Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VI Semester (Computer Science & Engineering)

w.e.f. July 2023

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	CS61	PEC	Professional Elective Course-II	70	20	10	-	-	100	3	1	-	4
2	CS62	OEC	Open Elective Course-I	70	20	10	-	-	100	3	1	-	4
3	CS63	PCC	Computer Networks	70	20	10	30	20	150	3	-	2	4
4	CS64	PCC	Software Engineering	70	20	10	30	20	150	3	-	2	4
5	CS65	PCC	Cryptography and Network Security	70	20	10	30	20	150	3	-	2	4
6	CS66	PI	Minor Project	-	-	-	60	40	100	-	-	4	2
7		MC	Industrial Training	Minimum Four weeks Duration. Evaluation will be done in 7th semester.									
Total				**350**	**100**	**50**	**150**	**100**	**750**	**15**	2	**10**	**22**
8	CS67	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-		8
9	CS68	MC	NSS/NCC/Swatchhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum 8 credits against additional MOOC courses in subject code CS67 for the award of Honours (Minor Specialization).									

Note: 01. Departmental BOS will decide list of three/four optional subjects those are available in MOOC,OEC as well for PEC.

02. MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator.

03. Industrial training should be apart from laboratory work unertaken in the college rather it should have industrial orientation and practical aspects/field work. Report to be sbmitted at the beginning of 7th semester and students have to give a presentation in the Department. Evaluation will be done in 7th semester.

Professional Elective Course-II		
S.No.	**Subject Code**	**Subject Name**
1	CS61A	Data Center Management
2	CS61B	Parallel Computing
3	CS61C	Blockchain Technologies

Open Elective Course-I		
S.No.	**Subject Code**	**Subject Name**
1	CS62A	Image Processing
2	CS62B	Mobile Computing
3	CS62C	Robotics

1 hour lecture (L) = 1 credit

1 hour Tutorial (T) = 1 credit

2 hour Practical (P) = 1 credit

PEC: Professional Elective Course, OEC: Open Elective Course, PCC: Professional Core Course, PI: Project and Internship, DLC: Distance Learning Course, MC: Mandatory Course

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS61A	**Data Center Management**	70	20	10	-	-	100	3	1		4

Course Contents:

Module-I: Introduction to Data Center: Role of data center in digitalization, components of datacenters, Types and tier classification of datacenters. Carbon footprints of data center, methods to reduce the carbon footprint. Natural Cooling solutions. Energy Optimization techniques in data center, Power Usage Effectiveness (PUE). Data localization: Policies resulting in need of Data centers to be hosted in the Country (GDPR, Indian Personal Data Protection bill).

Module-II: Data Center Design: features of a good datacenter Design: layout, flexibility, modularity, scalability, environmental control, network infrastructure, high availability, security and service oriented infrastructure (SOI). **Server Architecture:** Tower, Rack and Blade servers. Network server types: mail server, file server, web server etc. standalone, stateful and stateless servers. Server Clustering.

Module-II: Data Center Networking: Data Center cabling standards: TIA/EIA-942, Structured and unstructured cabling, fiber and copper cabling characteristics, cable management, bandwidth requirements, I/o connectivity. Datacenter Network design: core, aggregation and access layers. Top of rack (ToR), end of row (EOR), architectures, solutions that reduce power and cabling.

Module-IV: Virtualization: Server virtualization, Virtual machine monitors (VMM) : Type 1 and Type 2 Hypervisor, Containers; Provisioning of virtual CPUs using a Hypervisor, Virtual storage and Connectivity to storage area networks (SAN) . Case Study: VMWare workstation, / Oracle VirtualBox / Microsoft Hyper-V .

Module-V: Resource Management and Monitoring: Load balancing: Need, Types of Load balancers: internal, external, software/ hardware based, layer 4, layer 7 implementation. Load balancing algorithms: Static, dynamic, round robin, IP hashing etc.

Suggested Books:

1. Administering Data centers: servers, Storage and voice over IP, Kailas Jayaswal.
2. Data Center Handbook by Hwaiyu Geng, Wiley; 1 edition.
3. Virtualization Essentials, 2nd Edition, by Matthew Portnoy , sybax-wiley brand

Data Center Management (CS61A)
Course Outcomes: After completion of course, student will be able to:

CO1: Explain the Data Center, carbon footprint of data centers, Need of cooling, need of data localization, a good datacenter design, datacenter standards, virtual servers, load balancing and resource monitoring techniques.

CO2: Select the right type of servers, datacenter components, right design, cooling methods, cables, hypervisors, datacenter tier for max availability.

CO3: Classify types of data centers, types of servers, types of network design (TOR/EOR), types of cables, types of load balancing and types of hypervisors.

CO4: Evaluate a data center's PUE.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS61B	**Parallel Computing**	70	20	10	-	-	100	3	1	-	4

Course Content:

Module I : Introduction:
Parallel computing, scope of parallel computing, Abstract model of serial & parallel computation, pipelining, data parallelism, control parallelism, scalability , topologies in processor organization, parallel computing design consideration, parallel algorithms & parallel architectures, applications of parallel computing.

Module II : Memory Architecture:
Shared memory multiprocessors (UMA-Uniform memory Access), Distributed memory multiprocessors (NUMA- Non Uniform memory Access), SIMD, Systolic processor ,Cluster computing, Grid computing, Multicore Systems.

Module III : Introduction to Parallel Algorithms:
Introduction to parallel algorithms, parallel algorithm models, Decomposition Techniques, characteristics of tasks & interactions, mapping techniques for load balancing, methods for containing interaction overheads.

Module IV: Parallel Algorithms:
Matrix multiplication, parallel reduction, parallel sorting : bubble, quick sort, Graph algorithm: Minimum spanning tree(prim's algorithm), Fast Fourier transform: serial and transpose algorithm .

Module V : Parallel Programming Models & Performance Measures:
Paradigms, parallel programming models, shared memory programming, message passing programming , MPI , PVM ,Threads. Sources of overhead in parallel programs , performance metrics for parallel systems , effect of granularity & data mapping on performance, scalability of parallel systems, analysis of parallel programs.

Suggested Books:

1. Ananth Grama ,George Karypis, Vipin Kumar, Anshul Gupta. "Introduction to Parallel Computing", Addison.
2. Fayez Gebali , "Algorithms and Parallel Computing ", Wiley India.
3. M.Sasikumar , Dinesh shikhare, P. Ravi Prakash , "Introduction to parallel processing " Eastern Economy edition.
4. P. Venkata Krishna, Ane's , "Principles of Grid computing ", Ane Books Pvt Ltd.

Parallel Computing (CS61B)
Course Outcomes: After completion of course, student will be able to:

CO1: Understand the basics of parallel computing, including its models, techniques, and applications.

CO2: Explain different memory architectures used in parallel computing, including shared and distributed memory systems.

CO3: Describe parallel algorithm models and techniques for task decomposition, load balancing, and minimizing interaction overheads.

CO4: Apply parallel algorithms to problems such as matrix multiplication, sorting, and graph algorithms.

CO5: Evaluate parallel programming models and measure performance, considering overheads, granularity, and scalability.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS61C	**Blockchain Technologies**	70	20	10	0	0	100	3	1	0	4

Course Content:

Module I: Introduction: Block chain or distributed trust, Protocol, Currency, Cryptocurrency, How a Cryptocurrency works, Crowdfunding.

Module II: Extensibility of Blockchain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Blockchain Environment.

Module III: Blockchain Science: Gridcoin, Folding coin, Blockchain Genomics, Bitcoin MOOCs.

Module IV: Currency, Token, Tokenizing, Campuscoin, Coindrop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency.

Module V: Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations.

Suggested Books:

1. Building Blockchain Apps, Michael Juntao Yuan, Pearson Education
2. Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition
3. Bradley Lakeman, Blockchain Revolution: Understanding the Crypto Economy of the Future. A Non-Technical Guide to the Basics of Cryptocurrency Trading and Investing, ISBN: 1393889158.
4. Melanie Swan, Blockchain Blueprint for Economy, O'reilly.

Blockchain Technologies (CS61C)

Course Outcomes: After completion of the course, students will be able to:

CO1: Describe the basic concepts and technology used for blockchain, the primitives of distributed computing and cryptography related to blockchain.

CO2: Illustrate the concepts of Bitcoin and their usage.

CO3: Implement Ethereum block chain contract.

CO4: Apply security features in blockchain technologies.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS62A	**Image Processing**	70	20	10	-	-	100	3	1	-	4

Course Content:

Module I: Digital Image Fundamentals:

Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures

Module II: Intensity transformation and filtering:

Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters- first and second derivative, two-dimensional DFT and its inverse, frequency, domain filters – low-pass and high-pass.

Module III: Color Image Processing:

Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Module IV: Image Compression:

Fundamentals, Huffman Coding, Arithmetic Coding, LZW coding, Bit plane Coding, Symbol Based Coding, Block Transform Coding (walsh-Hadamard transform Discrete Cosine Transform), Wavelet Coding.

Module V: Mathematical morphology:

Erosion,Dilation,Duality,Opening And Closing,Hit-or-miss transformation, Boundary Extraction, Hole Filling, Extraction of Connected Components, convex Hull, Thinning, Thickening, Skeletons, Pruning. **Image Segmentation**: Point, Line and Edge Detection, Thresholding, Region based Segmentation.

Suggested books:

1. Rafael C. Gonzalez, Richard E. Woods "Digital Image Processing" Pearson.
2. Milan Sonka and Vaclav Hlavac and Roger Boyle "Image Processing, Analysis and Machine Vision" Springer-Science.
3. Anil Kumar Jain "Fundamental of Digital Image Processing" pearson education.
4. Rafael C. Gonzalez, Richard E. Woods , "Digital Image Processing Using MATLAB", Mc Graw Hill India.

Image Processing (CS62A)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Review the fundamental concepts of a digital image processing system.
CO2: Analyze images in the frequency domain using various transforms.
CO3: Evaluate the techniques for image enhancement and image restoration.
CO4: Categorize various compression techniques.
CO5: Interpret Image compression standards.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS62B	**Mobile Computing**	70	20	10	-	-	100	3	1	-	4

Course Content:

Module I: Signal propagation: Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading. Capacity of flat and frequency selective channels. Antennas- Antennas for mobile terminal monopole antennas, PIFA, base station antennas.

Module II: Multiple access schemes and their comparison : FDMA, TDMA, CDMA and SDMA; OFDM

Module III: Cellular concepts: Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards, GSM.

Module IV: Mobile layers: Mobile network layer - Mobile IP - Goals - Packet Delivery - Strategies - Registration - Tunneling and Reverse Tunneling -Mobile transport layer - Congestion Control - Implication of TCP Improvement - Mobility - Indirect - Snooping - Mobile - Transaction oriented TCP - TCP over wireless - Performance.

Module V: Mobile environment processing and personal area networks: Personal Area Network: Bluetooth: Protocol stack, types of bluetooth network. Mobile agents, Security of mobile computing and transaction processing in mobile computing environment. Adhoc Networks.

Suggested Books:

1. J. Schiller, "Mobile Communications", Pearson Education, Delhi.
2. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer.
3. PeiZheng, Lionei Ni, "Smart Phone and Next Generation Mobile Computing", (Morgan Kaufmann Series in Networking) , Elsevier.
4. Hansmann, LotharMerk, Martin Niclous, Stober, "Principles Of Mobile Computing", Dreamtech Press.
5. WCY Lee, "Mobile Communications Design Fundamentals", Prentice Hall.
6. AJ Viterbi, 'CDMA: Principles of Spread Spectrum Communications", Addison Wesley.
7. VK Garg&JE Wilkes, "Wireless & Personal Communication Systems", Prentice Hall.
8. Paolo Bellavista and Antonio Corradi (Eds.), "Handbook of Mobile Middleware", Auerbach Publication. Reza B'Far (Ed), "Mobile Computing Principles", Cambridge University Press. Chen &Kwai-Man Luk, "Antennas for Base Stations in wireless communications", TMH.

Mobile Computing (CS62B)
Course Outcome: After completion of the course, Students will be able to:

CO1: Understand signal propagation mechanisms, fading channels, and antenna types used in mobile communication.

CO2: Compare different multiple access schemes like FDMA, TDMA, CDMA, SDMA, and OFDM.

CO3: Explain cellular concepts such as frequency reuse and handoff, and outline 2G and 3G standards, including GSM.

CO4: Analyze mobile network and transport layer protocols, focusing on mobility management and TCP performance over wireless.

CO5: Explore personal area networks like Bluetooth, mobile security, and adhoc networks.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS62C	**Robotics**	70	20	10	-	-	100	3	1	0	4

Course Content:

Module I: Introduction: Classification ofRobots, Basic Robot Components, Manipulator End Effectors, Controller, Power Unit, Sensing Devices, Specification ofRobot System, Accuracy Precision and Repeatability. Coordinate Systems: Cartesian Coordinates, Transformation Matrices, Reference Frame Transformations, Orientation, Inverse Transformations, and Graphs.

Module II: Robotic Sensing Devices: Position, Velocity and Acceleration Sensors, Proximity and Range Sensors, Touch and Slip Sensors, Tactile Sensors, Force and Torque Sensors. Robotic Vision System: Imaging Components Picture Coding, Object Recognition, Training and Vision Systems, Review of Existing Systems.

Module III: Robotics Programming: Methods of Robotics Programming, Types of Programming, Robotics Programming Language, Artificial Intelligence. Robot Application: Material Transfer and Machine Loading Unloading, Processing Applications, Welding and Painting Assembly and Inspection, Future Robotic Application and Related Technologies Development.

Module IV: Image Identification: Lenses, Vidicon Tube, Solid-State Vision System, Image Process Binary [mage Analysis Identification, The Transformation. Actuators and Power Transmission Devices: Pneumatic and Hydraulic Actuators, Electrical Actuators, Power Transmission Trajectory Planning & Control: Manipulator Equations of Motion Manipulator Control, The Measure of the Robot.

Module V: Control: Basic Concepts in Control Systems, Digital Control for Positions. System Inte$ation: Mechanism, Actuators and Sensors

Suggested Books:

1. J.craig, "Introduction to Robotics" Addision Wesley.
2. Klafter, chmielewski and nagrin, "Robotics Engineering", Prentice hall.
3. Robert J. Schilling, "Fundamental of Robotics analysis and control", Pearson education.

Robotics(CS62C)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: To learn about knowledge for the design of robotics.

CO2: Will understand robot kinematics and robot programming.

CO3: Will understand the application of Robots.

CO4:To learn about force and torque sensing.

CO5:To learn about the application of robots.

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		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS63	**Computer Networks**	70	20	10	30	20	150	3	-	2	4

Course Content:

Module I: Computer Network:

Definitions, Goals, Components, Architecture, Classifications & Types. Layered Architecture: Protocol hierarchy, Design Issues, Interfaces and Services, Connection Oriented & Connectionless Services, Service primitives, Design issues & its functionality, ISO OSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/P. Network standardization. Queuing Models: Little's Theorem, Queuing System: M/lvV1, M,Azl/m, M/N4/oo, MIM/mJm, }1/GI l.

Module Il: Data Link Layer:

Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol. Elementary & Sliding Window protocol: l-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Bit oriented protocols: SDLC, HDLC, BISYNC, LAP and LAPB. Protocol verification: Finite State Machine Models & Petri net models.

Module III: MAC Sub layer:

MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes Contention Schemes: for Data Services (ALOHA and Slotted ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), Collision Free Protocols: Basic Bitmap, BRAP, Binary Countdown, MLMA. Limited Contention Protocols: Adaptive Tree Walk, URN Protocol, High Speed LAN: Fast Ethernet, Gigabit Ethemet, FDDI, Performance Measuring Metrics. IEEE Standards 802 series & their variants.

Module IV: Network Layer :

Need, Services Provided , Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing, Congestion Control Algorithms: General Principles of Congestion control, Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram subnets. IP protocol, IP Addresses, Comparative study of IPv4 & IPv6, Mobile IP.

Module V: Transport Layer:

Design Issues, UDP: Header Format, Per-Segment Checksum, Carrying Unicast/lVlulticast Real-Time Traffic, TCP: Connection Management, Reliability of Data Transfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP Timer Management. Session layer: Authentication, Authorization, Session layer protocol (PAP, SCP, H.245). Presentation layer: Data conversion, Character code translation, Compression, Encryption and Decryption, Presentation layer protocol (LPP, Telnet, X.25 packet Assembler/Disassembler). Application Layer: WWW and HTTP. FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP). Study of internetworking devices and their configuration- Switches, Hubs, Bridges; Routers and, Gateways etc.

Suggested Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks" Pearson Education.
2. Kaveh Pahlavan, Prashant Krishnamurthy, "Networking Fundamentals", Wiley Publication.
3. Uyless Black, "Computer Networks", PHI Publication, Second Edition.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill.

Computers Networks (CS63)

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Explain OSI and TCP/IP Protocol based reference model used for constructing Computer Networks.

CO2: Construct a computer Network using the Data Link Layer protocol and MAC Layer protocol.

CO3: Compare Routing Strategies, Networks Configuration and Various Protocols

CO4: Design computer Network by using efficient protocols and Internetworking devices,

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		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS64	**Software Engineering**	70	20	10	30	20	150	3	-	2	4

Course Content:

Module I: Introduction:
Phases in Software development, Software Development Life Cycle (SDLC), software development process models Software process models (Linear Sequential Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, and Rational Unified Process), Agile process.

Module II: Software Requirement specification (SRS):
Role of SRS, Requirements gathering and problem analysis, requirement specification, validation of SRS document. Use cases: Use case modeling, Use case diagram and use case documents/specifications.

Module III: Object-Oriented Modeling (using UML):
Analysis Modeling, Developing Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram. System and Subsystem Design, Design goals.

Module IV: Software Testing:
Unit testing, Integration testing, System testing, Regression testing, Black-box and White-box techniques, Static Techniques like code inspections, static analysis and dynamic analysis.

Module V: Software Project Management:
Software Project Planning, Cost Estimation, Scheduling, Risk Management, Quality Management, Software Change Management, Software refactoring, Re-engineering, Reverse Engineering, Defect cycle and bug management.

Suggested Course Project Work (One of the Lab Assignment) : Develop and Deploy a small project on some OSS platform like GitHub.

Suggested books:

1. R S. Pressman ,"Software Engineering: A Practitioner's Approach", McGraw-Hill.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning.
3. Sommerville,"Software Engineering", Pearson Education.
4. Grady Booch, Robart A. Maksimchuk, Michael W. Engle, Bobbij Young, Jim Conallen, and Kellia Houston, "Object Oriented Analysis & Design with Applications" , Pearson Education India.
5. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa.
6. Bernd Bruegge, Allen Dutoit: "Object-Oriented Software Engineering: Using UML, Patterns, and Java", Prentice Hall.
7. Blaha and Rumbaugh. "Object-Oriented Analysis and Modeling using UML",TMH.

Software Engineering (CS64)

Course Outcomes: After successful completion of the course, the students will be able to:

CO1: Understand and Explain concepts of software engineering such as SDIC and software process models, SRS, UML models (or Software Artifacts), software testing and software project management

CO2: Analyze SRS/problem specifications to extract relevant domain clements such as domain class, class attributes, operations and relationships between classes

CO3: Develop the use case models, analysis level class diagram and sequence diagrams for the given problem

CO4 : Design UML models such as Class Diagram, Sequence Diagram, Class Collaboration Diagram, Activity Diagram, State Transition Diagram and test cases for a given software problem.

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		Theory			Practical			L	T	P	
		End Sem	Mid Sem Exam	Quiz, Assignment	End Sem	Lab Work	Total Marks				
CS65	**Cryptography and Network Security**	70	20	10	30	20	150	3	-	2	4

Course Content:

Module-1: Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of attacks, Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, Diffie-Hellman Key Exchange, steganography, key range and key size, possible types of attacks.

Module-2: Symmetric Key Cryptography: Introduction, Algorithm Types and Modes, An Overview of Symmetric-Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard (AES),

Module-3: Asymmetric-Key Cryptography: An Overview of Asymmetric-Key Cryptography, The RSA Algorithm, Digital Signatures: Message Digests, MD5, Secure Hash Algorithm (SHA), SHA-512, Message Authentication Code (MAC), HMAC, Knapsack Algorithm.

Module-4: Internet-Security Protocols**:** Introduction, Basic Concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Hyper Text Transfer Protocol (SHTTP), Secure Electronic Transaction (SET), SSL Versus SET, Wireless Application Protocol (WAP) Security, Security in 3G, IEEE 802.11 Security.

Module-5: E-Mail and Network Security: Introduction, Privacy Enhanced Mail (PEM), Pretty Good Privacy (PGP), Secure Multipurpose Internet Mail Extensions (S/MIME), Brief Introduction to TCP/IP, Firewalls, IP Security, Authentication Header, Encapsulating Security Payload (ESP), IPSec Key Management, Virtual Private Network (VPN), Intruders.

Suggested Books:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education.
2. B. Forouzan, "Cryptography & Network Security", Tata McGraw-Hill.
3. AtulKahate, "Cryptography and Network Security," Tata McGraw-Hill.
4. Charlie Kaufman, Radia Perlman and Mike Speciner,'Network Security", Prentice Hall of India.
5. Eric Maiwald, "Fundamentals ofNetwork Security," McGraw-Hill.

Cryptography & Network Security (CS65)

Course Outcomes: Upon completion of the course, the students will be able to

CO1: Understanding of the basics of network security and cryptographic techniques.
CO2: Illustrate various symmetric key cryptographic techniques'
CO3: Evaluate the asymmetric and hash algorithms.
CO4: Discuss Internet-Security Protocols.
CO5: Discuss and design the concepts of EMail and Network Security.

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