands-On-Approach)”, VPT, 2014.
3. Security Challenges and Approaches in Internet of Things, Sridipta Misra Muthucumar Maheswaran Salman Hashmi, Springer publication

REFERENCE BOOKS:

1. Cuno Pfister, —Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud||, Maker Media, 2011.

E – BOOKS :

1. IoT Security Issues, Alasdair Gilchrist, e-book, ePub https://www.buecher.de/shop/datenschutz/iot-security-issues-ebook-pdf/gilchristalsadair/products_products/detail/prod_id/47661634/
2. Internet of Things- Principles and Paradigms, Rajkumar Buyya, Amir Vahid Dasterdi

MOOCS:

1. Internet of Things: mega Course Udemy

https://www.udemy.com/course/internet-of-things-the-mega-course/?LSNPUBID=Z*nNMT6UOvY&ranEAID=Z*nNMT6UOvY&ranMID=39197&ranSiteID=Z.nNMT6UOvY-eXKfdLfg.rIff.6meMAjJA&siteID=Z.nNMT6UOvY-eXKfdLfg.rIff.6meMAjJA&utm_source=adwords&utm_medium=udemyads&utm_campaign=DSA_Catchall_la.EN_cc.INDIA&utm_content=deal4584&utm_term=._.ag_82569850245_._ad_437477497173_._kw_._.de_c_._dm_._.pl_._.ti_dsa21781902600_._li_9062011_._.pd_._.&matchtype=b&gclid=EAIAIQobChMIp6uEluv6gIVIH0rCh2GBQprEAMYASAAEgIBUfD_BwE

2. Introduction to IoT : https://swayam.gov.in/nd1_noc19_cs65/preview Advanced IoT Applications: <https://nptel.ac.in/courses/108/108/108108123/>

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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Apply in-depth knowledge of Internet of Things in Identifying the appropriate Devices, APIs and Enabling Technologies required to develop applications of IoT			P3A1
2. Demonstrate in-depth knowledge of Internet of Things for analyzing the given problem and arriving at solution model.			P3A2
3. Apply Modern tools and techniques to provide solution to benefit an identified community	P1A2		
4. Prepare a technical document on the IoT solution model developed		P2A3	



BMS COLLEGE OF ENGINEERING, BENGALURU-19

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Course Title	NETWORK MANAGEMENT				
Course Code	20ISCNPCNM	Credits	3	L-T-P	3-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours			36

UNIT – 1	6 Hrs
Case Histories on Network, System and Service management, Some Common Network Problems, Challenges of IT Managers, NM Goals, Organization, Functions. Network Management perspectives.	
UNIT – 2	7 Hrs
NM Standards, NM Models, Organization Model, Information Model, Management Information Trees, Communication Model. ASN.1- Terminology, Symbols and Conventions, Objects and Data Types, Encoding Structure, Functional Model.	
UNIT – 3	7 Hrs
Case history, Internet Organizations and standards, Organization Model, System Overview, Information Model, Structure of Management Information, Management of Information Base, System group, IP group and TCP group.	
UNIT – 4	7 Hrs
SNMP Communication model, Functional Model, SNMP Management: RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 –Management Information Base.	
UNIT – 5	9 Hrs
Event Correlation Techniques, Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State	



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Machine Model, Security Management, Policies and Procedures, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management.

TEXT BOOK:

1. Mani Subramanian, Network Management- Principles and Practice, 2nd Edition, Pearson Education.

REFERENCE BOOKS:

1. J. Richard Burke, Network management Concepts and Practices: A Hands-On Approach, PHI.
2. Rishabh Anand, Network Management, S K Kataria & Sons.
3. Douglas Mauro and Kevin Schmidt, Essential SNMP, 2nd Edition, O'Reilly Media Publishers.
4. Network Management Fundamentals, Alexander Clemm, Cisco Press, 1st Edition.

E-BOOKS:

1. Internetworking Technologies Handbook, Fourth Edition, by Cisco Systems, Inc. Publisher: Cisco Press.
2. Simple Network Management Protocol (SNMP), Erlang, Ericsson AB.
3. RMON Configuration Guide, Cisco IOS Release 12.4, by Cisco Systems, Inc. Publisher: Cisco Press.



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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Enumerate the applications of NM and challenges pertaining to security management of an IT Manager.			P3A1
2. Articulate network management standards, models and language.			P3A3
3. Prioritizing network management functional groupings.			P3A3
4. Infer the performance of RMON groups and functions.			P3A5
5. Evaluate on event correlation techniques, TLV formats and parameters of SNMP model groups.			P3A5
6. Learn the network management models using ASN.1 notation and latest RFCs update.			P3A6



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Course Title	HIGH PERFORMANCE COMMUNICATION NETWORKS				
Course Code	20ISCNPEHP	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1		5 Hrs
<p>High Speed Networks: Frame Relay. Packet-Switching Networks. Frame Relay Networks. Asynchronous Transfer Mode (ATM). ATM Protocol Architecture. ATM Logical Connections. ATM Cells. ATM Service Categories. ATM Adaptation Layer (AAL).</p>		
UNIT – 2		5 Hrs
<p>High-Speed LANs. :The Emergence of High-Speed LANs. Ethernet. Fibre Channel. Wireless LANs</p> <p>Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control –Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.</p>		
UNIT – 3		5 Hrs
<p>Advanced network architecture: IP forwarding architectures overlay model, Multi-Protocol Label Switching (MPLS), integrated services in the Internet, Resource Reservation Protocol (RSVP), Differentiated services.</p>		
UNIT – 4		4 Hrs
<p>Protocols for Qos support :RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms –Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP –Protocol Architecture</p>		
UNIT – 5		5 Hrs
<p>High Speed Digital Access & Broadband Technologies: ADSL, other DSL Technologies; Cable Modem: Traditional Cable Networks, HFC Networks, Internet Over Cable, SONET: SONET Devices, SONET Frame, Frame Transmission, Synchronous Transport Signals, STS-1, Virtual Tributaries, Higher-Rate Services; B-ISDN architecture</p>		
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. William Stallings, ‘High Speed Networks: Performance and Quality of Service’, 2nd Edition, Pearson Education, 2002. 2. William Stallings, ”ISDN and Broadband ISDN with Frame Relay and ATM”, 4th edition, Pearson education Asia, 2002 		



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LAB COMPONENT:

Selected topics from recent advances in high performance networks; next generation internet; asynchronous transfer mode; traffic management, quality of service; high speed switching.

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Demonstrate In-depth knowledge In high speed networks and estimate the link performance.			P3A1
2. Communicate and present effectively the principles used in High Performance computing.			P3A2
3. Engage in critical analysis to arrive at a valid conclusion for novel ideas in the area of High Speed Networking via research Publications.	P1A2		
4. Engage in independent study to prepare a Technical document to address High Speed Networks concepts.		P2A3	



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Course Title	ADVANCED ALGORITHMS				
Course Code	20ISCNPEAA	Credits	03	L-T-P-S	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1		5 Hrs
<p>Growth of Functions: Asymptotic notations, Standard notations and common functions, Recurrences and Solution of Recurrence equations- The substitution method, The recurrence tree method, The master method</p> <p>Amortized Analysis: Aggregate, Accounting and Potential Methods.</p>		
UNIT – 2		5 Hrs
<p>Graph Algorithms: Bellman - Ford Algorithm, Single source shortest paths in a DAG, Flow networks and Ford-Fulkerson method, Maximum bipartite matching.</p>		
UNIT – 3		5 Hrs
<p>Number -Theoretic Algorithms: Elementary notions, GCD, Modular Arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element.</p>		
UNIT – 4		4 Hrs
<p>String-Matching Algorithms: Naïve string Matching, Rabin - Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm.</p>		
UNIT – 5		5 Hrs
<p>NP-Completeness: Polynomial time, Polynomial time verification, NP-Completeness and reducibility, NP-Complete problems.</p> <p>Approximation Algorithms: vertex cover problem, the set – covering problem, randomization and linear programming, the subset – sum problem</p>		



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LABORATORY WORK:

Lab involves implementation of the algorithms in any programming language C/C++/Java or Python. The focus is to acquire coding skills through appropriate choice of data structure and algorithm

TEXT BOOK:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007
2. Mark Allen Weiss, Data Structures and Algorithms Analysis in C++, 4th Edition, Pearson,2014
3. Steven S Skiena, The Algorithm Design Manual, Springer, 2008

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Determine the asymptotic complexity of iterative and recursive algorithms			P3A1
2. Design and implement efficient solutions to various real world problems through algorithms.			P3A2
3. Evaluate and justify algorithmic solutions for their correctness and complexity.			P3A3
4. Carry out independent investigations of algorithm solutions for a defined computational problem through experiments	P1A1		

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Course Title	BIG DATA ANALYTICS				
Course Code	20ISCNPEBD	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			36

UNIT - 1	7 Hrs
Classification of Digital Data , Structured Data, Semi-Structured Data, Unstructured Data, Introduction to Big Data, Challenges of Big Data, Introduction to Big Data Analytics	
UNIT – 2	7 Hrs
Bigdata technology landscape: Classification of Analytics, Introduction to Data Science, Terminologies Used in Big Data Environment CAP theorem, NoSQL, Types of NoSQL Databases, Advantages of NoSQL, SQL versus NoSQL, New SQL.	
UNIT – 3	7 Hrs
Hadoop: Features of Hadoop, Key Advantages of Hadoop, Versions of Hadoop, Hadoop Ecosystems, Hadoop Distributions, Hadoop versus SQL, RDBMS versus Hadoop, Hadoop Components, Hadoop Conceptual Layer, High Level Architecture of Hadoop, Hadoop Distributed File System, HDFS Daemons, Processing Data with Hadoop, MapReduce daemons, MapReduce Example, Managing Resources and Applications with Hadoop Map Reduce programming, YARN.	
UNIT – 4	7 Hrs
Introduction to MONGODB , Using Java script object notation, Generating unique key, Datatypes in mongodb, Query language, Introduction to mapreduce programming, mapper, reducer, combiner, partitioner, searching, sorting, compression, Introduction to Jasperreports, Connecting to Mongoddb NoSQL database.	
UNIT – 5	8 Hrs
Introduction to machine learning: Regression model, implementation of Regression model using R, Clustering, K-Means Algorithm, Collaborative filtering, Association rule mining, Decision trees.	



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TEXT BOOKS:

1. Seema Acharya, Subhashini Chellappan, Big data and Analytics, Wiley publications, 2014.
2. Tom White, Hadoop: The Definitive Guide, Third Edition, O'Reilly, 2012.
3. Eric Sammer, Hadoop Operations, O' Reilly, 2012.
4. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.

REFERENCE BOOKS:

1. Harness the Power of Big Data, IBM big data platform Paul C. Zikopoulos Dirk deRoos Krishnan Parasuraman Thomas Deutsch David Corrigan James Giles, Mcgrawhill, 2013
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data Author: Education EMC Services, Publisher: Wiley ISBN

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Analyze big data, data science and its applications.			P3A1
2. Analyze NoSQL data models and compare with RDBMS.			P3A2
3. Identify and analyze design issues of Hadoop and HDFS.			P3A4
4. Use MongoDB and MapReduce to perform data analytics and for data visualization.			P3A3



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Course Title	CLOUD COMPUTING				
Course Code	20ISCNPECC	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1				5 Hrs	
<p>Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, 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</p>					
UNIT – 2				5 Hrs	
<p>Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.</p>					
UNIT – 3				5 Hrs	
<p>Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and para-virtualization, Hardware support for virtualization, Case Study: Xen a VMM based para-virtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization.</p>					
UNIT – 4				5 Hrs	
<p>Python for Cloud: Python for Amazon Web services, Python for Google Cloud platform, Python for Windows Azure, python for map Reduce</p>					



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UNIT – 5	4 Hrs
Cloud Security: Introduction, CSA - Cloud Security Architecture, authentication, authorization, Identity and Access Management, data security	
PRACTICAL WORKS: 1. Student must identify a problem in the area of Cloud Computing, make critical analysis to arrive at a valid conclusion through research and provide an alternate/optimal solution to an identified problem 2. Building a private Cloud	
TEXT BOOKS: 1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013. 2. Arshdeep Bahga, vijay Madiseti “ Cloud Computing – A Hands-on approach”, Universities Press, 2014	
REFERENCE BOOKS: 1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014. 2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013	

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Apply depth knowledge of Cloud computing theories and practices for building and managing Cloud.			P3A13
2. Engage in critical analysis to arrive at a valid conclusion through research to provide an alternate/optimal solution to an identified problem	P1A3	P2A1	
3. Demonstrate in-depth knowledge of Cloud computing for analyzing and building a private Cloud			P3A5



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Course Title	MOBILE APPLICATION DEVELOPMENT				
Course Code	20ISCNPEMD	Credits	3	L-T-P	2-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours			24

UNIT – 1	5 Hrs
Introduction to Android., Understanding the Android Software Stack, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components.	
UNIT – 2	5 Hrs
Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control. Building Blocks for Android Application Design.	
UNIT – 3	5 Hrs
Laying Out Controls in Containers, Utilizing Resources and Media, Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments. Using Selection Widgets and Debugging, Displaying and Fetching Information.	
UNIT – 4	4 Hrs
Using Dialogs and Fragments Advanced Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations.	
UNIT – 5	5 Hrs
Displaying web pages and maps communicating with sms and emails. creating and using content providers: Creating and consuming services, Publishing android applications.	



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LABORATORY WORK:

Design and development of application programs to demonstrate Android activity life cycle, types of controls, Layouts, Dialogs, Fragments, Internet, Services, display of web pages and maps, publishing applications.

TEXT BOOK:

1. B.M. Hirwani- Android programming Pearson publications-2013.

REFERENCE BOOKS:

1. Pro Android 5, Dave MacLean, Satya Komatineni and Grant Allen, Apress, 2015.
2. Expert Android Studio, Murat Yener, Onur Dundar, Wrox publications, 2017.
3. Enterprise Android, Zigurd Mednieks, G Blake Meike, Laird Dornin, Zane Pan, Wrox publications, 2014

E-BOOKS:

1. Paul Deitel, Harvey Deitel and Alexander Wald, Android 6 for Programmers, An App-Driven Approach, Deitel Developer Series, Prentice Hall, 2015.
2. Zigurd Mednieks, Laird Dornin, G. Blake Meike and Masumi Nakamura, Programming Android, Second Edition, Oreilly Publishers.
3. Dawn Griffiths and David Griffiths, Head First Android Development, Oreilly Publishers, 2015.
4. Jeff McWherter and Scott Gowell, Professional Mobile Application Development, Wiley Publications.



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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Gain insight on components, controls and functionalities of Android for application development.			P3A1
2. Conceptualize on Android constructs to obtain feasible modules as a solution for engineering problems.			P3A2
3. Analyse packages, project libraries and services to obtain a framework for solving problems in development of mobile			P3A5
4. Obtain the code patterns by investigating resources to arrive at valid conclusions using debugging tools.			P3A4
5. Illustrate programming resolutions for applications by incorporating appropriate settings.			P3A4



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Course Title	COMPUTER NETWORK				
Course Code	20ISCNOECN	Credits	04	L-T-P	4-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	4	Total Lecture Hours			48

UNIT – 1		9 Hrs
<p>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</p>		
UNIT – 2		9 Hrs
<p>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, Subnetting and classless addressing, Address Translation (ARP) Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels</p>		
UNIT – 3		9 Hrs
<p>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</p>		
UNIT – 4		11 Hrs
<p>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.</p>		



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UNIT – 5	10 Hrs
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)	
TEXT BOOKS: 1. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5 th Edition , Elsevier -2014 2. Douglas E Comer, “ Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014	
REFERENCE BOOKS: 1. Uyles Black “Computer Networks, Protocols , Standards and Inte rfaces” 2 nd Edition - PHI 2. Behrouz A Forouzan “TCP /IP Protocol Suite” 4 th Edition – Tata McGraw-Hill	

COURSE OUTCOMES (COs):

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

CO1	Apply the knowledge of networking architectures and technologies in designing/building a computer network and evaluating its performance.
CO2	Demonstrate various protocols, global addressing, Subnetting, VLAN, forwarding and routing in Internetworking.
CO3	Design various Internetworking applications (e.g. Client Server applications, Web Services).
CO4	Perform in a team to implement network applications using networking tool.



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Course Title	WEB TECHNOLOGIES				
Course Code	20ISCNIEWT	Credits	04	L-T-P	4-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	4	Total Lecture Hours			48

UNIT – 1		9 Hrs
<p>HTML5& CSS: Document structure, HTML Tags, forms, Working with Video and Audio, Cascading Style Sheets: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Alignment of text, color, The Box model, Background images, transitions and animations. Case Study : Twitter Bootstrap</p>		
UNIT – 2		11 Hrs
<p>Java Script: Program structure in JavaScript: Variables, Conditions, functions, scope and array, objects, classes, arrow functions, promises, Aysnc-Wait and JSON.</p>		
UNIT – 3		14 Hrs
<p>Type Script:ES6 Standard, Type scripting Vs. Java Script, Types, Array, Tuples, Loops, Map, Set, Arrow functions, Classes, Date Object, Duck-typing, Type Script Build Tools.</p>		
UNIT – 4		9 Hrs
<p>Angular JS: Why Angular, Single Page Application development, Dependency Injections, Angular Core Components, Services, filters, Directive Name Matching, Creating Custom Directive, Routing: Routing Single Page Applications, ngRoute, Route Registration</p>		
UNIT – 5		5 Hrs
<p>Node JS & Mongo DB : Introduction to Node js, Events, Listeners, Timers, Callbacks, Handling Data I/O, File Access, HTTP Access, Socket Service. MongoDB: SQL Vs NoSQL,</p>		



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Accessing DB with Node js, Manipulating, DB data Types, Data Life cycles.

TEXT BOOKS:

1. Achyut Godbole, Atul Khathe: Web Technologies 3/e, McGraw Hill Education, 2013.
2. Robert W. Sebesta, Programming the World Wide web, 7th Edition, Pearson Education, 2013.
3. Brad Dayley, Brendan Dayley, Caleb Dayle:, Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications, Pearson Education; Second Edition edition, 2018.

REFERENCE BOOKS:

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, , Internet & World Wide Web How to Program, 5/e , Prentice Hall, , 2013

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Apply HTML, CSS and Javascript to design and build webpages.			P3A1
2. Use core web coding languages to add dynamic content, animation and effects to websites			P3A2
3. Design web apps using data-driven technologies.	P1A2		
4. Build an interactive website(s) with regard to issues of usability, accessibility and Standards Using modern Integrated Development Environments.		P2A3	



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Course Title	BUSINESS MODELS AND ENTREPRENEURSHIP				
Course Code	20ISCNPEBM	Credits	2	L-T-P	2-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	2	Total Lecture Hours			24

UNIT - 1	5 Hrs
Origins of the lean startup, the lean startup method management's, second century entrepreneurial management, the roots of the lean startup, who, exactly, is an entrepreneur what's a startup, learn, validated learning, brilliant strategy, value vs. waste, find validation, the audacity of zero	
UNIT - 2	5 Hrs
Experiment, from alchemy to science, think big, start small, for long-term change, experiment immediately, break it down, an experiment is a product, how vision leads to steering, leap, strategy is based on assumptions, analogs and antilogs, value and growth, design and the customer archetype, analysis paralysis, test, the concierge minimum viable product, the role of quality and design, innovation accounting,	
UNIT - 3	4 Hrs
Measure, an accountability framework, innovation accounting, establish the baseline, tuning the engine, pivot or persevere, improving a product, cohort analysis, optimization versus learning, vanity metrics, actionable metrics versus vanity metrics, the value of the three a's,	
UNIT - 4	5 Hrs
Pivot, a startup's runway is the number of pivots it can still make, pivots require courage, failure to pivot, a catalog of pivots, a pivot is a strategic hypothesis, accelerate, start your engines	



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UNIT – 5	5 Hrs
Batch, small batches in entrepreneurship, continuous deployment beyond software, small batches in action, the large-batch death spiral, pull, don't push, grow, where does growth come from?, the three engines of growth, engines of growth determine product/market fit, when engines run out, adapt	
REFERENCE BOOK: 1. The Lean Startup, Eric Ries,	

COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Demonstrate knowledge of management methods			P3A6
2. Ability to experiment the strategy.			P3A6
3. Ability to frame an innovative accountability.			P3A6
4. Ability to pivot, accelerate and grow the startup's			P3A6



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Course Title	BUSINESS ANALYTICS				
Course Code	20ISCNPEBA	Credits	2	L-T-P	2-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	2	Total Lecture Hours			24

UNIT – 1	6 Hrs
<p>What Is Business Analytics?, Evolution of Business Analytics, Impacts and Challenges, Scope of Business Analytics, Software Support, Data for Business Analytics, Data Sets and Databases, Big Data, Metrics and Data, Classification, Data Reliability and Validity, Models in Business Analytics Decision Models, Model Assumptions, Uncertainty and Risk, Prescriptive Decision Models, Problem Solving with Analytics, Recognizing a Problem, Defining the Problem, Structuring the Problem, Analyzing the Problem, Interpreting Results and Making a Decision, Implementing the Solution.</p>	
UNIT – 2	3 Hrs
<p>Data Visualization, Dashboards, Tools and Software for Data Visualization, Creating Charts in Microsoft Excel, Column and Bar Charts, Data Labels and Data Tables Chart Options, Line Charts, Pie Charts, Area Charts, Scatter Chart, Bubble Charts, Miscellaneous Excel Charts, Geographic Data, Other Excel Data Visualization Tools, Data Bars, Color Scales, and Icon Sets, Sparklines, Excel Camera Tool, Data Queries: Tables, Sorting, and Filtering, Sorting Data in Excel, Pareto Analysis, Filtering Data, Statistical Methods for Summarizing Data, Frequency Distributions for Categorical Data, Relative Frequency Distributions, Frequency Distributions for Numerical Data, Excel Histogram Tool, Cumulative Relative Frequency Distributions, Percentiles and Quartiles, Cross-Tabulations, Exploring Data Using PivotTables, PivotCharts, Slicers and PivotTable Dashboard</p>	
UNIT – 3	5 Hrs
<p>Populations and Samples, Understanding Statistical Notation, Measures of Location Arithmetic Mean, Median, Mode, Midrange, Using Measures of Location in Business Decisions, Measures of Dispersion, Range, Interquartile Range, Variance, Standard Deviation Chebyshev's Theorem and the Empirical Rules, Standardized Values, Coefficient of Variation, Measures of Shape, Excel Descriptive Statistics Tool, Descriptive Statistics for Grouped Data, Descriptive Statistics for Categorical Data: The Proportion, Statistics in PivotTables Measures of Association,</p>	



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Covariance, Correlation, Excel Correlation Tool, Outliers, Statistical Thinking in Business Decisions, Variability in Samples	
UNIT – 4	5 Hrs
Modeling Relationships and Trends in Data, Simple Linear Regression, Finding the Best-Fitting Regression Line, Least-Squares Regression, Simple Linear Regression with Excel, Regression as Analysis of Variance, Testing Hypotheses for Regression Coefficients, Confidence Intervals for Regression Coefficients Residual Analysis and Regression Assumptions, Checking Assumptions, Multiple Linear Regression, Building Good Regression Models, Correlation and Multicollinearity, Practical Issues in Trendline and Regression Modeling, Regression with Categorical Independent Variables, Categorical Variables with More Than Two Levels, Regression Models with Nonlinear Terms	
UNIT – 5	5 Hrs
The Scope of Data Mining, Data Exploration and Reduction, Sampling, Data Visualization Dirty Data, Cluster Analysis, Classification, An Intuitive Explanation of Classification, Measuring Classification Performance, Using Training and Validation Data, Classifying new Data, Classification techniques, k-Nearest Neighbors (k-NN), Discriminant Analysis, Logistic Regression Association Rule Mining, Cause-and-Effect Modelingg	
REFERENCE BOOKS:	
1. Business Analytics by James Evans, persons Education. 2. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.	



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COURSE OUTCOMES (COs):

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

COURSE OUTCOMES	POs		
	1	2	3
1. Apply the knowledge of data analytics			P3A6
2. Mastery in data visualization tools to make effective analytics			P3A6
3. Demonstrate the ability to statistical methods on business data.			P3A6
4. Mastery the utilization of different kind of regression models on business data.			P3A6
5. Apply data mining techniques to extract the hidden data			P3A6



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Course Title	English for Research Paper Writing				
Course Code	20ISCNACPW	Credits	0	L-T-P	0-0-0-0
CIE	P	SEE			
Contact Hours / Week	-	Total Lecture Hours			

UNIT – 1	
Writing Skills Planning and Preparation, Word Order, Breaking Up Long Sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness, Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing	
UNIT – 2	
Sections of the Paper Titles, Abstracts, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions, Useful Phrases, The Final Check, Links and References	

TEXT BOOK:

1. English for Writing Research Papers, Adrian Wallwork, Springer Science+Business Media, LLC 2011



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Course Title	Stress Management by Yoga				
Course Code	20ISCNACSM	Credits	0	L-T-P-S	0-0-0
CIE	P	SEE			
Contact Hours / Week	-	Total Lecture Hours			-

UNIT – 1	
Introduction Overview, What is Yoga, Importance of Yoga, Yoga – Its History, Objectives of Yogic Practices, General Guidelines for Yogic Practices, Common Yogic Practices, Yama and Niyama, Asana, Pranayama, Pratyahara, Bandha Mudra, Shatkarma/Kriya, Meditation	
UNIT – 2	
Yoga for Health Overview, Surya Namaskar, Asanas, Tadasana, Vrikshasana, Utkatasana, Vajrasana, Swastikasana, Ardhapadmasana, Niralamba Bhujangasana , Ardhashalabhasana Makarasana, Uttanapadasana, Pawanamuktasana, shavasana, Breathing with Awareness, Trataka, Meditation	
UNIT – 3	
Yoga for Physical Fitness Overview, What is Flexibility, Yogic Practices to Enhance Flexibility, Surya Namaskara, Asanas, Tadasana, Hastottanasana, Trikonasana, Katichakrasana, Padmasana, Yogamudrasana, Paschimottanasana, Dhanurasana, Makarasana, Supta Vajrasana, Chakrasana, Ardhalasana, Shavasana, Kriya, Kapalabhati, Pranayama, Anuloma-viloma Pranayama, Bhastrika Pranayama, Meditation	
UNIT – 4	
Yoga for Concentration Overview, Yogic Practices for Concentration, Asana, Garudasana, Baddhapadmasana, Gomukhasana, Ardhamatsyendrasana, Bhujangasana, Shalabhasana, Makarasana, Matsyasana, Naukasana, Setubandhasana, Halasana, Shavasana, Kriya, Agnisara, Pranayama, Anuloma-viloma Pranayama, Seetkari Pranayama, Bhramari Pranayama, Meditation	



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UNIT – 5	
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Raja Yoga being lectures by the Swami Vivekananda	
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TEXT BOOKS:	
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- | | |
|---|--|
| <ol style="list-style-type: none">1. Yoga A Healthy Way of Living, National Council of Educational Research and Training, 20152. Raja Yoga , Swami Vivekananda, Weed-Parsons Printing Company, 1920. | |
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