Semester-V

Categories of Course	Course Title	Course Code	Credits = 4			Max Marks: 70 Min Marks: 22 Duration: 3:00 Hrs.
			L	T	P	
DC	Operating System	CSE -1851	3	--	2	

Prerequisites: Basic knowledge of computers, its components and programming skills

Course Objectives:
To understand operating system architecture and functioning along with in-depth knowledge of internals and working of OS modules like process management, Storage management, file system, security and protection

UNIT I : Overview-Introduction to Operating Systems, Evolution of Operating System mainframe, desktop, multiprocessor, Distributed, Network Operating System, and Clustered and Handheld System), Operating System Structure- Operating System Services and System Calls, System Programs. Types of Operating Systems: Batch Processing, Real Time, Multitasking and Multiprogramming, time-sharing system and Distributed Operating systems

UNIT II: Process Management-Concept, Process Control Blocks (PCB), Process Scheduling. Scheduling Criteria, Scheduling Algorithms and their evaluation. Threads Overview and Multithreading Models Inter Processes Communication and Critical Section Problem and Solution-Semaphores and Monitors, Deadlock Characterization, Methods for deadlock handling, deadlock prevention, deadlock avoidance, deadlock detection and recovery from deadlock

UNIT III: Storage Management-Memory Hierarchy, Concepts of memory management, MFT and MVT, logical and physical address space, swapping, contiguous and non- contiguous allocation, Paging and Segmentation Structure and Implementation of Page table, Virtual memory, Cache Memory Organization, Demand paging, Page replacement Algorithms. Thrashing, Demand segmentation

UNIT IV: File and Disk Management-File concepts, Access methods, Directory Structure, File Sharing and Protection, Free space management, Efficiency and Performance- Case study on Unix, Linux and Windows, Disk Structure and Scheduling, efficiency case study of UNIX.I?O system –Hardware ,Application, input-output interface.

UNIT V: Protection and Security- Protection Goals of Protection, Principles of Protection, Domain of Protections. Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights Security The Security Problem, Program threats system and network threats, Cryptography as s security tool, user authentication, implementation of security defense- Firewall system, Case study - LINUX and Windows

Course Outcomes

CO -1: Understanding of the inherent mechanism involved in functioning of an operating system.
CO -2: Ability to analyse various scheduling and synchronisation techniques.
CO -3: Knowledge of file systems its implementation and protection.
CO -4: Analysis of memory and device management methodology.
CO -5: Comprehensive outlook in design principles of operating systems.

References

1. Peterson, J.L. &Silberschatz, A.: Operating System Concepts, Addison, Wesley-Reading.
2. Brinch, Hansen: Operating System Principles, Prentice Hall of India.
3. Haberman, A.N.: Introduction to Operating System Design Galgotia Publication, New Delhi.
4. Tanenbaum, A.S.: Operating Systems.
5. Hansen, P.B.: Architecture of Concurrent Programs, PHI.
6. Shaw, A.C.: Logic Design of Operating Systems, PHI.

Semester:-V

Categories of Course	Course Title	Course Code	Credits = 4			Max Marks: 70 Min Marks: 22 Duration: 3:00 Hrs.
			L	T	P	
DC	Compiler Design	CSE -1852	3	--	2	

Prerequisites: Basic knowledge in Theory of Computations. Experience with programming languages such as C/C++.

Course Objectives:
The purpose of the course is to give the participants knowledge of concepts and techniques required to implement and understand different phases of compiler design

Course Contents:

UNIT I: Introduction to Compiler and Lexical Analysis Introduction to Compiler, single and multi-pass compilers, Major data Structure in compiler, Overview and use of linker and loader, Interpreter and assembler, Bootstrapping, Role of Lexical Analyzer, Various Phases of Compiler, Input buffering, Regular expression, Finite automata, Specification and Recognition of tokens, LEX.

UNIT II: SYNTAX ANALYSIS AND PARSING TECHNIQUES: Syntactic specification of programming languages: Context free grammars, derivation and parse trees, Ambiguous grammar, Introduction to Parsing and its techniques, Top-Down Parsing, Bottom Up Parsing, LR parsers(SLR, LALR, LR), Operator precedence parsing, Error Handling.

UNIT III: SYNTAX DIRECTED TRANSLATION & INTERMEDIATE CODE GENERATION Syntax-Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed Definitions, L-Attributed Definitions and Implementation of Syntax directed Translators, translation schemes.
Intermediate code and translation of assignment statements, Boolean expression and control structures, Postfix notation, Three address codes, quadruples, triples and indirect triples.

UNIT IV: Run Time Environment and Storage Allocation Storage organization, activation records, Storage allocation strategies, Access to Non local Names, Parameter passing, symbol table, data structure used for symbol table generation, dynamic storage allocation techniques.

UNIT V: Code Generation and Code Optimization Global data flow analysis, Basic Block and Flow graphs, Directed Acyclic Graph, DAG representation of Basic Blocks, Back patching, Simple Code Generator, Issues in the design of Code generator, Local optimization, dead code elimination, Loop optimization, Peephole Optimization.

Course Outcomes

CO1: Learn the fundamentals of language translator and compiler design
CO2: Ability to design algorithms for Parsers (Top-down and Bottom-Up).
CO3: Classify and discuss intermediate code generation and optimization techniques to improve the performance of a program
CO4: Gain knowledge of techniques of symbol table organization, fundamentals of runtime environment and Code generation.

Reference Books:

1. Alfred Aho, Ravi Sethi, V.Jeffery Ullman D. "COMPILERS PRINCIPLES, TECHINQUES AND TOOLS ", Addison- Wesley, 1988.
2. Alfred V Aho, Jeffrey D. Ullman, "Principles of Compiler Design", Narosa pub.
3. Compiler construction (Theory and Practice), A.Barret William and R.M. Bates, Galgotia.
4. A. C. Holub, "Compiler Design in C", Prentice-Hall Inc., 1993.
5. Raghavan, "Compiler Design", TMH Pub

Semester:-V

Categories of Course	Course Title	Course Code	Credits = 4C			Max Marks: 70 Min Marks: 22 Duration: 3:00 Hrs.
			L	T	P	
DC	Analog and Digital Communication	CSE -1853	3	--	2	

Prerequisites: Knowledge of calculus.

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding of Analog and digital communication by being able to do each of the following:

1. To introduce the concepts of analogue communication systems.
2. To equip students with various issues related to analogue communication such as modulation, demodulation, transmitters and receivers and noise performance.

Course Contents:

UNIT I :Signals Analysis: Review of Fourier Transformation, signal transformation and its properties through linear system, signal distortion in transmission, bandwidth and rise time, energy and power density and Parseval's theorem for energy and power signals, convolution &correlations.

UNIT II :Linear Modulation: Necessity of modulation, principal of amplitude modulation generation and detection of DSB-SC, SSB-SC and VSB-SC, AM-LC, Comparison of various AM systems, FDM and TDM.

UNIT III: Angle Modulation - Definition and relationship between PM ad FM frequency deviation, Bessel's function , spectrum and transmission BW of FM , NBFM,WBFM , phase diagram of FM signals in FM system s, comparison of AM and FM systems.
Digital Modulation: Block diagram of PCM system, Inter-symbol Interference, Compounding, Delta Modulation (DM), Limitation of DM, ADM, Comparison between PCM & DM, DPCM

UNIT IV : Radio transmitter and receiver: Different type of AM and FM transmitters and receivers, AM and FM standard broadcast calculation of noise for signal and cascaded stages. Noise-performance of analog communication systems: SNR, Noise figure. Line Codes.
Data Transmission: Generation and Detection of ASK, FSK, PSK, DPSK, QPSK.

UNIT V: Information Theory: Unit of Information, Entropy, Rate of Information, Joint & Conditional Entropy, Mutual Information, Channel Capacity, Shawn's Theorem, Shannon Harder Theorem, Coding Efficiency, Shannon Fano Coding, Hoffman Coding, Blocks Codes.

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Course Outcomes: The students would be able to

CO-1:Understand the fundamentals of digital and analog communication systems.
CO-2:Able to apply Fourier analysis to communication signals and derive the power spectral density of signals.
CO-3:Able to define, formulate and analyse various techniques for amplitude and angle modulation.
CO-4:Analyse different techniques for digital data transmission and analyse the performance of spread spectrum communication systems.

Reference Books:

1. Taub and Schilling: Principles of Communication System, TMH.
2. Simon Haykin: Digital Communication, John Wiley.
3. J. G. Proakis: Digital Communications, MGH.
4. G. Kennedy: Electronic Communication System, TMH.

Semester:-V

Categories of Course	Course Title	Course Code	Credits = 4C			Max Marks: 70 Min Marks: 22 Duration: 3:00 Hrs.
			L	T	P	
DC	Computer Graphics and Multimedia	CSE -1854	3	1	--	

Prerequisites: Basic Knowledge of Matrix, 2-dimensional & 3-dimensional concepts.

Course Objectives:
Throughout the course, students will be expected to demonstrate their understanding in Computer Graphics by being able to:

1. Understand the basic concepts of computer graphics and its applications.
2. Apply and analyze the algorithms to draw graphics output primitives.
3. Apply and create 2-D & 3-D transformation on various objects.

Course Contents:
UNIT I : Basic of Computer Graphics, Applications of computer graphics, Display devices, Cathode Ray Tube, quality of phosphors, CRTs for color display, beam penetration CRT, The Shadow - Mask CRT, Direct View Storage Tube,LED and LCD. Graphics input devices, Graphics software and standards, Output primitives, attributes of output primitives, point and line style, color and intensity, Area filling algorithms, Scan line algorithm, boundary fill & flood fill algorithm, Antialiasing techniques.

UNIT II : Line drawing- various algorithms and their comparison, circle generation - Bresenham's midpoint circle drawing algorithm, 2D transformation- Basic Transformations, Matrix Representation and Homogeneous Coordinates, translation, scaling, rotation, reflection, sheering, composite transformation, Window to view port transformation, line clipping algorithm; Cohen Sutherland, polygon clipping; Sutherland hodgman algorithm.

UNIT III: Need for 3-Dimensional imaging, techniques for 3-Dimesional displaying, 3D transformation, projection and its types, Curve- parametric and non parametric functions, Bezier (Bernstein Polynomials) Curves, Cubic-Splines, B-Splines, Need for hidden surface removal, Back face detection, Z-buffer method, Painter's algorithm.

UNIT IV: Shading Algorithms-Phong's shading model, Gouraud shading, Shadows and background, illumination, light sources, illumination methods (ambient, diffuse reflection, specular reflection), Color models: properties of light, XYZ, RGB, YIQ and CMY color models

UNIT V: Multimedia systems-An introduction, multimedia hardware and architecture, Data and file format standard i.e. RTF, TIFF, MIDI, JPEG, MPEG, Video- AVI, 3GP, MOV, MPEG, Compression standards, Multimedia Authoring.

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Course Outcomes

CO-1:. To understand the Graphics systems, its applications, hardware & software requirement.
CO-2: To apply scan conversion algorithms of various graphics output primitives.
CO-3 To understand the basic principles of homogeneous coordinate systems, 2-dimensional & 3-dimensional computer graphics systems.
CO-4: Understand the concept of multimedia hardware and architecture along with various file format and compression techniques.
CO-5:. To apply window into viewport, clipping algorithms of graphics objects against a window.

Reference Books:-

1. Computer Graphics C Version, Donald Hearn & M. Pauline Baker , Pearson Education, New Delhi, 2004 (Chapters 1 to 12 except 10-9 to 10-22)
2. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics- Principles and practice, Second Edition in C, Pearson Education, 2007.
3. OpenGL ES 3.0 Programming Guide 2nd Edition (English, Paperback, Budi Rijanto Purnomo, Dan Ginsburg), PEARSON.
4. Rogers, "Procedural elements of Computer Graphics", Tata McGraw Hill.
5. Parekh, "Principles if multimedia", Tata McGraw Hill.

Semester:- V

Categories of Course	Course Title	Course Code	Credits = 3			Max Marks: 70 Min Marks: 22 Duration: 3:00 Hrs.
			L	T	P	
OC-1	Principle of Programming Language	CSE - 1855(A)	3	--	--	

Prerequisites:
Knowledge of computer programming with any programming language like C/C++, Java.

Course Objectives:
To enable the students to understand the evolution of programming languages, different types of programming practices and programming languages and their distinctive features and applications, compilation basics, working and design principles of programming language constructs like data types, subprograms, blocks, control structures etc.

UNIT I: Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms — Imperative, Object Oriented, functional Programming, Logic Programming. Programming Language Implementation — Compilation and Virtual Machines, programming environments. Issues in Language Translation: Syntax, Semantics, Stages, analysis and synthesis, Parse Tree, CFG and BNF grammar.

UNIT II: Data types. Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference data types, design and implementation issues related to these data types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization. Sequence control with Expressions, Conditional Statements, Loops, Exception handling.

UNIT III: Subprograms and Blocks: Fundamentals of sub-programs, Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic subprograms, design issues for functions overloaded operators, co routines.

UNIT IV: Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, Static and Stack-Based Storage management, heap based storage management. Garbage Collection, Concurrency: Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C++ threads.

UNIT V: Exception handling, Exceptions, exception Propagation, Exception handler in C++ and Java. Logic Programming Language: Introduction and overview of logic programming, basic elements of prolog, application of logic programming. Functional Programming Languages: Introduction, fundamentals. Introduction to 4GL.

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Course Outcomes: The students would be able to
CO1: Ability to appreciate the difference between different types of programming practices and languages.
CO2: Ability to apply appropriate programming technique and language for different types of problem solving.
CO3: Ability to analyze, design and use different programming language constructs rightly.
CO4: Understanding of the implementation of programming languages.

Reference Books:

1. Sebesta,"Concept of programming Language", Pearson Edu.
2. Louden, "Programming Languages: Principles and Practices", Cengage Learning
3. Tucker, "Programming Languages: Principles and paradigms", Tata McGraw —Hill
4. Terrance W Pratt, "Programming Languages: Design and Implementation", Pearson Edu.
5. Cavlo Ghezziand Mehdi Jazayeri, "Programming Languages Concepts", Willey India
6. E Horowitz, "Programming Languages", 2nd Edition, Addison Wesley

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Semester:-V

Categories of Course	Course Title	Course Code	Credits = 3			Max Marks: 70 Min Marks: 22 Duration: 3:00 Hrs.
			L	T	P	
OC	Information Storage and Management	CSE-1855(B)	3	--	--	

Course Objective:

- Define backup, recovery, disaster recovery, business continuity, and replication.
- Examine emerging technologies including IP-SAN.
- Understand logical and physical components of a storage infrastructure.
- Identify components of managing and monitoring the data center.
- Define information security and identify different storage virtualization technologies.

UNIT I : Introduction to storage technology: Data proliferation, evolution of various storage technologies, Overview of storage infrastructure components, Information Lifecycle management, Data categorization.

UNIT II : Storage Systems Architecture: Intelligent disk subsystems overview, Contrast of integrated vs modular array, Component architecture of intelligent disk subsystems, Disk physical structure component, properties, performance, and specifications, RAID implementations, techniques, and levels along with the impact of RAID on application performance . Parity algorithms, hot sparing, Front end to host storage provisioning, mapping and operation.

UNIT III : Introduction to networked storage: JBOD, DAS, NAS, SAN, & CAS evolution and comparison. Applications', Elements, connectivity, standards, management, security and limitations of DAS, NAS, SAN, & CAS.

UNIT IV : Hybrid Storage solutions, Virtualization: memory, network, server, storage and appliances. Data center concepts and requirements, Backup and disaster recovery, principles managing and monitoring, Industry management standards (SNMP, SMI-S, and CIM), standard framework applications, Key management metrics.

UNIT V: Information storage on cloud: Concept of cloud, Cloud computing storage on cloud, Cloud vocabulary, Architectural framework, cloud benefits, cloud computing evolution, Application and services on cloud, cloud service provides and models,Essential characteristics of cloud computing, cloud security and integration.

Course Outcomes:

CO-1: Ability to identify key challenges in managing information and analyze different storage networking technologies and virtualization.

CO-2: Ability to understand components and the implementation of NAS.

CO-3: To understand CAS architecture and types of archives and forms of virtualization.

CO-4: To monitor the storage infrastructure and management activities.

Reference Books:

1. G. Somasundaram & Alok Shrivastava (EMC Education Services) editors, Information Storage and management: Storing, managing, and protecting digital information, Wiley India.
2. Ulf Troppens, Wolfgang Mueller Friedt, Rainer Erkens, Rainer Wolafka, Nils Haustein,Storage network explained : Basic and application of fiber channels, SAN, NAS, iSESI, INFINIBAND and FCOE, wiley India.
3. John W. Rittinghouse and James F. Ransome, Cloud Computing: Implementation, management and security, CRC press, Taylor Frances Pub.
4. Nick Antonopoulos, Lee Gillam, cloud computing: Principles, System & Application, and Springer.

Semester:-V

Category of Course	Course Title	Course Code	Credits=3			End Sem-30 Lab work-20
			L	T	P	
DLC	Data Communication	CSE-1855(C)	3	--	--	

Prerequisite: Knowledge of basic Computers

Course Objectives:

1. Apply frequency and time division multiplexing techniques to share network bandwidth among multiple users
2. Use data compression algorithms to maximize network throughput
3. Use queuing theory and reliability and availability techniques to meet network performance criteria

Course Contents

UNIT I: Introduction, Switching Techniques: Circuit Switching, Message Switching, Packet Switching, Protocols, Layered Network Architecture and Architecture of OSI & TCP/IP Reference model, ATM Model, ISDN and BISDN, Physical Layer Transmission Medium, Modem, Topologies.

UNIT II: Data Link Layer: Framing , HDLC, ARQ: Stop and Wait, Sliding Window. Efficiency, Error detection and Correction. CRC, Checksum, MAC Sub layer – LAN Protocols, ALOHA, Slotted, ALOHA, CSMA, CSMA/CD, Token Bus, Ring.

UNIT III: Network Layer: Routing – Data gram and Virtual Ckt, Dijkstra's, Bellman Ford, DV and Link state routing. Congestion Control and ATM Traffic Management – AAL, X.25, Internet Layer : IP Protocols, ICMP,ARP and RARP.

UNIT IV: Transport Layer: Connection Oriented transport Protocol Mechanism, TCP, TSAP, Transport Flow Regulation, UDP Fragmentation & Reassembly, Session and Transport Interaction, Synchronization Points, Session Protocols Data Unit.

UNIT V: Translation, Encryption / Decryption, Data Compression . Application Layer Protocols like: FTP, TFTP, RPC, Remote Login, DNS, SMTP, SNMP

Course Outcomes:

CO-1: Explain the role of line codes in a data communications network.
CO-2: Explain the role of digital communications devices in a data communications network.
CO-3: Describe the various types of signals and their features.
CO-4: Identify and de.ne roles and features of various data transmission protocols.
CO-5: Describe the features and functions of multiplexing and modulation.

Reference Books

1. B. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill, 2012 A.
2.Tanenbaum, Computer Networks, 5th Edition, Prentice Hall, 2010
3. W. Stallings, Data and Computer Communications, 10th Edition, Prentice Hall, 2013
4. E. R. Harold, Java Network Programming, 4th Edition, O'Reilly, 2013

Semester:-V

Category of Course	Course Title	Course Code	Credits=1C			End Sem-30 Lab work-20
			L	T	P	
DLC	Linux and Shell Programming	CSE-1856	--	--	4	

Prerequisites: Fundamentals of computer operations and programming

Course Objectives:

To provide in-depth knowledge to work with Linux Operating System so that students become capable to use Linux as open source software development platform.

Course Contents:

UNIT I:

Overview of Linux: What is Linux, Linux's Root in UNIX, Common Linux Features, Advantages of Linux, Overview of UNIX and LINUX Architectures, Linux File System, Hardware requirements for Linux.

UNIT II:

Linux File system: Logging in, getting familiar with Linux desktop, shell interface. Understanding Linux shell, using shell, types of Text editors, using vi editor, prompt character, correcting typing errors, simple shell commands-date, cal, who, tty, uname, passwd, be, echo, logging out, Environment variables, wildcard characters, absolute and relative path, listing. Files and directories commands, navigating file system-pwd, cd, mkdir, rmdir, ls, Handling or binary files, Basic file attributes- file, permissions, changing permissions.

UNIT III:

Processes and filters: Simple filters, head and tail, cut, paste, sort. uniq, tr, Regular expression, Grep utility, Shell command line, redirection, pipeline, split output, tree, and Process system, processes: internal and external commands, back ground process, premature termination of process, process priorities, process scheduling.

UNIT IV:

Shell programming: Interactive scripts, shell variables, assigning values to variables, positional parameters, command line arguments, arithmetic in shell script, exit, status of a command, sleep and wait, script termination.

UNIT V:

Decision taking,- if else, nested if, file tests, string tests, case control structure, Loop control, break, continue, logical operators and executing Script, Debugging a script, executing multiple scripts, System Administration: Configuration of Linux, Installation of Linux, Connecting to remote machines-ftp, telnet, Adding and removing users.

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Course Outcomes:

CO-1: Define the architecture of Linux operating system.
CO-2: Understanding and use of Linux system commands, tools and utilities.
CO-3: Implement Knowledge of shell programming.

CO-4: Ability to use different open source software in Linux environment.

Reference Books :

1. Venkatesh Murthy, "Introduction to Unix andShell", Pearson Edu.
2. Forouzan, "Unix and Shell Programming", Cengage Learning.
3. Sumitab Das, "Unix Concept and Application", TMH.
4. Gopalan, Shivaselvan, "Beginners Guide to Unix", PHI Learning
5. Venkatesh wavle, "Linux Programming Tools Unveiled", B S Publication.
6. Richard Peterson, "Linux Complete Reference", TMH.
7. Richard Peterson, "Unix Complete Reference", TMH.