COURSE STRUCTURE(R19)
AND
DETAILED SYLLABUS
(III YEAR)

COMPUTER SCIENCE & SYSTEMS ENGINEERING

For
B.Tech., Four Year Degree Course
(Applicable for the batches admitted from 2019-20)

LENDI INSTITUTE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution
Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with "A" Grade and NBA (CSE, ECE, EEE & ME)
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DEPARTMENT OF COMPUTER SCIENCE AND SYSTEMS ENGINEERING ENGINEERING

B. Tech III-Year Course Structure and Syllabus –R19

III Year I Sem							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19CSS-PC3101	Data Mining and Data Warehousing	PC	3	0	0	3
2	R19CSE-PC3102	Computer Networks	PC	3	0	0	3
3	R19CSS-PC3102	Compiler Design	PC	3	0	0	3
4	R19CSS-PC3103	Advanced Data Structures	PC	3	0	0	3
5	R19CSS-PE3101.1 R19CSS-PE3101.2 R19CSS-PE3101.3 R19CSS-PE3101.4 R19CSS-PE3101.5	**Professional Elective – I** 1. Embedded Systems 2. High PerformanceComputing 3. Multi Core Computing 4. GPU Computing 5. Quantum Computing	PE	3	0	0	3
6	R19CSS-PC3104	Computer Networks & Compiler Design Lab	PC	0	0	3	1.5
7	R19CSS-PC3105	Advanced Data Structures Lab	PC	0	0	3	1.5
8	R19CSS-PC3106	Data Mining and Data Warehousing Lab	PC	0	0	4	2
9	R19BSH-MC3101	Employability Skills - 2	MC	3	0	0	0
10	R19CSS-PJ3101	Socially Relevant Projects	PJ	0	0	1	0.5
11	R19CSS-MC3101	MOOCS-3	MC	0	0	0	0
12	R19CSS-SI3101	Summer Internship-1 (Evaluation)	SI	0	0	0	0
			Total	18	0	11	20.5

***Honors Course(CSS) -2**							
Track No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19CSS-HN3101	TCP/IP Protocol Suite	HN	3	1	0	4
2	R19CSS-HN3102	Secure Coding					
3	R19CSS-HN3103	Angular Framework					
4	R19CSS-HN3104	Mathematical Essential For Data Science					
***Minor Course-2**							

III Year II Sem							
S.No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19CSS-PC3201	Web Technologies	PC	3	0	0	3
2	R19CSS-PC3202	Functional Programming	PC	3	0	0	3
3	R19CSE-PC3203	Design and Analysis of Algorithms	PC	3	0	0	3
4	 R19CSS-PE3201.1 R19CSS-PE3201.2 R19CSS-PE3201.3 R19CSS-PE3201.4 R19CSS-PE3201.5	**Professional Elective courses: II** 1.Distributed Systems 2.Advanced Computer Networks 3.Human Computer Interaction 4. Cloud Computing 5. Mean Stack Technology	PE	3	0	0	3
5	 R19ECE-OE3202 R19CSE-OE3204 R19CSE-OE3205 R19CSE-OE3206 R19CSE-OE3207	**Open Elective Course-1:** 1.VLSI 2.Multimedia Application Development 3.NoSQL Databases 4. Internet of Things 5. Block Chain Technology	OE	3	0	0	3
6	R19BSH-HM3201	Managerial Economics and Financial Accountancy	HM	3	0	0	3
7	R19CSS-PC3203	Web Technology Lab	PC	0	0	3	1.5
8	R19CSS-MC3201	MOOCS-4	MC	0	0	0	0
			Total	**18**	**0**	**3**	**19.5**
***Honors Course(CSS) -3**							
Track No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
1	R19CSE-HN3201	Wireless Sensor Networks	HN	3	1	0	4
2	R19CSE-HN3202	Block Chain Technologies					
3	R19CSE-HN3203	.NET Framework					
4	R19CSE-HN3204	Natural Langauge Processing					
***Minor Course-3**							
Summer Internship-2(After Third Year & Evaluated in IV-I Semester)							

**The Eligeble students who opted the courses for B.Tech with Honors/Minor only*

Note: L-Lecture, T-Tutorial, P-Practical, C-Credits

HONOR DEGREE IN COMPUTER SCIENCE AND ENGINEERING

Track-I (Networks)

S.No	Year & Semester	Course Code	Subject Title	Category	L	T	P	C
1	II-II	R19CSS-HN2201	Data Communication	HN	3	1	0	4
2	III-I	R19CSS-HN3101	TCP/IP Protocol Suite	HN	3	1	0	4
3	III-II	R19CSS-HN3201	Wireless Sensor Networks	HN	3	1	0	4
4	IV-I	R19CSS-HN4101	Internet of Things	HN	3	1	0	4
5	II Year to IV Year	R19CSS-HNMS01.1	Honors MOOCS-1	HN	0	0	0	2
6	II Year to IV Year	R19CSS-HNMS01.2	Honors MOOCS-2	HN	0	0	0	2
							Total	**20**

Track- II(Cyber Security)

S.No	Year & Semester	Course Code	Subject Title	Category	L	T	P	C
1	II-II	R19CSS-HN2202	Information Security	HN	3	1	0	4
2	III-I	R19CSS-HN3102	Secure Coding	HN	3	1	0	4
3	III-II	R19CSS-HN3202	Blockchain Technologies	HN	3	1	0	4
4	IV-I	R19CSS-HN4102	Vulnerability Assessment & Penetration Testing	HN	3	1	0	4
5	II Year to IV Year	R19CSS-HNMS02.1	Honors MOOCS-1	HN	0	0	0	2
6	II Year to IV Year	R19CSS-HNMS02.2	Honors MOOCS-2	HN	0	0	0	2
							Total	**20**

Track III (Web Frameworks)

S.No	Year & Semester	Course Code	Subject Title	Category	L	T	P	C
1	II-II	R19CSS-HN2203	Web UI Framework	HN	3	1	0	4
2	III-I	R19CSS-HN3103	Angular Framework	HN	3	1	0	4
3	III-II	R19CSS-HN3203	.Net Framework	HN	3	1	0	4
4	IV-I	R19CSS-HN4103	J2EE Framework	HN	3	1	0	4
5	II Year to IV Year	R19CSS-HNMS03.1	Honors MOOCS-1	HN	0	0	0	2
6	II Year to IV Year	R19CSS-HNMS03.2	Honors MOOCS-2	HN	0	0	0	2
							Total	**20**

Track IV (Data Science)

S.No	Year & Semester	Course Code	Subject Title	Category	L	T	P	C
1	II-II	R19CSS-HN2203	Advanced Python Programming	HN	3	1	0	4
2	III-I	R19CSS-HN3103	Mathematical Essential For Data Science	HN	3	1	0	4
3	III-II	R19CSS-HN3203	Natural Language Processing	HN	3	1	0	4
4	IV-I	R19CSS-HN4103	Deep Learning	HN	3	1	0	4
5	II Year to IV Year	R19CSS-HNMS03.1	Honors MOOCS-1	HN	0	0	0	2
6	II Year to IV Year	R19CSS-HNMS03.2	Honors MOOCS-2	HN	0	0	0	2
							Total	**20**

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3101	Data Mining and Data Warehousing	3	0	0	3

Course objectives:

- Students will be enabled to understand and implement classical models and algorithms in Data Warehousing and Mining.
- They will learn about different tools used in data mining.
- They will learn how to analyze the data, identify the problems, and choose the relevant models and algorithms to apply
- They will further be able to assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior

Course Outcomes:

1 Understand stages in building a Data Warehouse and correlate the various system architectures.
2 Understand the need and importance of reporting and query tools.
3 Understand the need and importance of data mining functionalities.
4 Understand the process of classification.
5 Apply the Clustering techniques on sample data.

UNIT –I:

Data Warehousing:Data warehousing Components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata

Learning Outcomes:

At the end of this module student will be able to:

- Differentiate a data warehouse with data mining(L2)
- Understand different system Architectures.(L2)

UNIT –II:

Business Analysis: Reporting and Query tools and Applications – Tool Categories – The Need for Applications –Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model –OLAP Guidelines – Multidimensional versus Multi relational OLAP – Categories of Tools – OLAP Tools and the Internet

Learning Outcomes:

At the end of this module student will be able to:

- Understand the OLAP architecture(L2)
- Recognize OLAP tools.(L2)

UNIT III:

Data Mining: Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

Learning Outcomes:

At the end of this module student will be able to:

- Summarize the process of Data Mining .(L2)

UNIT –IV:

Association Rule Mining and Classification: Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

At the end of this module student will be able to:

- Experiment the process of classification on sample data.(L3)
- Construct a decision tree for any sample data.(L3)
- Apply Association rules on sample data.(L3)

UNIT –V

Clustering and Trends in Data Mining: Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

Learning Outcomes:

At the end of this module student will be able to:

- Understand the concept of Clustering.(L2)
- Apply the traditional clustering techniques on sample Data(L3).

Text Books:

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third
2. Edition, Elsevier, 2012.AULibrary.com

Reference Books:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory and Practice",Eastern Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition,Prentice Hall of India, 2006.
4. Daniel T. Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.

Subject Code	Subject Name	L	T	P	C
R19CSE-PC3102	Computer Networks	2	1	0	3

Course Objectives:

- Understand the network architecture and applications.
- Understand about the basic Networking Components and their functionality.
- Understand the functionalities of the Data Link Layer.
- Understand the protocols for data transfer.
- Analyse different protocols and architecture of IEEE 802.11

Course Outcomes:

1. Understand and Compare the Reference Models.
2. Identify the Network Components and learn about their functionality and Analyse the services provided by the Data Link Layer.
3. Analyse the services provided by the Data Link Layer to the Network Layer.
4. Understand the use of Transport Layer protocols.
5. Understand the use of DNS and Remote Login Application Layer.

Unit 1:

Overview of Data Communication and Networking: Introduction to data communications components, Data Representation, Direction of data flow, Network Criteria, Physical Structures, Protocols and Standards, Reference Model: OSI, TCP/IP Reference Model, Addressing.

Physical Layers: Overview of data(Digital & Analog), Signal (Digital & Analog), Transmission (Digital & Analog), Transmission Modes-Serial and Parallel, Multiplexing: TDM,FDM, WDM, Transmission Media: Guided and Unguided, Switching: Circuit Switched & Packet Switched.

Unit 2:

Data Link Layer: Types of erros, Framing (Bit and Character Stuffing) Error Detection: CRC, Error Correction: Hamming Code, Flow Control: Noiseless-Simplest, Stop and Wait, Noisy: Stop and Wait ARQ, Go Back N, and Selective Repeat.

Multiple Accesses: Random Access:CSMA, CSMA/CD, CSMA/CA, Controlled Access: Reservation, Polling, Token Passing.

Connecting LAN's: Connecting Device: Passive Hub, Repeaters. Active Hub, Bridges, Two Layer Switches, Routers, Gateways, Bridges- Transparent Bridges, Loop Problem , Spanning tree to eliminate Loop Problem.

Unit 3:

Addressing : IPV4 Addressing: Class full, Classless, Sub Netting, Super Netting NAT, IPv6 Addressing.

Network Layer:IPv4 Data Format, IPv6 Data Format, Address Mapping: ARP, RARP and BOOTP.
DHCP and Routing Protocols: DHCP, Delivery and Forwarding, Routing Table Format, Distance Vector Routing, Path Vector routing, Link State Routing.

Unit 4:

Transport Layer:TCP,UDP, Congestion Control: Open Loop, Closed Loop.
Quality of Service: Flow Characteristics, Techniques to Improves QOS Scheduling, Traffic Shaping, Integrated Services and Differentiated Services.

Unit –5 :

DNS: Name Space, DNS Distribution of Name Space, DNS in the Internet, Resolution, DNS

Messages.

Remote Login & Application Layer: Telnet, Electronic Mail, WWW-Architecture, URL, Web Documents, HTTP.

Text Books:

1. Data Communications and Networking ,Behrouz A Forouzan,Fourth Edition.
2. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010

Reference Books:

1. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, FirouzMosharraf, McGraw Hill Education
2. Larry L. Peterson and Bruce S. Davie, “Computer Networks - A Systems Approach” (5th ed), Morgan Kaufmann/ Elsevier, 2011

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3102	Compiler Design	3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

- The phases of acompiler
- Design of lexical analyzers, Syntax analyzers, Intermediate codegenerators
- Usage of Lex/Bison tools in writingcompilers
- Different optimizations and analyses required to do thoseoptimizations
- Issues in the code generation, code generation generationalgorithms

Course Outcomes:

The students should be able to:

Understand the basics of language processing and implement lexical analyzer for anylanguage

1. Understand the different types of parsing and implement parser for anylanguage
2. Understand the different intermediate code representations and use Syntax directed
3. definitions to design a intermediate code generators for any languageconstruct.
4. Understand the basics of data flow analysis, optimizations, and run time environment required for handling recursiveprocedures
5. Understand the issues in the code generation and code generationalgorithms.

UNIT - I:

Introduction and Lexical Analysis: Language Processors, the structure of a compiler, the science of building a compiler, phases of a compiler. Lexical Analysis: The role of the lexical analyzer, Identifying tokens, Transition diagrams for recognizing tokens, Input buffering, The lexical analyzer generator Lex, Finite automata, Conversion from regular expressions to automata, design of a lexical analyzer generator, Optimization of DFA-based patternmatchers.

UNIT - II:

Syntax Analysis: Introduction, Context-Free Grammars, BNF(Backus-Naur Form), EBNF(Extended Backus-Naur Form). Preprocessing of grammars: left recursion elimination, left factoring. Top-Down Parsing: Recursive-descent parsers, LL(1) parsers. Bottom-Up parsing: Introduction to LR parsers, Simple LR, Canonical LR, Lookahead LR. Extending parsers to handle ambiguous grammars, Parser generators Yacc/Bison.

UNIT – III:

Syntax-Directed Translation, Semantic Analysis, Intermediate Code Generation: Syntax-Directed Definitions, Evaluation orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, and Implementing L-Attributed SDD's.

Intermediate code generation: Variants of Syntax trees, Three-address code, Types and declarations, Type checking, Control flow, Back patching, Switch-Statements, Intermediate Code for Procedures.

UNIT - IV:

Code Optimization, Run-time Environment: Run-Time Environments: Storage organization, Activation record, Stack allocation, ccess to nonlocal data on the stack, Heap management, Introduction to garbage collection, Introduction to trace-based collection. Machine-Independent optimizations: The principal sources of optimization, Basic blocks and flow graphs, Introduction to data-flow analysis, Foundations of data-flow analysis, Constant propagation.

UNIT - V: Target Code Generation

Code Generation: Issues in the design of a Code Generator, The target language, Addresses in the target code, A simple code generator.

Machine-dependent Optimizations: Peephole optimization, Register allocation and assignment, Dynamic Programming code generation.

Text Books:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred VAho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman,Pearson.
2. Compiler Construction-Principles and Practice, Kenneth C Louden, CengageLearning.

Reference Books:

1. Modern Compiler ImplementationinC, Andrew W Appel, Revised edition, Cambridge UniversityPress.
2. The Theory and Practice of Compiler writing, J. P. Tremblay and P. G. Sorenson,TMH
3. lex &yacc, 2nd Edition by John Levine, Doug Brown, TonyMason

E-resources:

i. https://www.edx.org/course/compilers
ii. https://nptel.ac.in/courses/106/108/106108113/

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3103	Advanced Data Structures	3	0	0	3

Course Objectives:

- To Demonstrate the importance ofExternal Sorting.
- Describe the various implements of Hashing Techniques, variants of trees, heaps, queues and analysis
- To Deal with the Optimal, Efficient binary search trees and Multi-way Trees
- To Create awareness on Digital Search trees and tries.

Course Outcomes:

1. Understand how to handle massive amounts of data which resides in external memory i.e. disks and CDs etc using external sorting algorithms and apply external sorting algorithm on massive amounts of data.
2. Understand and implement indexing techniques using hashing techniques.
3. Apply concepts of Binary Heap and binomial queues in real time applications.
4. Apply the data structures such as Red-Black trees, splay trees and M-way search trees.
5. Apply data structures such as B trees and B+ trees in data base indexing. Understand digital search trees and tries.

UNIT-I:

Sorting: Introduction to External Sorting, External storage devices, Difference between internal sorting and external sorting, K-way(multi-way) Merging - Buffer Handling for parallel Operation- Run Generation- Optimal Merging of Runs, polyphase merge.
Dictionaries: Introduction, representation using linked list, operations.

Learning outcomes: Student should be able to

1. Understand the External sorting techniques with some examples(L2)
2. Understand Differences between internal and external sorting techniques(L2)
3. Implement the K-way Merging Techniques(L6)
4. Understand the concept of dictionaries (L2)

UNIT-II:

Hashing: Introduction, Hash Tables, Hash Function, different hash functions, types of hashing, hashing with chains, linear probing, quadratic probing, double hashing, rehashing, extendible hashing, Collisions- introduction, resolution of collision,advantages and disadvantages of hashing, applications of hashing.

Learning outcomes: Student should be able to

1. Understand the concept of Hashing (L2)
2. Implement the various techniques of Hashing Techniques(L6)
3. Understand collision resolution(L2)

UNIT -III:

Heaps: Binary Heaps-properties, types,create, insert and delete operations on binary heaps, Applications of binary heaps, Priority Queues.Binomial Queues-Introduction, properties, Binomial Queue Operations- insert, delete.

AVL Trees: Introduction, properties, operations.

Learning outcomes: Student should be able to

1. Understand the concepts of Binary Heap and Binomial Queues(L2)
2. Apply the Heap techniques in Priority Queues(L4)
3. Understand the concept of AVL trees(L2)

UNIT-IV

Red Black Trees: Definition, Representation of a Red- Black Tree, searching a Red-Black Tree, Inserting into a Red Black Tree, Deletion from a Red-Black Tree.

Splay Trees: Introduction, Splay operation- L, R, LL, LR, RL, RR Splay steps.
Multiway Search Trees: Definition, search, insert, delete operations.
Learning outcomes: Student should be able to

1. Understand different Balanced Binary Search trees like Red-Black and Splay Trees(L2)
2. Apply the data structures such as Red-Black and M-Way search trees(L4)

UNIT-V:

B-Trees: Definition, Number of Elements in a B-tree, Insertion into B-Tree, Deletion from a B-Tree. B+Tree Definition, Searching a B+Tree, Insertion into B+-tree, Deletion from a B+-Tree.
Digital Search Trees: Definition, Search, Insert and Delete operations.
Tries:introduction, types of tries- standard trie, compressed trie, suffix trie.
Learning outcomes: Student should be able to

1. Understand the concepts of B-Trees and B+ -Trees(L2)
2. Apply data structures such as B trees and B+ trees in data base indexing(L4)
3. Understand digital search trees and various kinds of tries(L2)

Text Books:

1. Data Structures, a Pseudo code Approach, Richard F Gilberg, Behrouz A Forouzan,Cengage
2. Fundamentals of DATA STRUCTURES in C: 2nd ed, , Horowitz , Sahani, Andersonfreed, Universities Press
3. Data structures and Algorithm Analysis in C, 2nd edition, Mark Allen Weiss, Pearson

Reference Books:

1. Web : http://lcm.csa.iisc.ernet.in/dsa/dsa.html
2. http://utubersity.com/?page_id=878
3. http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
4. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms
5. File Structures :An Object oriented approach with C++, 3rd ed, Michel J Folk, GregRiccardi, Bill Zoellick
6. C and Data Structures: A Snap Shot oriented Treatise with Live examples from Science
7. and Engineering, NB Venkateswarlu & EV Prasad, S Chand, 2010.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3101.1	Embedded Systems **(Professional Elective-1)**	3	0	0	3

Course Objectives:

- To introduce major components of an embedded system
- To introduce INTEL 8051 micro controller
- To explain interfacing of various communication and I/O devices to an embedded system
- To expose role of firmware, operating systems in correlation with hardware systems.
- To explain embedded software development tools
- To demonstrate implementation of embedded system

Course Outcomes:

1. Interpret embedded system and its hardware and software.
2. Comprehend the knowledge of microcontrollers
3. Develop interfacing with hardware
4. Illustrate different types of operating systems and Multitasking
5. Apply embedded Software development tools and Design and develop the embedded system

Unit 1:

Introduction to Embedded Systems: What is embedded system, embedded systems vs general computing systems, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, Processor and OS trends in embedded system. Embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, skills required for an embedded system designer, examples of the embedded systems.

Learning Outcomes:

1. Differentiate embedded system and general computing system (L4)
2. Classify embedded systems based on performance, complexity and era in which they are evolved (L4)
3. Discuss basic hardware and software units used in embedded systems (L2)

Unit 2 :

Intel 8051 micro controller: Microcontrollers and embedded processors, Introduction to Classic 8051 family Architecture, Von Neumann Architecture and Harvard architecture, Address and data bus with multiplexed I/O pins. Addressing modes, instruction set, I/O programming and other application programming in Assembly and C language.

Learning Outcomes:

1. Differentiate processor architectures (L4)
2. Discuss instruction set and addressing modes (L2)
3. Discuss basic programming in Assembly and C language (L2)

Unit 3:

Interfacing: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.

Learning Outcomes:

1. Understand and apply Interfacing (L2)
2. Understand Serial Data Communication(L2)

Unit4:

Hardware& software Codesign: Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronisation, Device Drivers, Fundamental Issues in Hardware Software Co-Design.

Learning Outcomes:

1. Understand and apply hardware & software architectures(L2)
2. Describe scheduling of Tasks(L2)

Unit 5:

Embedded Software development tools and Debugging techniques: Embedded Software development tools, Host and target systems, cross compilers, linkers, locators for embedded systems. Getting embedded software in to the target system. Debugging techniques. Testing on host machine, Instruction set emulators, logic analyzers. In-circuit emulators and monitors.

Learning Outcomes:

1. Understanding and use tools for Embedded Software development(L2)
2. Burning embedded software in to the target system(L3)
3. Apply debugging techniques (L3)

Text Books

1. Computers as Components-principles of Embedded computer system design, Wayne Wolf, Elseveir.
2. Ali Mazidi Mohammed Gillispie, Mazide Janice, "The 8051Microcontroller and Embedded Systems using assembly& C", 2nd Edition, Pearson Education, 2009.
3. An Embedded Software Primer, David E. Simon, Pearson Education.

References

1. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3rd edition, McGraw Hill Education, 2017.
2. Shibu K V, Introduction to Embedded Systems, 2nd edition, McGraw Hill Education,2017.
3. Embedding system building blocks, Labrosse, via CMP publishers.
4. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3101.2	High Performance Computing **(Professional Elective-1)**	3	0	0	3

Course Objectives

- Provide systematic and comprehensive treatment of the hardware and the software highperformance techniques invovled in current daycomputing.
- Introduce the fundamentals of high performance computing with the graphics processing units andmany integrated cores using their architectures and corresponding programmingenvironments.
- Introduce the learner to fundamental and advanced parallel algorithms through the GPU andMIC programmingenvironments
- Provide systematic and comprehensive treatment of the components in the pipeline that extractinstruction levelparallelism.
- Provide a strong foundation on memory hierarchy design and tradeoffs in both uniprocessorand multiprocessors.
- Illustrate the cache coherence and consistency problems in multiprocessors, and their existingsolutions.

Course Outcomes (COs)

1. The learner will be able to design, formulate, solve and implement high performance versions of standard single threaded algorithms
2. The learner will know and will be able to demonstrate the architectural features in the GPU and MIC hardware accelarators.
3. The learner will be able to design programs to extract maximum performance in a multicore, shared memory execution environment processor.
4. The learner will be able to design and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm.
5. The learner will be able to know about Share Memory and Parallel Programming.

Unit -1:

Graphics Processing Units: Introduction to Heterogeneous Parallel Computing. GPU architecture. Thread hierarchy. GPU Memory Hierarchy.

Unit -2:

GPU Programming: Vector Addition, Matrix Multiplication algorithms. 1D, 2D, and 3D Stencil Operations. Image Processing algorithms – Image Blur, Grayscaling. Histogramming, Convolution, Scan, Reduction techniques.

Unit -3:

Many Integrated Cores: Introduction to Many Integrated Cores. MIC, Xeon Phi architecture. Thread hierarchy. Memory Hierarchy. Memory Bandwidth and performance considerations.

Unit 4:

Message Passing Interface:MPI Introduction. Collective communication. Data grouping for communication.

Unit 5:

Shared Memory Parallel Programming: Symmetric and Distributed architectures. OpenMP Introduction. Thread creation, Parallel regions. Worksharing, Synchronization.

List of Text Books & Reference Books, On-line CourseResources

1. Wen-MeiWHwu,DavidBKirk,ProgrammingMassivelyParallelProcessorsAHands-onApproach, Morgann Kaufmann, 3e.
2. Rezaur Rahman, Intel Xeon Phi Coprocessor Architecture and Tools, Apress Open,2013.
3. Barbara Chapman, Gabriele Jost, Ruud van der Pas, Using OpenMP, MIT Press,2008.
4. Gropp, Lusk, Skjellum, Using MPI, Using MPI,2014.
5. Recent publications in IPDPS, PACT, andsimilar.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3101.3	Multi Core Computing **(Professional Elective-1)**	3	0	0	3

Course Objectives:
To learn parallel programming with graphics processing units (GPUs).
Course Outcomes: Students would learn

1. Concepts in parallel programming,
2. Implementation of programs on GPUs,
3. Debugging and profiling parallel programs.
4. 4.Student can able to solve Parallel Algorithm Design.
5. Concepts of Parallel Programming using OpenMP.

Unit-1:

Introduction: The power and potential of parallelism, Examining sequential and parallel programs, Parallelism using multiple instruction streams, The Goals: Scalability and performance portability, Balancing machine specifics with portability, A look at six parallel computers: Chip multiprocessors, Symmetric multiprocessor architectures, Heterogeneous chip designs, Clusters, Supercomputers, Observations from the six parallel computers.

Unit-2:

Reasoning about Performance: Motivation and basic concepts, Sources of performance loss, Parallel structure, Performance trade-offs, Measuring performance, Scalable performance.

Unit-3:

Multi-Core Architectures: Introduction to Intel Architecture, How an Intel Architecture System works, Basic Components of the Intel Core 2 Duo Processor: The CPU, Memory Controller, I/O Controller; Intel Core i7: Architecture, The Intel Core i7 Processor, Intel QuickPath Interconnect, The SCH; Intel Atom Architecture. Introduction to Texas Instruments' Multi-Core Multilayer SoC architecture for communications, infrastructure equipment

Unit-4:

Parallel Algorithm Design: Introduction, The Task / Channel model, Foster's design methodology, Examples: Boundary value problem, Finding the maximum, The n-Body problem, Adding data input.

Unit-5:

Parallel Programming – 1 (Using OpenMP): Designing for threads: Task decomposition, Data decomposition, Data flow decomposition, Implications of different decompositions; Challenges in decomposition, Parallel programming patters

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3101.4	GPU Computing **(Professional Elective-1)**	3	0	0	3

Course Objectives:

To learn parallel programming with graphics processing units (GPUs).

Course Outcomes: Students would learn

1. Concepts in parallel programming,
2. Implementation of programs on GPUs,
3. Debugging and profiling parallel programs.
4. Students can able to Debugging GPU Programs.
5. Case Studies.

Unit-1:

Introduction: History, GPU Architecture, Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming, CUDA OpenCL / OpenACC, Kernels Launch parameters, Thread hierarchy, Warps/Wavefronts, Threadblocks/Workgroups, Streaming multiprocessors, 1D/2D/3D thread mapping, Device properties, Simple Programs

Unit-2:

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

Unit-3:

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU

Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

Unit-4:

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects

Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Unit-5:

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning. Advanced Topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU, processing, Peer access, Heterogeneous processing

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3101.5	Quantum Computing **(Professional Elective-1)**	3	0	0	3

Course Objectives:

This course teaches the fundamentals of quantum information processing, includingquantum computation, quantum cryptography, and quantum information theory.

Course Outcomes:

By the end of this course, the student is able to

1. Analyze the behaviour of basic quantum algorithms
2. Implement simple quantum algorithms and information channels in the quantum circuit model
3. Simulate a simple quantum error-correcting code
4. Prove basic facts about quantum information channels
5. Analysis about Quntam Computing Models.

UNIT I

Introduction: Quantum Measurements Density Matrices, Positive-Operator Valued Measure, Fragility of quantum information: Decoherence, Quantum Superposition and Entanglement, Quantum Gates and Circuits.

UNIT II

Quantum Basics and Principles: No cloning theorem & Quantum Teleportation, Bell's inequalityand its implications, Quantum Algorithms & Circuits.

UNIT III

Algorithms: Deutsch and Deutsch–Jozsa algorithms, Grover's Search Algorithm, Quantum Fourier Transform, Shore's Factorization Algorithm.

UNIT IV

Performance, Security and Scalability: Quantum Error Correction: Fault tolerance; Quantum Cryptography, Implementing Quantum Computing: issues of fidelity; Scalability in quantum computing.

UNIT V

Quantum Computing Models: NMR Quantum Computing, Spintronics and QED MODEL, Linear Optical MODEL, Nonlinear Optical Approaches; Limits of all the discussed approaches,Future of Quantum computing.

Text Books:

1. Eric R. Johnston, Nic Harrigan, Mercedes and Gimeno-Segovia "Programming Quantum Computers: Essential Algorithms And Code Samples, SHROFF/ O'Reilly.
2. Dr. Christine Corbett Moran, Mastering Quantum Computing with IBM QX: Explore the world of quantum computing using the Quantum Composer and Qiskit, Kindle Edition Packt
3. V.K Sahni, Quantum Computing (with CD), TATA McGrawHill.

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3104	Computer Networks and Compiler Design Lab	0	0	3	1.5

Course Objectives:

- To write, execute and debug c programs which use Socket API.
- To understand the use of client/server architecture in application development
- To understand how to use TCP and UDP based sockets and their differences.
- To get acquainted with unix system internals like Socket files, IPC structures.
- To Design reliable servers using both TCP and UDP sockets

Course Outcomes:

1. Hands on experience with Unix System Calls.
2. Understand and explain the basic concepts of networking commands
3. Hands on experience with C language. ·
4. Understand and explain the basic concepts of networking commands
5. Understand and Implement different analyzer's , precedence Grammars

List of Programs: Computer Networks Programming

1. Implement the data link layer framing methods such as character stuffing and bit stuffing.
2. Implementation Of CRC.
3. Implementation Of Checksum.
4. Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whois etc.
5. Usage of elementary socket system calls (socket (), bind(),listen(), accept(), connect(), send(),recv(),sendto(),recvfrom()).
6. Implementation of Connection oriented concurrent service (TCP).
7. Implementation of Connectionless Iterative time service (UDP).
8. Implementation of gesockopt (), setsockopt () system calls.
9. Implementation of getpeername () system call.

List of Programs: Compiler Design

1. Lexical Analyzer
2. FIRST Function
3. FOLLOW Function
4. Operator Precedence Grammar
5. Recursive Descendent Parser

Reference Books:

1. Unix Network Programming, Volume 1: The Sockets Networking API
2. Network Programmability and Automation: Skills for the Next-Generation Network Engineer

Case Study: Client Server Chat Applications.

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3105	Advanced Data Structures Lab	0	0	3	1.5

Course Objectives:

- To develop skills to design and analyze various data structures
- To Strengthen the ability to identify and apply the suitable data structure for the given problem
- To Gain knowledge in practical applications of data structures

Course Outcomes:

1. Analyze External sorting Techniques.
2. Analyze the concepts of hashing techniques
3. Apply various operations on binary heaps and AVL-trees.
4. Implementation various operations on different advanced Trees.
5. Implementation various operations on B+ Trees

List of programs:

1.Write a program to implement functions of Dictionary.
2. Write a program to implement K-way merge
3. Write a program to implement linear probing.
4. Write a program to implement quadratic probing.
5. Write a program to implement double hashing.
6. Write a program to perform various operations i.e., insertions and deletions on AVL trees
7. Write a program to perform various operations i.e., insertions and deletions on 2-3 trees.
8. Write a program to perform various operations on binary heap.
9.Write a program to perform the following operations on Red Black trees.
   i) insert ii) delete iii) search
10Write a program to perform various operations on B+-Trees
   i) insert ii) delete iii) search

References:

1. Fundamentals of Data Structures in C: 2nd ed, , Horowitz , Sahani, Andersonfreed,
2. Universities Press
3. Data structures and Algorithm Analysis in C, 2nd edition, Mark Allen Weiss, Pearson

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3106	Data Mining and Data Warehousing Lab	0	0	3	1.5

Course Objectives:

• Practical exposure on implementation of well known data mining tasks.
• Exposure to real life data sets for analysis and prediction.
• Learning performance evaluation of data mining algorithms in a supervised and anunsupervised setting.
• Handling a small data mining project for a given practical domain.

Course Outcomes:

1. The data mining process and important issues around data cleaning, pre-processing and integration.
2. The principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction..

System/Software Requirements:

· Intel based desktop PC
· WEKA TOOL

1. Demonstration of preprocessing on dataset student.arff
2. Demonstration of preprocessing on dataset labor.arff
3. Demonstration of Association rule process on dataset contactlenses.arff using apriori
4. algorithm
5. Demonstration of Association rule process on dataset test.arff using apriori algorithm
6. Demonstration of classification rule process on dataset student.arff using j48 algorithm
7. Demonstration of classification rule process on dataset employee.arff using j48 algorithm
8. Demonstration of classification rule process on dataset employee.arff using id3 algorithm
9. Demonstration of classification rule process on dataset employee.arff using naïve bayes
10. algorithm
11. Demonstration of clustering rule process on dataset iris.arff using simple k-means
12. Demonstration of clustering rule process on dataset student.arff using simple k- means.

Subject Code	Subject Name	L	T	P	C
R19BSH- MC3101	Employability Skills- 2	3	0	0	0

Course Objectives

- Encourage use of a wide range of grammatical structures and vocabulary in speech and writing
- Demonstrate good writing skills for effective paraphrasing, argumentative essays, and formal correspondence
- Provide training and opportunities to develop fluency in English through participation informal group discussions and presentations using audio-visual aids
- Knowing the best practices at the workplace to perform well in the interview.
- Encouraging smart self-learning, communication skills that focus on employability.

Course Outcomes

1. understand the grammatical forms of English and the use of these forms in specific communicative and career context
2. use a wide range of reading comprehension strategies appropriate to texts, to retrieve information
3. strengthen their ability to write paragraphs, essays, emails and summaries
4. improve their speaking ability in English both in terms of fluency and comprehensibility by participating in Group discussion and oral assignments
5. prepare their own resume and answer interview related questions unhesitatingly with acceptable soft skills

Unit 1

Preparing for Written Assessment [6 Hours]

Grammar: Articles: Know how to use different types of Articles**,** use articles appropriately in context Identify errors in the use of articles, **Prepositions**: Learn to use prepositions in context, Identifying errors in the use of prepositions, Look at the different functions of Prepositions, **Tenses**: understand the different form of tense used in sentences, know the various purposes of using different Tense forms, Use appropriate tense forms of verbs in context, Identify the errors in the use of tense forms, **Concord**: Know how to identify Subject-Verb-Agreement in sentences, Use SVA appropriately in Context, identify the errors in the use of SVA, **Voices**: Know when to use Active or Passive Voice, Convert Active sentences to Passive ones, Relative Clause: Know what relative pronouns are, know when to use relative clauses, know the functions of Relative Clauses.

Soft Skills: Leadership: Introduction to Leadership, Leadership Power, Leadership Styles, And Leadership in Administration. **Interpersonal Relations**: Introduction to Interpersonal Relations, Analysis of different ego states, Analysis of Transactions, Analysis of Strokes, Analysis of Life position

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ Comprehend the factors that influence use of grammar and vocabulary in speech and writing(L3)
- ➢ Produce a range of valid grammatical sentences in the real world situations and professional environment.(L3)
- ➢ develop employability skills through Leadership skills and interpersonal skills (L3)

Unit 2

Reading Comprehension **[6 Hours]**

Purposes & Strategies of Reading: know the general purpose of Reading, assess your skills of reading ,develop reading Strategies **Skimming for details**: Skim through a variety of passages, understand how skimming will orient you to the text, **Identifying main Ideas**: Identify the main ideas in the give text, Look for supporting statements in a passage, understand how the writer supports main ideas with details **Scanning for information:** Scan passages for factual information, understand how scanning can help find certain answers quickly, know how to look for factual answers, **drawing inferences:** Understand how to draw inferences, infer meanings while reading passages, **vocabulary**: Learn strategies to understand difficult words used in the passage, Apply strategies of reading to understand a variety of passages, **practice tests**

Soft Skills: Communication: Introduction to Communication, Flow of Communication, Listening, Barriers of Communication, How to overcome barriers of communication. **Stress Management**: Introduction to Stress, Causes of Stress, Impact Stress, Managing Stress

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ assess the reading skill by developing reading strategies (L3)
- ➢ Understand the skimming & scanning techniques orients to identify the theme, purpose and statements.(L2)
- ➢ develop employability skills through communication skills and stress management(L3)

Unit 3

Writing paragraphs & Essays **[6 Hours]**

Features of Good Writing: understand what makes a piece of writing good, Analyze & discuss some samples of good & bad writing, **Gathering Ideas**: Discuss various techniques for gathering ideas before you start writing, practice some of the techniques that can be used in the Prewriting stage ,**Purposes of Writing:** understand the importance of purpose of writing, explore various purpose of writing, choose content & language based on the purpose **Writing for Specific audience:** Study ways of tailoring content to suit a target audience, analyse text to deduce the target audience, discuss how language is used to suit the target audience **organizing ideas:** understand the importance of organising ideas in a text, Learn the different ways of organising ideas, practice organising ideas while writing **Writing an introduction:** Know the importance of a good introduction, understand the different ways in which writers catch the attention of readers, **Developing supporting ideas:**Learn how to develop your ideas in a paragraph, discuss a variety of supporting ideas ,**Writing a conclusion:**Learn the different parts of a conclusion, Practice writing an effective conclusion **Using linkers:**Learn the different types of Linkers or cohesive devices, Discuss why it is important to use connectors in writing, **Choosing the right words:** Discuss why writers make a careful choice of language,Learn how to select language to make the intended impact, **Writing film & book reviews:** Learn the different categories of books & films,Know the elements which go into analysing books & films,Write your own film & book reviews **Common errors in writing, editing & proofreading**.:Practice correcting errors in basic sentence structure,Learn to proof-read & edit your draft before writing the final version

Soft Skills:Group Dynamics and Team Building: Importance of groups in organization,Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, How to build a good team?

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ produce logically coherent argumentative essays (L3)
- ➢ understand the use of passive voice in academic writing (L2)

- ➢ use appropriate vocabulary to express ideas and opinions (L2)
- ➢ develop employability skills through group dynamics and team building (L3)

Unit 4

Preparing for oral Assignment [6 Hours]

Group Discussion: Group Discussions as a tool for selection, skills for GD,Leadership & Problem-Solving Skills, Types of GD, Group Dynamics, Roles & Functions: Beginning, Presenting, Elaborating, Roles & Functions: Clarifying, Synthesising & Challenging, Roles &Functions: Agreeing, Disagreeing & Summarizing., Etiquette: Body Language & Time Management, GD Activities

Soft Skills: Conflict Management:Introduction to Conflict, Causes of Conflict, Managing Conflict **Time Management:** Time as a Resource, Identify Important Time Wasters, Individual Time Management Styles, Techniques for better Time Management.

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ participate in group discussions using appropriate conventions and language strategies and develop advanced listening skills for in-depth understanding of academic text(L3)
- ➢ collaborate with a partner to make discussions (L2)
- ➢ develop employability skills through conflict management and time management(L3)

Unit 5

Interview Skills [6 Hours]

Purpose of interviews: Know what recruiters looking for during Interviews,Become familiar with the process of career search, understand your skills,interests,achievements and attitude better **Preparing a Resume:**Understand what a job application is,know the details to be included in a CV,Know how to lay out details of a CV & prepare CV on your own **Writing a Cover Letter:**Study the information which is included in a cover letter.Learn how to organise information in a cover letter ,**Before and at the interview:**Learn how to prepare for an interview,learn how to behave during the interview, discuss what the interviewer might assess you on **Answering FAQs about yourself & your families:**Learn how to answer questions about yourself & family, Learn how to identify & talk about your strengths and Weaknesses **Answering FAQs about Likes & Dislikes:**Learn to choose interests which will be relevant to your Interview.learn to speak about your likes & Dislikes **Answering FAQs about Justifying your candidature:**Know what you need to say to answer a question about yourself, Be able to answer questions about your suitability for a job **Answering FAQs about Priorities,Attitudes & Biases:**Understand what your priorities will be in a job & learn to talk about them,learn to correct understanding of your attitude, biases & prejudice, if any, towards others,know positive qualities that are valued at work **Answering FAQs about Professional goals:** Become aware of the things you need to keep in mind while choosing a job,Set goals for your professional growth & plan how to achieve them **Public Speaking: Planning, Practice & Delivery:**Plan one minute speeches on simple topics, understand how to capture the audience's attention, be able to create strong closing statements.

Soft Skills:Motivation: Introduction to Motivation, Relevance and types of Motivation, Motivating subordinates, Analysis of Motivation

Learning Outcomes

At the end of the module, the learners will be able to

- ➢ prepare a CV with a cover letter to seek internship/ job (L2)
- ➢ understand the structure of Interviews and familiar with frequently asked questions while interview and how to respond to it (L3)
- ➢ develop employability skills through motivation and analysis of motivation (L3)

ASSESSMENT

The learners will demonstrate their knowledge and abilities through completion of the

following required assessments while or at the end of this course. —1 Quiz, 1 GD, 2 Activities on Interview Readiness and Softskills, 1 Personal Interview

Quiz: (10M)

Quiz is conducted on Grammar, Vocabulary and Reading Comprehension. The Quiz consists of 50 questions and will be scaled down to 10 Marks. Duration of the quiz is 1hr 30 Min only and it is Computer Based Test (CBT)

Resume:(10 M)

Each student is required to submit 3 independently written Resumes during the course. Specific requirements for each one are accessed on the following Link: https://docs.google.com/document/d/1W15961dOEnIxlnMm9BKyO8L9WIa7nPbEfgR-9DT_mRg/edit?usp=sharing

GD:(10 M)

1. Each student has to perform 5 Group Discussions during the course on a peer evaluation basis which fetches them 5 Marks.
2. The Final Assessment through one formal GD by the Internal Examiner is for 5 marks.

The GD will be assessed on the following criteria :

- Content (3M)
- Body Language(2M)
- Group dynamics & Leadership Skills (3M)
- Communication Skills (2M)

Soft Skills:(10M)

Student will be Assessed on

- Presentation of his/her Readiness of Interview (Grooming) with Prepared Resume (5M)
- Aptitude based question/Case study/Behavior based Question (5M)

Activities on Interview Readiness:(10M)

The external Examiner assess on Interview readiness

1) **Tell something about Yourself (5M)**

   Assessment Parameters:

   a) Initiation
   b) Confidence level
   c) Body Language
   d) Attention Grabbing

2) **JAM/Face to Face Interview (5M):**Student will be given a topic on-Spot for JAM and will be assessed by the External examiner on
   - Flow of Speech (2M)
   - Accuracy and Language (2M)
   - Confidence (1M)

Grading:

Assessment Model	Points
Quiz	**10**
Resume	**10**
GD	**10**
Soft Skills Activity	**10**
Personal Interview	**10**
Total	**50**

Pass Criterion:

1. Student has to Secure 30 Marks to pass this examination
2. Student who has an achievement certificate of any National or International Level Quiz/Psychometric Analysis, he/she has to secure a Minimum 20 Marks in this examination (Certificate+20 Marks) to pass the summative exam.
3. Clearing all categories is mandatory. Need to get 60% in each category.
4. 20M +Certificate=Successful or 30M+No certificate=Successful

Subject Code	Subject Name	L	T	P	C
R19CSS-HN3101	TCP/IP Protocol Suite **(Honors Courses 2: Track-1)**	3	1	0	4

Course Objectives:

- To understand the architecture and principles of today's Internet.
- To understand the various protocols and their functionalities.
- To understand the **Congestion and Quality of Service**
- To understand the **Queue Management**
- To understand the requirements for the future Internet and its impact on the computer network architecture.

Course Outcomes:

1. Understand different reference models and networking Devices .
2. Analyze the various protocols and IP addressing.
3. Illustrate different methods to handle Congestion Control.
4. Analyze the **Queue and** Buffer Management.
5. Analyze **Stream Control Transmission Protocol**.

UNIT – I :

Overview Network Models: Layered Tasks, The OSI Model, Layers in OSI Model, TCP/IP Protocol suite,Addressing. Connecting devices: Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks.

Learning outcomes: Student should be able to

1. Acquire the knowledge on basic arrangement of nodes (computers) in the network(L2)
2. Analyze the structure of layers in the network OSI and TCP/IP Reference Models(L4)

UNIT – II :

Properties of the Internet, Internet Architecture, Interconnection through IP Routers TCP, UDP & IP: TCP Services, TCP Features, Segment, A TCP Connection, Flow Control, Error Control, Congestion Control, Process to Process Communication, User Datagram, Checksum, UDP Operation, IP Datagram, Fragmentation, Options, IP Addressing: Classful Addressing, IPV6.

Learning Outcomes: Student should be able to

1. Acquire the knowledge on different Protocols (L2).
2. Analyzethe IP addressing scheme(L4)

3.Analyzethe header formats (L4)

UNIT – III :

Congestion and Quality of Service: Data Traffic, Congestion, Congestion Control, Congestion Control in TCP, Congestion Control in Frame Relay, Source Based Congestion Avoidance, DEC Bit Scheme, Quality of Service, Techniques to Improve QOS: Scheduling, Traffic Shaping, Admission Control, Resource Reservation, Integrated Services and Differentiated Services.

Learning Outcomes: Student should be able to

1. Acquire the knowledge on **Congestion**control (L2)
2. Analyze the how to Improve Quality of Service (L4)

UNIT – IV :

Queue Management: Concepts of Buffer Management, Drop Tail, Drop Front, Random Drop, Passive Buffer Management Schemes, Drawbacks of PQM, Active Queue Management: Early Random Drop, RED Algorithm.

Learning Outcomes: Student should be able to

1. Acquire the knowledge on **Queue Management** (L2)
2. Analyze thePQM(L4)

UNIT – V :

Stream Control Transmission Protocol: SCTP Services, SCTP Features, Packet Format,FlowControl, Error Control, Congestion Control. Mobile Network Layer: Entities and Terminology, IP Packet Delivery, Agents, Addressing, Agent Discovery, Registration, Tunneling and Encapsulating, Inefficiency in Mobile IP.

Learning Outcomes: Student should be able to

1. Acquire the knowledge on **Stream Control Transmission Protocol** (L2)
2. Analyze the how IP Packet Delivery process (L4)

Text Books:

1. Behrouz A Forouzan, "TCP/IP Protocol Suite", TMH, 3rd Edition
2. B.A. Forouzan, "Data communication & Networking", TMH, 4th Edition.

References:

1. Mahbub Hasan & Raj Jain, " High performance TCP/IP Networking", PHI -2005
2. Douglas. E.Comer, "Internetworking with TCP/IP ", Volume I PHI
3. Larry L. Perterson and Bruce S. Davie , "Computer Networks- A Systems Approach", 2011, Morgan Kaufmann
4. Jochen Schiiler, "Mobile Communications", Pearson, 2nd Edition.

Subject Code	Subject Name	L	T	P	C
R19CSS-HN3102	Secure Coding **(Honors Courses 2: Track-2)**	3	1	0	4

Course Objectives:

- To understand the security development process.
- Knowledge of outline of the techniques for developing a secure application.
- To handling dynamic memory management effectively.
- Knowledge on stored procedures and XSS attacks.
- Acquire knowledge on software architecture and design.

Course Outcomes: At the end of the course, student will be able to

1. Analyze secure systems and various security principles.
2. Demonstrate the development of process of software leads to secure coding practices
3. Apply Secure programs and various risk in the dynamic memory management.
4. Understand XSS related attacks and remedies
5. Understand various software architecture models.

UNIT–I:

Introduction-Need for secure systems, Proactive security development process, Security principles to live by and threat modeling.

Learning Outcomes:student will be able to

- Understand the need of secure system (L2).
- Analyzesecurity development process(L4).
- Analyze various threats in secure systems (L4).

UNIT–II:

Secure Coding in C-Character strings- String manipulation errors, String Vulnerabilities and exploits Mitigation strategies for strings, Pointers, Mitigation strategies in pointer based vulnerabilities Buffer Overflow based vulnerabilities.

Learning Outcomes:student will be able to

- Describe the string manipulation errors (L2).
- Analyze the string buffer overflow Vulnerabilities (L4).
- Analyzemitigation strategies for strings (L4).

UNIT–III:

Secure Coding in C++ and Java-Dynamic memory management, Common errors in dynamic memory management, Memory managers, Double –free vulnerabilities, Integer security, Mitigation strategies.

Learning Outcomes:student will be able to

- Analyze errors in dynamic memory management (L4).
- Analyze double free vulnerabilities (L4).
- Apply integer security to various applications (3).

UNIT–IV:

Database and Web Specific Input Issues-Quoting the Input, Use of stored procedures, Building SQL statements securely, XSS related attacks and remedies.

Learning Outcomes:student will be able to

- Understand the stored procedures (L2).
- Implement SQL statements related to security (L5).
- Analyze XSS attacks and remedies (L4).

UNIT–V:

Software Security Engineering-Requirements engineering for secure software: Misuse and abuse cases, SQUARE process model Software security practices and knowledge for

architecture and design.

Learning Outcomes:student will be able to

- Describe Misuse and abuse cases in requirements engineering (L2).
- Understand software security practices (L2).
- Understand software architecture and design (L2).

Text Book:

1. Michael Howard, David LeBlanc, "Writing Secure Code", Microsoft Press, 2nd Edition, 2003.

Reference Books:

1. Robert C. Seacord, "Secure Coding in C and C++", Pearson Education, 2nd edition, 2013.
2. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, "Software Security Engineering: A guide for Project Managers", Addison-Wesley Professional, 2008.

Subject Code	Subject Name	L	T	P	C
R19CSS-HN3103	Angular Framework **(Honors Courses 2: Track-3)**	3	1	0	4

Course Objectives:

- Understand model view framework for building applications.
- Create modules for binding the application.
- Understand dependency injection for implementing services.
- Create and establish routes redirects and navigation.
- Validate forms for the submission of data.

Course Outcomes:

1. Create Angular component using angular dependencies.
2. Apply data binding objects for implementing modules.
3. Create service and retrieve rest call data.
4. Understand routes and their configuration in angular.
5. Implement form handling with event driven apps.

Unit I:

Angular –Introduction to Angular, AngularJS vs Angular, MVC Framework, Component Based Model, Setting Up Angular, Installation of Node and NPM, Angular CLI, Creating and Running Project, Dependencies, App Component, Anatomy of Component, Creating Components.

Learning Outcomes:student will be able to

- Understand MVC framework for building applications.(L2)
- Understand the installations of Node, NPM and angular.(L2)
- Create Components using angular dependencies. (L4)

Unit II:

Data Binding: Introduction to Data Binding, Types of Binding, Binding Data from Component, Async, Template Interpolation, Looping with ngFor, Condition with ngif, Passing inputs and variables to Components, ngModel for 2-way binding, ngOnInit, Styling with components, Creating multiple modules

Learning Outcomes: Student will be able to

- Understand data binding for components. (L2).
- Implement looping and decision making for components.(L4).
- Create components and modules for binding data from the applications.(L4)

Unit III:

Dependency Injection: Understanding Dependency Injection(DI), Services, Creating a Service, Service Injection Context, Rest Calls with HttpClient, Building Angular Project.

Learning Outcomes: Student will be able to

- Understand the dependency injection and its types. (L2)
- Create rest based calls from client using HttpClient. (L4)
- Create Angular project by building angular services .(L4)

Unit IV:

Routing & Wrap Up: Introduction to Routing, Angular Project with routing, Creatingroutes, Route redirects and wild cards, Configuring child routes, Navigation for routes, Wrap Up

Learning Outcomes: Student will be able to

- Understand routing with angular (L2)
- Create and redirect routes for navigation. (L4)
- Implement wild cards and wrap up for building angular project. (L4)

Unit V:

Form Handling : Introduction to Form Handling, Form Validation, ng-minlength, ng-

maxlength, ng-pattern, ng-required, Submitting Forms, Event Handling with Forms.

Learning Outcomes: Student will be able to

- Understand the working of forms and its validations. (L2)
- Implement event handling methods for form submissions. (L4)

Applications:

- Online web applications
- Financial, banking applications and gateways etc
- Online and Social media applications

Text Books:

1. Angular 6 by Example: Get up and running with Angular by building modern real-world web apps, 3rd Edition, by Chandermani Arora.
2. Pro Angular 6, Apress, by Adam Freeman

Reference Books:

1. Angular JS by Green, Orielly

2. Professional AngularJS (WROX), by Valeri Karpov

Subject Code	Subject Name	L	T	P	C
R19CSS-HN3104	Mathematical Essential For Data Science **(Honors Courses 2: Track-4)**	3	1	0	4

Course Objectives:

1. To introduce the various mathematical concepts and models, and provide skills required to implement the models.
2. To undertake a critical evaluation of a wide range of numerical and data.
3. To develop designing skills for modeling non-deterministic problems.

Course Outcome:

1. Apply linear algebra in data science problems
2. Apply decompose the matrices to solve data science problems.
3. Demonstrate the data analysis using regression models.
4. Apply the optimization techniques to data science models.
5. Demonstrate with illustrative examples using sampling theorey in data science models.

Unit-1

Linear Algebra (All theorems without Proofs): Introduction to Data Science. Importance of Mathematics in Data Science. Vector spaces and subspaces, basis and dimensions, rank, null space, linear transformations, basic properties-invertible lineartransformation, matrices of linear transformations. Inner products space, orthogonality, orthonormal basis, Gram-Schmidt orthogonalisation.

Unit-2

Matrix Decompositions: The LU decomposition, The Cholesky decomposition, QR decomposition, Singular value decomposition (SVD), Eigen values and Eigen vectors using **t**he power method.

Unit-3

Linear Regression: Linear Models, Simple Linear Regression, Multiple Regression Generalized Linear Models: Logistic Regression, Poisson Regression, other Generalized Linear Models: Survival Analysis, Nonlinear Models: Splines, Decision- Random Forests.

Unit-4

Optimization – Jacobian, hessian, convex sets, convex functions and its properties, Unconstrained and Constrained optimization, Lagrange's Method, Kuhn-tucker conditions, Numerical optimization techniques for constrained and unconstrained optimization: Newton's method, Steepest descent method, Penalty function method. Linear Programming Problems, Simplex Method.

Unit-5

Statistics and Hypothesis Testing:, Basic Fundamentals of Sampling, Simple Random Sampling, Stratified Random Sampling, Bootstrap Methodology, Sampling distributions and Functions of random variables, Statistical inference, Methods of point estimation of parameters, Point and confidence interval estimation, and test of hypothesis, Test of hypothesis for attributes and, t-distributions, p-values, Z-scores, z-tests, and t-tests.

Text Books

1. Jin Ho Kwak and Sungpyo Hong, Linear Algebra, Second edition Springer(2004)(For Unit-1).
2. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.
3. Matthias Dehmer, Salissou Moutari, Frank Emmert-Streib, Mathematical Foundations of Data Science Using R, De Gruyter Oldenbourg, 2020(for Unit-5).
4. Norman Matloff, Probability and Statistics for Data Science: Math + R + Data, CRC Data Science Series, 2019.
5. S.D.Sharma, Operations Research, Kedar Nath Ram Nath & Co. Meerut(for Unit-4)

6. Jared P. Lander, R for Everyone Advanced Analytics and Graphics, , Pearson(Unit-3)
7. D. S. Watkins, Fundamentals of Matrix Computation, 2nd Edition, Wiley, 2002(Unit-2)
8. William G. Cochran, Sampling Techniques, John Willey, 1977(for Unit-5).

References

1. Bradley Efron, R.J. Tibshirani, An introduction to the bootstrap, Chapman and Hall/CRC 1994.
2. D. G. Luenberger and Y. Ye, Linear and Nonlinear Programming, 3rd Edn., Springer, 2010.
3. Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Introduction to Linear Regression Analysis by (Wiley).
4. E. K. P. Chong and S. H. Zak, An Introduction to Optimization, 2nd Edn., Wiley India Pvt. Ltd., 2010.
5. G. James, D. Witten, T. Hastie and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R (Springer Texts in Statistics), Springer, 2013.
6. Gene H. Golub, Charles F. Va n Loan, Matrix Computations, The Johns Hopkins University Press, 2013.
7. Heumann, Christian, Schomaker, Michael, Shalabh, Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R, Springer 2016
8. Irwin Miller, Marylees Miller, Probability and Statistics for Engineers.
9. J. Nocedal and S. J. Wright, Numerical Optimization. New York: Springer Science+Business Media, 2006.
10. J. S. Rosenthal, A First Look at Rigorous Probability Theory (Second Edition). Singapore: World Scientific Publishing, 2006.
11. C.R. Rao, H. Toutenburg, Shalabh, and C. Heumann, Linear Models and Generalizations - Least Squares and Alternatives (Springer, 2008)
12. Nathan Carter, Data Science for Mathematicians, CRC Press, Taylor & Francis Group, 2021.
13. Norman R. Draper, Harry Smith ,Applied Regression Analysis ,Wiley
14. P.S.R.S. Rao, Sampling Methodologies and Applications, Chapman and Hall/ CRC
15. Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Liquet, The R Software-Fundamentals of Programming and Statistical Analysis -, Springer 2013
16. Robert V. Hogg. Allen T. Craig, Introduction to. Mathematical. Statistics, Pearson Education
17. S. Axler, Linear Algebra Done Right (Third Edition). Springer International Publishing, 2015.
18. W.G. Cochran, Sampling Techniques : Wiley
19. Trevor Hastie, Robert Tibshirani, Jerome Friedman, Data Mining, Inference, and Prediction,Springer.
20. W John Braun, Duncan J Murdoch, A First Course in Statistical Programming with R, Cambridge University Press 2008.
21. W. Cheney, Analysis for Applied Mathematics. New York: Springer Science+Business Medias, 2001.

III Year-II Semester

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3201	Web Technologies	3	0	0	3

Course Objectives:

- Creating Web User Interfaces
- Creating dynamic Web pages
- Implementing the usage of Scripts in Web Pages
- Analyzing real world objects into Web Pages as Scripts Handlers
- Analyzing look and feel kind of applications which are useful for real world
- Web framework implementation using Model View Controller
- Writing background scripts to run the virtual machines and servers
- Interpreting the server side scripts to call Remote procedural calls back to client

Course Outcomes:

1. Demonstrate knowledge on web page design elements.
2. Design web pages with dynamic content
3. Create Responsive layout with customized forms
4. Write simple client-side scripts using AJAX
5. Build web applications using PHP

UNIT-I:

HTML

Introduction: Fundamentals of HTML, Working with text,Organizing text in HTML, Working with links and URLs, Creating tables, Working with images, Canvas, Forms, Frames and Multimedia.

HTML5: Introduction, HTML5 document structure, Creating editable content, Checking spelling mistakes, Exploring custom data attributes, Client-Sid storage, Drag and drop feature, Offline web applications, Web communications, Cross-Document messaging and desktop notifications.

Learning Outcomes:

After completion of this unit, student will be able to

1. Identify basic steps that are followed to develop web applications [L2]
2. Understand the functions of different HTML5 tags and how to use them [L2]
3. Design and develop basic web pages using HTML5[L3]

UNIT-II:

CSS AND JAVASCRIPT

CSS: Introduction, CSS selectors, Inserting CSS in an HTML document, Backgrounds, Fonts, and Text styles, Creating boxes, Displaying, Positioning and floating elements, Features of CSS3,Media queries. Javascript: Overview of JavaScript, JavaScript functions, Events, Image maps and animations, JavaScript objects, Working with browser and document objects.

Learning Outcomes:

After completion of this unit, student will be able to

1. Learn the basic syntax of the CSS Style rule[L2]
2. Get an idea about different CSS Selectors[L2]
3. Use style rules to apply styles to different elements[L3]
4. Understand HTML5 DOM object hierarchy[L2]
5. Understand java script event handling mechanism[L2]

UNIT-III:

JQUERY and BOOTSTRAP

JQuery: Introduction, JQuery selectors, Events, Methods to access HTML elements and attribute. Bootstrap: Getting started with Bootstrap, Creating responsive layouts using

Bootstrap CSS - Basic HTML structure for Bootstrap, Responsive classes, Rendering images, the grid system, Constructing data entry forms.

Learning Outcomes:

After completion of this unit, student will be able to

1. Understanding the Bootstrap file structure[L2]
2. Learning the basics of responsive design[L2]
3. Understanding the all-important grid system in Bootstrap[L2]
4. Introduce Bootstrap as a responsive design framework[L2]

UNIT-IV

XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches,

AJAX A New Approach: Introduction to AJAX, Integrating PHP and AJAX.

Learning Outcomes:

After completion of this unit, student will be able to

1. Learn the basic building blocks of XML Documents [L1]
2. Understand how name clashes are avoided using namespaces [L2]
3. Learn how to create forms dynamically [L2]
4. Learn how to generate dynamic tables[L2]
5. Write interactive web applications using AJAX [L3]

UNIT-V:

INTRODUCTION TO PHP

Introduction, Data types, Variables, Constants, Expressions, String interpolation, Control structures, Functions, Arrays, Embedding PHP code in web pages, Object Oriented PHP.

PHP Web forms: PHP and web forms, Sending form data to a server, Working with cookies and session handlers PHP with MySQL: Interacting with the database, Prepared statement, Database transactions.

Learning Outcomes:

After completion of this unit, student will be able to

1. Examine the relationship between PHP and MySQL L2]
2. Plan a PHP Web application [L4]
3. Create and use a Logon Window [L6]
4. Manage User sessions using cookies and sessions [L3]

Text Books:

1. Kogent Learning Solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQuery, Dreamtech Press, Second Edition, 2016.
2. W. Jason Gilmore, Beginning PHP and MySQL, APress, Fourth Edition, 2011.

Reference Books:

1. Snig Bahumik, Bootstrap Essentials, PACKT Publishing, 2015 (e-book).
2. Thomas A. Powell, The Complete Reference: HTML and CSS, Tata McGraw Hill, Fifth Edition, 2010.
3. Andrea Tarr, PHP and MySQL, Willy India, 2012.
4. Ruby on Rails Up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006)

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3202	**Functional Programming**	3	0	0	3

Course Objectives:

- To understand and describe syntax and semantics of programming languages
- Understand the significance and implementation of programming languages in a compiler or interpreter.
- To implement programs in an Imperative, functional, logical and object-oriented programming languages.
- Learning principles to design new programming languages.
- Increase capacity to express programming concepts alternative ways.

Course Outcomes:

1. Analyze syntax and semantic of programming languages and design parsers for the grammars.
2. Design and implement the concepts of data types, arrays, pointers and control structures in various programming languages**.**
3. Design and implement basic concepts of subprograms in various programming languages
4. Design and implement basic concepts of OOPs, Multithreading and Exception handling in various programming languages.
5. Acquire the basic knowledge of lambda calculus, functional programming languages, Programming with Scheme, Programming with ML and Acquire the basic knowledge of Logic programming, Prolog and Multi-paradigm languages.

UNIT-I

Prelimenary concepts: Reasons for studying,concepts of programming languages,language evaluation criteria,influences on language design,language categeories,programming language implementation-complilation,hybrid implementation,pure implementatiom,virtual machines

Methods of describing syntax-BNF,EBNF for common programming language features,parse tree,ambiguous grammar,attribute syntax and semantics:Genaral problem of describing syntax and semantics

Learning Outcomes:

Student can be able to

- Understand the syntax and semantics of programming languages
- Design the parsers of given grammar

UNIT-II

Data types and Basic statements: Names, variables, binding, Type checking, scope Rules, primitive data types, strings, array types, associative arrays, Record types, union types, pointers and references, Arithmetic expressions, overloaded operators, relational & Boolean expressions Statements & mixed mode assignments, control structures.

Learning Outcomes:

Student can be able to

- Understand the concepts of data and data types
- Analyze the overloaded operators and different types of expressions
- Understand the concept of control structures

UNIT-III

Subprograms and implementations: Subprograms & Design issues,Local referencing environments,Parameter passing, Overloaded& Generic Methods, Design issues for functions, Semantics of call & Return, Implementing programs Stack & Dynamic local variables, Nested subprograms, Blocks, Dynamic scoping.

Learning Outcomes:
student can be able to

- Design subprograms and functions
- Understand the semantics of call and return
- Implement the stack,dynamic,and nested subprograms

UNIT-IV

Object orientation: Design issues for oops languages, Implementation of object oriented constructs.

Concurrency: Semaphores, monitors, Message passing, Threads, Statement level concurrency, Exception handling, Event handling.

Learning Outcomes:
Student can be able to

- Understand and design the concept of object oriented programming
- Understanding the utilization of different level of concurrency
- Implement threads and handle exceptions

UNIT-V

Functional programing languages:
Introduction to lambda calculus, fundamentals of functional programming languages, Programming with Scheme, Programming with ML.

Logic programming languages: Overview, Basics of prolog, Applications of Logic programming, Programming with prolog, Multi-paradigm languages.

Learning Outcomes:
Student can be able to

- Understand the concepts of lambda calculus, functional programming
- Design programming with scheme and ML
- Understand the concept of logic programming and applications of prolog
- Design programming with prolog

Text Books:

1. Robert W. Sebesta, "Concepts of Programming Languages", Tenth Edition, Addison Wesley2012
2. Programming Languages, Principles & Paradigms, 2ed, Allen B Tucker, Robert E Noonan, TMH

Reference Books:

1. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, MIT Press, 2009
2. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Prentice Hall, 1998
3. W. F. Clocksin& C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003

Subject Code	Subject Name	L	T	P	C
R19CSE-PC3203	Design and Analysis of Algorithms	3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

- Analyze the asymptotic performance ofalgorithms
- Write rigorous correctness proofs foralgorithms
- Demonstrate a familiarity with major algorithms and datastructures
- Apply important algorithmic design paradigms and methods ofanalysis
- Synthesize efficient algorithms in common engineering designsituations

Course Outcomes:

The students should be able to:

1. Analyse the performance of an Algorithm in terms of Space, Time and Amortized Complexity.
2. Apply the Divide and Conquer techniques to the Algorithms.
3. Apply the greedy paradigm to the Algorithms.
4. Apply the dynamic-programming paradigms for the Analasys of algorithms
5. Apply the Backtracking and branch and bound paradigms for the analasys of Algorithms

UNIT - I:

Introduction: What is an Algorithm, Algorithm Specification, Pseudo code Conventions Recursive Algorithm, Performance Analysis, Space Complexity, Time Complexity, Amortized Complexity, Amortized Complexity, Asymptotic Notation, Practical Complexities' Performance Measurement.

UNIT - II:

Decrease-and-Conquer: Insertion Sort Algorithms for Generating Combinatorial Objects Decrease-by-a-Constant-Factor Algorithms Variable-Size-Decrease Algorithms

Dived and Conquer: Merge Sort, Quick Sort, Multiplication of Large Integers and Strassen's Matrix Multiplication

Transform and conquer: Pre-sorting Balanced Search Trees, Heaps and Heap sort

UNIT - III:

The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines Minimum-cost Spanning Trees, Prim's Algorithm, Kruskal's Algorithms, An Optimal Randomized Algorithm, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT - IV:

Dynamic Programming: The General Method Multistage graph ,All - Pairs Shortest Paths, , String Edition, 0/1 Knapsack, Reliability Design, optimal binary search trees.

UNIT - V:

Backtracking: The General Method, The S-Queens Problem, Sum of Subsets, Graph Coloring Hamiltonian Cycles

Branch and Bound: The Method, Least cost (LC) Search, The 15-Puzzle: an Example, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC Branch and Bound, 0/1 Knapsack problem, LC Branch-and Bound Solution, FIFO Branch-and-Bound Solution, Traveling Salesperson problem.

Text Books:

1. Fundamentals of computer algorithms E. Horowitz S. Sahni, UniversityPress
2. Introduction to the design and analysis of Algorithms Anany Levitin pearson ,3rd edition iii.Introductionto Algorithms Thomas H Cormen PHILearning

Reference Books:

1. The Design and Analysis of Computer Algorithms,Alfred V Aho John E Hop croft

Jeffrey D Ullman
2. Algorithm Design, Jon Kleinberg,Pearson
3. Algorithms, by Dasgupta, Papadimitrou and Vazirani, McGraw-Hill Education,2006.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3201.1	Distributed Systems **(Professional Elective-I)**	3	0	0	3

Course Objectives:

- Provides an introduction to the fundamentals of distributed computer systems, assuming
- the availability of facilities for data transmission, IPC mechanisms in distributed
- systems, Remote procedure calls.
- Expose students to current technology used to build architectures to enhance distributed
- Computing infrastructures with various computing principles

Course Outcomes:

1. Develop a familiarity with distributed file systems.
2. Describe important characteristics of distributed systems and the salient architectural
3. features of such systems.
4. Describe the features and applications of important standard protocols which are used indistributed systems.
5. Gaining practical experience of inter-process communication in a distributed environment

UNIT-I:

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems,Resource Sharing and the Web, Challenges.

System Models: Introduction, Architectural Models- Software Layers, System Architecture,Variations, Interface and Objects, Design Requirements for Distributed Architectures,Fundamental Models- Interaction Model, Failure Model, Security Model.

UNIT-II:

Interprocess Communication: Introduction, The API for the Internet Protocols- TheCharacteristics of Interprocess communication, Sockets, UDP Datagram Communication, TCPStream Communication; External Data Representation and Marshalling; Client ServerCommunication; Group Communication- IP Multicast- an implementation of groupcommunication, Reliability and Ordering of Multicast.

UNIT-III:

Distributed Objects and Remote Invocation: Introduction, Communication betweenDistributed Objects- Object Model, Distributed Object Modal, Design Issues for RMI,Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events andNotifications, Case Study: JAVA RMI

UNIT-IV:

Operating System Support: Introduction, The Operating System Layer, Protection, Processesand Threads –Address Space, Creation of a New Process, Threads.

UNIT-V:

Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems:Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays.Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections,Multicast Communication.

Transactions & Replications: Introduction, System Model and Group Communication,Concurrency Control in Distributed Transactions, Distributed Dead Locks, TransactionRecovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

TEXT BOOKS:

1. Ajay D Kshemkalyani, MukeshSighal, “Distributed Computing, Principles, Algorithms and Systems”, Cambridge
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems- Concepts and

3. Design", Fourth Edition, Pearson Publication

Reference Books

1. Distributed-Systems-Principles-Paradigms-Tanenbaum PHI

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3201.2	Advanced Computer Networks **(Professional Elective-I)**	3	0	0	3

Course Objectives:

- To make the addressing mechanisms and address translation familiar to the student.
- To identify the fields in the Packet and its importance.
- Understand the Routing Protocols and its importance.
- Analyse the difference between connection oriented and connection less protocols.
- Understand the data transfer applications.

Course Outcomes:

1. Understand the Addressing Mechanisms.
2. Understand the packet Format and Various security fields in it.
3. Analyse the working of Routing Protocols.
4. Understand the Transport Layer Protocols.
5. Understand the e-mail architecture and file transfer.

Unit 1:

IP Addressing: AddressSpace,Notations,Classliilladdressing,Classless addressing, NetworkAddresstranslation(NAT).InternetProtocol(IP): Datagram Format,Fragmentation, Options. ICMPv4: Messages,DebuggingTools,ICMPCheck sum,MobileIP:Addressing,Agents,Three Phases. InefficiencyinMobileIP.VirtualPrivate NetworkTechnology.

Learning Outcomes: student will be able to

- Understand the addressing mechanisms. (L2).
- Understand the calculation of Check Sum.(L2)
- Analyze packet format.(L4).

Applications: Conceptual Framework of a Network, ATM, Online reservation systems, reservation systems.

Unit-2:

IPv6Addressing: Representation,addressspace,addressspaceallocation,Autoconfiguration,Renumbering. TransitionfromIPv4 to IPv6:Dual Stack, Tunneling, HeaderTranslation. IPv6 Protocol: Packet format,ExtensionHeader.

Learning Outcomes: Student will be able to

- Understand the IPV6 addressing .(L2).
- Analyze IPV6 Header fields. (L4).
- Understand the IPV6 format. (L2).

Applications: Addressing mechanisms in real time will be learnt.

Unit 3:

Introduction: Inter-domain,Intra-domainRouting. **Routing Algorithms:**DistanceVector Routing, Bellman—Fordalgorithm,LinkStateRouting,PathVectorRouting. UnicastRoutingProtocols:InternetStructure,RoutingInformationProtocol(RIP),OpenShortestPath First(OSPF),BorderGatewayProtocolVersion 4(BGP4). Protocols: MulticastDistanceVector(DVMRP),MulticastLinkState (MOSPF),ProtocolIndependentMulticast(PIM).

Learning Outcomes: Student will be able to

- Understand the Network Layer concepts. (L2)
- Understand the types of routing algorithms. (L2)

Applications: Routing techniques in real world.

Unit4:

User DatagramProtocol: UserDatagram, UDP Services, UDPApplications .

TransmissionControlProtocol:TCPServices,TCPfeatures,Segment,ATCPConnection,State TransitionDiagram,WindowsinTCP,FlowControl,ErrorControl,TCP CongestionControl,TCPTimers,Options. SCTP: SCTP Services,SCTPFeatures,PacketFormat,FlowControl,ErrorControl.

Learning Outcomes: Student will be able to

- Understand the Transport Layer protocols.(L2)
- Understand which protocols are used for Flow Control and Error Control.(L2)

Applications: Used to implement data transfer and collision detection mechanisms.

Unit 5

WorldWideWeb and HTTP,FTP,TFTP,e-mail :Architecture,SMTP,POP,emailsecurity,MIME,RemoteLogin:Telnet and SSH.

Learning Outcomes: Student will be able to

- Understand E-mail architecture(L2)
- Understand security in Email.(L2)

Applications: mail transfer and real time data transfer.

Text Books:

1. Data Communications and Networking ,Behrouz A Forouzan,Fourth Edition.
2. InterNetworking with TCP/IP Volume 1 Fourth Edition, PrenticeHallo1IndiaPrivateLimited,

Reference Books:

1. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, FirouzMosharraf, McGraw Hill Education
2. AdvancedComputerNetwork, B.M.Harwaniand DTEditorial, DreamtecISBN978-93-5004-013-3

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3201.3	Human Computer Interaction **(Professional Elective-I)**	3	0	0	3

Course Objectives:

- To get student to think constructively and analytically about how to design and evaluate interactive technologies.
- Describe the various styles and interactive devices in designing.
- Analyze the quality and different strategies in language processing.
- Study the design principles and guidelines of HCI.
- Apply different search patterns on data.

Course Outcomes:

1. Having the capabilities of both humans and computers from the viewpoint of human information processing.
2. Learning about human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Apply an interactive design process and universal design principles to designing HCI systems.
4. Describe and use HCI design principles, standards and guidelines.
5. Analyzed tasks and dialogs of relevant HCI systems based on task analysis and dialog design.

Unit 1:

Introduction: Usability of Interactive Systems- introduction, usability goals and measures, usability motivations, universal usability, goals for our profession

Managing Design Processes: Introduction, Organizational design to support usability, Four pillars of design, development methodologies, Ethnographic observation, Participatory design, Scenario Development, Social impact statement for early design review, legal issues, Usability Testing and Laboratories

Learning Outcomes: student will be able to

- Describe basic concepts of interactive systems.
- Analyze basic design and development methods.

Applications: useful formanaging design process.

Unit 2:

Menu Selection, Form Fill-In and Dialog Boxes: Introduction, Task- Related Menu Organization, Single menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data entry with Menus: Form Fill-in, dialog Boxes, and alternatives, Audio Menus and menus for Small Displays.

Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays- Small and large.

Learning Outcomes:student will be able to

- Describe utilisation of menus &dialog boxes.
- Analyze the interactive devices.

Applications: useful for designing of menus & dialog boxes in newly developed user applications.

Unit 3:

Command and Natural Languages: Introduction, Command organization Functionality, Strategies and Structure, Naming and Abbreviations, Natural Language in Computing

Quality of Service: Introduction, Models of Response-Time impacts, Expectations and attitudes, User Productivity, Variability in Response Time, Frustrating Experiences

Learning Outcomes: student will be able to

- Describe structure & strategies of natural language computing.
- Analyzeworking quality of designed applications.

Applications: useful for verifying quality of service by taking certain parameters.

Unit 4:

Balancing Function and Fashion: Introduction, Error Messages, Non anthropomorphic Design, Display Design, Web Page Design, Window Design, Color

User Documentation and Online Help: Introduction, Online Vs Paper Documentation, Reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process.

Learning Outcomes: student will be able to

- Analyzeand design different web pages.
- Analyzedocumentation generation.

Applications: useful for designing of different pages,documentation for each application

.**Unit 5:**

Information Search: Introduction, Searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Searching Interfaces Information Visualization: Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization

Learning Outcomes:student will be able to

- Analysis of information search in textual documentation.

Applications: Easy to apply information search in all categories.

Text Books:

1. Designing the User Interface, Strategies for Effective Human Computer Interaction, 5ed, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson
2. The Essential guide to user interface design,2/e, Wilbert O Galitz, Wiley DreamaTech.

Reference Books:

1. Human Computer, Interaction Dan R.Olsan, Cengage ,2010.
2. Designing the user interface. 4/e, Ben Shneidermann , PEA.
3. User Interface Design, Soren Lauesen , PEA.
4. Interaction Design PRECE, ROGERS, SHARPS, Wiley

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3201.4	Cloud Computing **(Professional Elective-I)**	3	0	0	3

Course Objectives:

- To implement Virtualization
- To implement Task Scheduling algorithms
- Apply Map-Reduce concept to applications
- To build Private Cloud
- Broadly educate to know the impact of engineering on legal and societal issues involved

Course Outcomes:

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

1. Interpret the key dimensions of the challenge of Cloud Computing
2. Examine the economics, financial, and technological implications for selecting cloud computing for own organization
3. Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
4. Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas
5. Illustrate Virtualization for Data-Center Automation

UNIT I

Introduction: Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing. Parallel and Distributed Systems: introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, and model concurrency with Petri Nets.

UNIT II

Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing, Cloud Computing : Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, HPC on cloud.

UNIT III

Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades, Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling.

UNIT IV

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2), Cloud Security: Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

UNIT V

Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1), Google: Google App Engine, Google Web Toolkit (Text Book 2), Microsoft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

Text Books:

1. Cloud Computing, Theory and Practice,1st Edition, Dan C Marinescu, MK Elsevier publisher ,2013
2. Cloud Computing, A Practical Approach, 1st Edition, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH,2017

Reference Books:

1. Mastering Cloud Computing, Foundations and Application Programming,1st Edition, Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH,2013
2. Essential of Cloud Computing, 1st Edition, K Chandrasekharan, CRC Press, 2014.
3. Cloud Computing, A Hands on Approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2014.

Subject Code	Subject Name	L	T	P	C
R19CSS-PE3201.5	Mean Stack Technologies **(Professional Elective-I)**	3	0	0	3

Course Objectives:

- From the course the student will learn
- Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client
- Writing optimized front end code HTML and JavaScript
- Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution
- Design and implementation of Robust and Scalable Front End Applications

Course Outcomes:

After the completion of the course, student will be able to

1. Enumerate the Basic Concepts of Web & Markup Languages
2. Develop web Applications using Scripting Languages & Frameworks
3. Make use of Express JS and Node JS frameworks
4. Illustrate the uses of web services concepts like restful, react js
5. Apply Deployment Techniques & Working with cloud platform

UNIT I

Introduction to Web: Internet and World Wide Web, Domain name service, Protocols: HTTP, FTP, SMTP. Html5 concepts, CSS3, Anatomy of a web page. XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches.

UNIT II

JavaScript: The Basic of JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions. Angular Java Script Angular JS Expressions: ARRAY, Objects, $eval, Strings, Angular JS Form Validation & Form Submission, Single Page Application development using Angular JS.

UNIT III

Node.js: Introduction, Advantages, Node.js Process Model, Node JS Modules. Express.js: Introduction to Express Framework, Introduction to Nodejs , What is Nodejs, Getting Started with Express, Your first Express App, Express Routing, Implementing MVC in Express, Middleware, Using Template Engines, Error Handling , API Handling , Debugging, Developing Template Engines, Using Process Managers, Security & Deployment.

UNIT IV

RESTful Web Services: Using the Uniform Interface, Designing URIs, Web Linking, Conditional Requests. React Js: Welcome to React, Obstacles and Roadblocks, React's Future, Keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, ReactDOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories.

UNIT V

Mongo DB: Introduction, Architecture, Features, Examples, Database Creation & Collection in Mongo DB. Deploying Applications: Web hosting & Domains, Deployment Using Cloud Platforms.

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Pro Mean Stack Development, ELadElrom, Apress

4. Restful Web Services Cookbook, Subbu Allamraju, O'Reilly
5. JavaScript & jQuery the missing manual, David sawyer mcfarland, O'Reilly
6. Web Hosting for Dummies, Peter Pollock, John Wiley Brand

Reference Books:

1. Ruby on Rails up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006).
2. Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012).
3. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
4. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning.
5. Express.JS Guide,The Comprehensive Book on Express.js, Azat Mardan, Lean Publishing.

e-Resources:

1. http://www.upriss.org.uk/perl/PerlCourse.html
2. www.android.universityupdates.in | www.universityupdates.in | www.ios.universityupdates.in

Subject Code	Subject Name	L	T	P	C
R19ECE-OE3202	VLSI Design **(Open Elective-I)**	3	0	0	3

Course Overview:

VLSI design course gives the knowledge about the fabrication of NMOS, PMOS, CMOS and their application in the present electronics world. The present course gives knowledge about different processes used for fabrication of an IC. The electrical properties of MOS transistor and analysis of CMOS, Bi CMOS inverters is carried out. This course gives detail study on design rules, stick diagrams, logic gates, types of delays, fan-in, fan-out which effects the action of a MOS. It also gives information on data path subsystem and array subsystems, and several PLD's like PLA, PAL, CPLD and FPGA's and also to the CMOS testing principles system level and chip level. Prerequisite(s): Electronic Devices and circuits, Switching Theory and Logic Design

Course Objectives:

1. To understand the Basic NMOS, CMOS & Bi CMOS circuits and their process technology.
2. To understand the Designing of stick diagrams and layouts for OS transistors.
3. To learn the concepts of modelling of Delay techniques and MOS layers.
4. To learn the concepts of Technology Scaling of MOS transistors.
5. To understand the concepts of testing of combinational and sequential circuits and also the scan of design techniques.

UNIT-I

Review of microelectronics and Introduction to MOS technology:
Introduction MOS and related VLSI technology – NMOS-CMOS-BICMOS-Gas Technologies – thermal aspects of processing – production of E beam masks.

UNIT-II

MOS and BICMOS circuit design process: MOS layers – stick diagrams – design rules and layout – 2 μm meter – 1.2 μm meter CMOS rules – Layout diagrams – Symbolic diagrams.

UNIT-III

Basic Circuit Concepts: Sheet resistance – Area capacitance of layers – delay UNIT – wiring capacitances – choice of layers.

UNIT-IV

Scaling of MOS circuits: Scaling models – Scaling function for device parameters – Limitation of Scaling. Subsystem design process: Architectural issues – switch logic – examples of structural design (Combinational logic)– design of ALU subsystem – commonly used storage elements – aspects of design rules.

UNIT-V

Test and Testability: Design for testability built in self test (BIST) – teaching combinational logic – testing sequential logic – practical design for test guide lines – scan design techniques – etc.

TEXT BOOKS:

1. Basic VLSI design by Douglas A, Pucknell, Kamran Eshraghian, Prantice Hall, 1996 3rd edition.

REFERENCE BOOK:

1. Mead, C.A and Conway, L.A., Introduction to VLSI Systems, Wesley – Wesley.

Subject Code	Subject Name	L	T	P	C
R19CSE-OE3204	Multimedia Application Development **(Open Elective-I)**	3	0	0	3

Course Objective:

The objective is to

- To analyze and explain various technologies involved to support multimedia application development.
- To understand multimedia authoring and Understanding the constraints on multimedia systems and the range of technologies available to multimedia systems designers and integrators.
- To understand how the quality of multimedia systems is perceived and how this Relate to the design of multimedia input, output and editing systems.
- To understand different compression principles and different compression technique and to know the mathematics involved in digital and analog conversion of components of multimedia.
- To design and develop multimedia systems according to the requirements of multimedia application and understand the particular issues of virtual reality.

Course Outcomes(COs):

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

1. Design and implementation of hypermedia & multimedia systems.
2. Achieve an in-depth understanding of the impact of multimedia on personal and distributed computer systems, the range of media types and tools to support their digital conversion and manipulation of images, audio and video and their compression.
3. Develop an interactive multimedia application to display their ability to use multimedia tools including multimedia authoring.
4. Evaluate and Discuss Excellent and ineffective interactive multimedia design.
5. Design and implement a number of multimedia network applications and Evaluate and discuss virtual reality systems.

UNIT- I:

Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

UNIT- II:

Fundamental Concepts in Video and Digital Audio: Types of video signals, analog video, and digital video, digitization of sound, MIDI, quantization and transmission of audio.

UNIT-III:

Action Script I: Action Script Features, Object-Oriented Action Script, Data types and Type Checking, Classes, Authoring an Action Script Class, Action Script II: Inheritance, Authoring an Action Script 2.0 Subclass, Interfaces, Packages, Exceptions, Application Development: An OOP Application Frame work, Using Components with Action Script Movie Clip Subclasses.

UNIT- IV

Multimedia Data Compression: Lossless compression algorithm: Run-Length Coding,VariableLength Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression,Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding,Embedded Zero tree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT),Basic Video Compression Techniques: Introduction to video compression, video compressionbased on motion compensation, search for motion vectors,

MPEG, Basic Audio CompressionTechniques.

UNIT-V

Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communicationsand Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimediaover ATM networks, Transport of MPEG- 4, Media-on- Demand (MOD).

Text Books:

1. Fundamentals of Multimedia, Ze-Nian Li , Mark S. Drew, PHI/ PEA
2. Multimedia Systems, Parag Havaldar, Gerard Medioni, cengage, 2009
3. Essentials Action Script 3.0, Colin Moock, SPD O, Reilly, 2007

Reference Books:

1. Multimedia Applications, Steinmetz, Nahrstedt, Springer
2. Digital Multimedia, Nigel Chapman, Jenny Chapman, Wiley- Dreamtech
3. Multimedia & Communications Technology, Steve Heath, Elsevier
4. Multimedia Technology & Applications, David Hilman , Galgotia
5. Multimedia Technologies, Banerji, Mohan Ghosh,MGH

Subject Code	Subject Name	L	T	P	C
R19CSE-OE3205	NOSQL Databases **(Open Elective-I)**	3	0	0	3

Course Objectives:

The objective of this course is to

- Explore the emergence, requirements and benefits of a NoSQL database.
- Understand the basic architecture and data models of a NoSQL database (key-value stores, document databases, column-family stores, graph databases).

Course Outcomes:

On completion of this course, the students will be able to

1. Differentiate between various non-relational (NoSQL) database.
2. Create Documentoriented NoSQL databases using Mongo DB.
3. Create Column- oriented NoSQL databases using Apache HBASE.
4. Create NoSQL Key/Value databases using Riak.
5. Create Graph NoSQL databases using Neo4.

UNIT-I:

Introduction and Basic Concepts: Overview, and History of NoSQL Databases, Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points, Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases.

UNIT-II:

NoSQL Key/Value databases using MongoDB: Document Databases, What Is a Document Database? Features, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT-III:

Column- oriented NoSQL databases using Apache HBASE: Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, What Is a Column-Family Data Store? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage, When Not to Use.

UNIT-IV:

NoSQL Key/Value databases using Riak: Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.

UNIT-V:

Graph NoSQL databases using Neo4: NoSQL database development tools and programming languages, Graph Databases, What Is a Graph Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.

Text Books:

1.NoSQLDistilled: A Brief Guide to the Emerging World of Polyglot Persistence,Pramod J. Sadalage, Martin Fowler,Pearson Education, 2013.
2.Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN: 978-0-470-94224-6.

Reference Books:

1. i.A Guide to Modern Databases and the NoSQL Movement Edition, Redmond, E. &Wilson
2. Redmond, E. & Wilson, J. (2012). Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1st Ed.). Raleigh, NC: The Pragmatic Programmers, LLC.
3. Dan Sullivan. NoSQL for Mere Mortals. Addison-Wesley Professional. 2015.
4. Guy Harrison. Next-Generation Databases. Apress. 2016.

Subject Code	Subject Name	L	T	P	C
R19CSE-OE3206	Internet Of Things **(Open Elective-I)**	3	0	0	3

Course Objectives:

The objectives of this course is to acquire knowledge on the

- What IoT is and how it works today and to Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and RealWorld Design Constraints
- To Understand the various IoT Protocols.
- To understand and program IoT devices.

Course Outcomes:

The students should be able to:

1. Recognize the factors that contributed to the emergence of IoT
2. Design and program IoT devices like Microcontrollers, sensors and actuators.
3. Use real IoT protocols for communication.
4. Define the infrastructure for supporting IoT deployment.
5. Design an IoT device to work with a Cloud Computing infrastructure and Transfer IoT data to the cloud and in between cloud providers.

UNIT - I:

Introduction to IOT: Understanding IoT fundamentals, IOT Architecture and protocols, Various Platforms for IoT, Real time Examples of IoT , Overview of IoT components and IoT Communication Technologies ,Challenges in IOT.

UNIT - II:

Arduino Simulation Environment: Arduino Uno Architecture, Setup the IDE, Writing Arduino Software, ArduinoLibraries, Basics ofEmbedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD.

Sensor & Actuators with Arduino

Overview of Sensors working, Analog and Digital Sensors,Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino,Interfacing of Actuators with Arduino.Interfacing of Relay Switch and Servo Motor with Arduino.

UNIT - III:

Raspberry Pi Programming: Installing and **Configuring** the Raspberry Pi,Getting Started with the Raspberry Pi,Using the Pi as a Media Centre, Productivity Machine and Web Server,Remote access to the Raspberry Pi. Preparing

Raspberry Pi for IoT Projects.

Creating the Sensor Projects,Creating the actuator Projects, Creating a IoT controller, creating a camera and working with HTTP protocol.

UNIT - IV:

Basic Networking with ESP8266 WiFi module : Basics of Wireless Networking,Introduction to ESP8266 Wi-Fi Module ,Various Wi-Fi library , Web server-introduction, installation, configuration ,Posting sensor(s) data to web server .IoT Protocols ,M2M vs. IOT Communication Protocols.

UNIT - V:

Cloud Platforms for IOT : Virtualization concepts and Cloud Architecture , Cloud computing, benefits ,Cloud services -- SaaS, PaaS, IaaS , Cloud providers & offerings ,Study of IOT Cloud platforms , ThingSpeak API and MQTT , interfacing ESP8266 with Web services

Text Books:

1.Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition McGraw- Hill Education

2.Peter Waher,Learning Internet of Things,Packt publishing.
3.OvidiuVermesan,PeterFriess, IoT-From Research and Innovation to Market deployment,River Publishers

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer.

Subject Code	Subject Name	L	T	P	C
R19CSE-OE3207	Block Chain Technologies **(Open Elective-I)**	3	0	0	3

Course Objective:

- To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.
- To understand the structure of a Blockchain and why/when it is better than a simple distributed database
- To make students understand the technological underpinnings of Blockchain operations as distributed data structures and decision-making systems.
- To understand a "smart" contract and its legal implications.

Course Outcomes

Upon completion of the course, it is expected that student will be able to:

1. Define and explain the fundamentals of Blockchain.
2. Understand decentralization and the role of Blockchain in it.
3. Understand and analyze Bitcioin Cryptocurrency and underlying Blockchain network.
4. Understand Etherium currency and platform, and develop applications using Solidity.
5. Understand Hyperledger project and its components; critically analyze the challenges and future opportunities in Blockchain technology

UNIT-I:

Introduction: History and basics, Types of Blockchain, Consensus, CAP Theorem.**Cryptographic Hash Functions**: Properties of hash functions, Secure Hash Algorithm, Merkletrees, Patricia trees.

UNIT-II:

Decentralization: Decentralization using Blockchain, Methods of decentralization, decentralization framework, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized Organizations, Platforms for decentralization.

UNIT-III:

Bitcoin: Introduction to Bitcoin, Digital keys and addresses, Transactions, Blockchain, The Bitcoin network, Bitcoin payments, Bitcoin Clients and APIs, Alternatives to Proof of Work, Bitcoin limitations.

UNIT-IV:

Etherium: Smart Contracts, Introduction to Ethereum, The Ethereum network, Components of the Ethereum ecosystem, Blocks and Blockchain, Fee schedule, Ethereum Development Environment, Solidity.

UNIT-V:

Hyperledger: Introduction, Hyperledger Projects, Protocol, Architecture, Hyperledger Fabric, Sawtooth Lake, Corda.

Challenges and Opportunities: Scalability, Privacy, Blockchain for IoT, Emerging trends

Text Book:

Mastering Blockchain, Imran Bashir, Second Edition, Packt Publishing

Reference Books:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas Antonopoulos, O'Reilly.
2. Blockchain Blueprint for a New Economy, Melanie Swan, O'Reilly.
3. Mastering Bitcoin: Programming the Open Blockchain, Antonopoulos, Andreas M. O'Reilly.
4. Blockchain Technology: Cryptocurrency and Applications, S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press

Subject Code	Subject Name	L	T	P	C
R19BSH-HM3201	Managerial Economics & Financial Analysis	3	0	0	3

Course Objectives:

- Inculcate the basic knowledge with the concepts of Economics & Demand and current business environment.(L2)
- Analyze various factors of production with proposed theories in relation to cost - volume profit analysis.(L4)
- Identify micro environment in which markets operate, how price determination is done under different kinds of competitions and know the different forms of Business organization. .(L4)
- Provide fundamental skills about accounting and explain the process of preparing accounting statements and analysis of financial statements. (L3)
- Apply the best investment decisions by means of time value of money.(L4)

Course Outcomes:

1. Equipped with the knowledge of fundamentals of economics, estimating the Demand for a product, Capable of analyzing Elasticity & Forecasting methods(L2)
2. Apply production concepts, assess the costs and Determine Break Even Point (BEP) of an enterprise for managerial decision making(L4)
3. Identify the influence and price determination of various markets structures and knowledge of the forms of business organization and Business cycles(L4)
4. Analyze and interpret the process & principles of accounting & apply financial statements for appropriate decisions to run the business profitably(L4)
5. Analyze how to invest adequate amount of capital in order to get maximum return from selected business activity.(L4)

Unit-I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Learning Outcomes:

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

- Awareness about basics of managerial economics(L1)
- Knowledge of the concepts of demand, elasticity of demand and methods of demand forecasting(L1)

Application:

1. Analyze the demand of a product by applying methods of the elasticity of demand.

Unit – II:

Theories of Production and Cost Analysis: Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Learning Outcomes:

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

- Examine various issues involved in production decision analysis (L1)

- Construct how production function is carried out to achieve least cost combination of inputs(L3)
- Apply Break – Even Analysis and its importance in managerial decision making(L4)

Application:

Compute contribution, revenue, Cost comparison, Margin of safety for making accurate decisions related to profitability of particular Enterprise

Unit – III:

Introduction to Markets, Theories of the Firm & Pricing Policies: Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Goods and services Tax, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company.

Learning Outcomes:

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

- Identify the various market structures like Monopoly, Monopolistic competition (L4)
- Determine the appropriate pricing strategies to be applied in each market(L2)
- Compare the suitability of various organizational and ownership structures like sole trading, partnership. (L2)

Application: Analyse the leaps and bounds faced by the service providers in estimation of pricing in Telecom sector**.**

Unit – IV:

Introduction to Accounting & Financial Analysis: Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements.

Learning Outcomes:

At the end of this unit students will be able to

- Knowledge about the framework for accounting process(L1)
- Analyze financial accounting decisions.(L3)

Application:

Prepare the financial accounting statements like Trading account, Profit and Loss account, Balance sheet of any organization.

Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Learning Outcomes:

At the end of this unit students will be able to

- Analyze how capital budgeting decisions are carried out(L4)
- Knowledge of the concepts and various methods of capital budgeting(L1)
- Apply traditional or modern methods of Capital budgeting in business decision making(L3)

Application:

1. Assess long term investments and funds required in small scale organization**.**

Text Books:

1. Aryasri, Managerial Economics and Financial Analysis, TMH, 2012.
2. Varshney&Maheshwari, Managerial Economics, Sultan Chand& Sons, 2014.

References:

1. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
2. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
3. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
4. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
5. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

WEBLINKS

1. https://www.smartzworld.com/notes/managerial-economics-and-financial-analysis-mefa/
2. Production and cost analysis- https://slideplayer.com/slide/5708722/
3. Accountinganalysis - https://www.readyratios.com/reference/accounting/accounting_analysis.html
4. .https://nptel.ac.in/courses/110/101/110101131/

Subject Code	Subject Name	L	T	P	C
R19CSS-PC3203	**Web Technologies Lab**	0	0	3	1.5

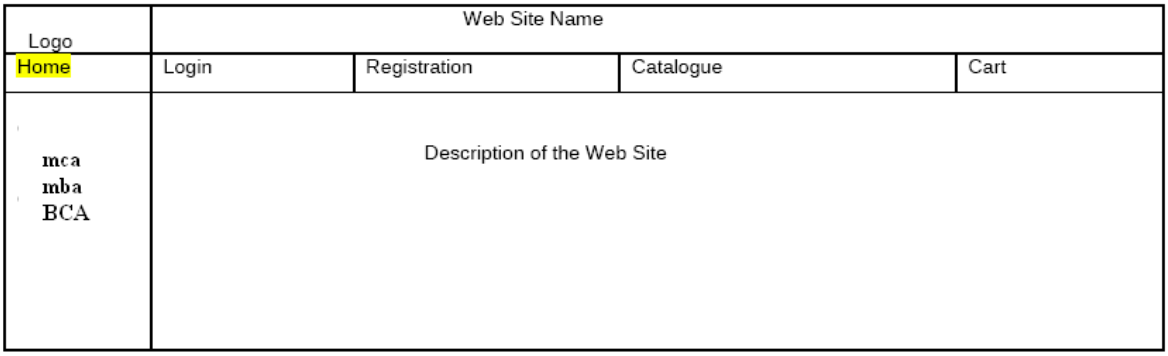
Course Objectives:

- To acquire knowledge of XHTML, Java Script and XML to develop web applications
- Ability to develop dynamic web content using Java Servlets and JSP
- To understand JDBC connections and Java Mail API
- To understand the design and development process of a complete web application

Course Outcomes:

1. Students will be able to develop static web sites using XHTML and Java Scripts
2. To implement XML and XSLT for web applications
3. Develop Dynamic web content using Java Servlets and JSP
4. To develop JDBC connections and implement a complete Dynamic web application

1. Design the following static web pages required for an online book store web site.
1) HOME PAGE:
The static home page must contain three frames.
Top frame: Logo and the college name and links to Home page, Login page, Registration page,
Catalogue page and Cart page (the description of these pages will be given below).
Left frame: At least four links for navigation, which will display the catalogue of respective links.
For e.g.: When you click the link "MCA" the catalogue for MCABooks should be displayed in
the Right frame.
Right frame: The pages to the links in the left frame must be loaded here. Initially this page contains description of the web site.



2)login page

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
MCA MBA BCA	Login : 11a51f0003 Password: ******** Submit Reset			

3) CATOLOGUE PAGE:
The catalogue page should contain the details of all the books available in the web site in a table.
The details should contain the following:
1. Snap shot of Cover Page.
2. Author Name.
3. Publisher.
4. Price.
5. Add to cart button.

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
MCA MBA		Book : XML Bible Author : Winston Publication : Wiely	$ 40.5	Add to cart
BCA		Book : AI Author : S.Russel Publication : Princeton hall	$ 63	Add to cart
		Book : Java 2 Author : Watson Publication : BPB publications	$ 35.5	Add to cart
		Book : HTML in 24 hours Author : Sam Peter Publication : Sam	$ 50	Add to cart

4. REGISTRATION PAGE:
Create a "registration form "with the following fields
1) Name (Text field)
2) Password (password field)
3) E-mail id (text field)
4) Phone number (text field)
5) Sex (radio button)
6) Date of birth (3 select boxes)

7) Languages known (check boxes – English, Telugu, Hindi, Tamil)
8) Address (text area)

5. Design a web page using CSS (Cascading Style Sheets) which includes the following:
1) Use different font, styles:
In the style definition you define how each selector should work (font, color etc.).
Then, in the body of your pages, you refer to these selectors to activate the styles

6. Write an XML file which will display the Book information which includes the following:
1) Title of the book
2) Author Name
3) ISBN number
4) Publisher name
5) Edition
6) Price
Write a Document Type Definition (DTD) to validate the above XML file.

7. Example PHP program for cotactus page.

8. User Authentication:
Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and
pwd4 respectively. Write a PHP for doing the following.
1. Create a Cookie and add these four user id's and passwords to this Cookie.
2. Read the user id and passwords entered in the Login form (week1) and authenticate with the
values (user id and passwords) available in the cookies.
If he is a valid user (i.e., user-name and password match) you should welcome him by name (user-name) else you should display "You are not an authenticated user ''.
Use init-parameters to do this.

9. Example PHP program for registering users of a website and login.

10. Install a database(Mysql or Oracle).
Create a table which should contain at least the following fields: name, password, email-id, phone number(these should hold the data from the registration form).
Write a PHP program to connect to that database and extract data from the tables and display them. Experiment with various SQL queries.
Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page (week2).

11. Write a PHP which does the following job:
Insert the details of the 3 or 4 users who register with the web site (week9) by using registration
form. Authenticate the user when he submits the login form using the user name and password
from the database (similar to week8 instead of cookies).

12. Create tables in the database which contain the details of items (books in our case like

Book
name , Price, Quantity, Amount) of each category. Modify your catalogue page (week 2)in such
a way that you should connect to the database and extract data from the tables and display them
in the catalogue page using PHP

Subject Code	Subject Name	L	T	P	C
R19CSS-HN3201	Wireless Sensor Networks **(Honors Courses 3: Track-1)**	3	1	0	4

Course Objectives:

1. Emphasize the basic WSN technology and sensor node architecture with its unique constraints and challenges in design of WSN for different Applications.
2. Summarize the transceiver design and network technologies used in wireless sensor and networks.
3. Explains various key MAC protocols for sensor networks with their merits and demerits.
4. Provide knowledge of different routing protocols with their advantages.
5. Create awareness on transport layer protocols,security considerations, sensor network platforms and tools with a brief study of different WSN applications.

Course outcomes:

1. Illustrate the wireless sensor node architectures.
2. Outline the physical layer design.
3. Inspect MAC protocols of wireless sensor and networks.
4. Inference various network layer routing protocols of wireless sensor.
5. Summarize the network security requirements.

Unit 1:

Overview of Wireless Sensor Networks: Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints and challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

Architectures:

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

Learning Outcomes:Students will be able to:

1. Describe application domain of Wireless Sensor Networks (L2)
2. Understand architecture of Wireless Sensor Networks(L2)

Unit II:

Networking Technologies:

Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, and WANETs.

Learning Outcomes: Students will be able to:

1. Describe design considerations of Physical Layer and Transceiver(L2)
2. Illustrate Topologies of PANs, MANETs, and WANETs (L2)

Unit III:

MAC Protocols for Wireless Sensor Networks: Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention – Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

Learning Outcomes: Students will be able to:

1. Understand MAC protocol(L2).
2. DescribeMAC Protocols that use Directional Antennas (L2).

Unit IV:

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient

Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols, Proactive Routing.

Learning Outcomes: Students will be able to:

1. Understand Routing Protocol for Ad Hoc Wireless Networks (L2)
2. Use Routing Protocols for Ad Hoc Wireless Networks (L2)

Unit V:

Transport layer and security protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks. Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning. Secure Routing in Ad Hoc Wireless networks.

Sensor network platforms and tools

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Learning Outcomes: Students will be able to:

1. Understand Transport Layer Protocol for Ad Hoc Wireless Networks (L2)
2. Security in Ad Hoc Wireless Networks (L2)

Text Books:

1. Ad Hoc wireless networks: Architectures and protocols - C.Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad - Hoc and Sensor Networks: Protocols, Performance and Control - Jagannathan Sarangapani, CRC Press.
3. Holger Karl & Andreas Willig, Protocol and Architectures for Wireless Sensor Networks, John Wiley, 2005.

References:

1. Kazem Sohraby, Daniel Minoli, &TaiebZanti, "Wireless Sensor Networks - Technology, Protocols and Applications", John Wiley, 2007.
2. Feng Zhao & Leonidas J.Guibas, “Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2007.
3. Ad Hoc Mobile Wireless Networks: Protocols & Systems, C.K.Toh, 1ed, Pearson Education.
4. Wireless Sensor Networks - C.S.Raghavendra, Krishna M.Sivalingam, 2004, Springer.
5. Wireless Sensor Networks - S Anandamurugan, Lakshmi Publications.

Subject Code	Subject Name	L	T	P	C
R19CSS-HN3202	Block Chain Technologies **(Honors Courses 3: Track-2)**	3	1	0	4

Course Objectives:

1. Understand how Block chain systems (mainly Bit coin and Ethereal) work,
2. To securely interact with Block chain systems,
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from Block chain technology into their own projects.
5. To identify the importance of crypto currency.

Course Outcomes: At the end of the unit, student will be able to:

1. Acquire basic skills and knowledge of Distributed Database and Cryptography.
2. Interact with a Block chain system by sending and reading transactions.
3. Design, build, and deploy a distributed application.
4. Understand the Basic knowledge of Crypto currency.
5. Understand the Basic knowledge of Crypto currency Regulation.

Unit I:

Basics Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Learning Outcomes: At the end of the unit, student will be able to

1. Acquire basic skills and knowledge of Cryptography.
2. Understanding of current trends of Block chain, and ability to imagine its use cases and future.

Unit II:

Blockchain: Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public Block chain.

Learning Outcomes: At the end of the unit, student will be able to

1. To understand the applications of Block chain.

Unit III:

Distributed Consensus:Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Learning Outcomes: At the end of the unit, student will be able to:

1. Identify the challenges in Distributed Consensus.

Unit IV:

Crypto currency: History, Distributed Ledger, Bit coin protocols - Mining strategy and rewards, Ethereum -Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Side chain, Name coin.

Learning Outcomes: At the end of the unit, student will be able to:

1. Understand the Basic knowledge of Crypto currency.
2. Analyze how Bit coin Crypto currency works uses in global market.

Unit V:

Crypto currency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy.

Learning Outcomes: At the end of the unit, student will be able to:

1. Understand the Basic knowledge of Crypto currency Regulation.

Text Book:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books:

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies.
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts.

Subject Code	Subject Name	L	T	P	C
R19CSS-HN3203	.NET Framework **(Honors Courses 3: Track-3)**	3	1	0	4

Course Objectives:

- To understand the working environment of Microsoft Visual Studio.
- Understand the OOPS concepts, Threads and File handling
- Understand and gain practical knowledge of Collections and Reflection framework
- To make the student to create websites using ASP.NET
- Understand the concept of session tracking mechanism in real time applications.

Course Outcomes:

1. Understand structure of C#program constructs.
2. Implement object oriented concepts with files and threads.
3. Implement generics and reflections for data collection.
4. Create user interactive web pages using ASP.NET
5. Develop secure web applications with persistence and state.

Unit I:

Introduction to C#-Overview of Environment-Microsoft Visual Studio 2019 and Visual C#,features,Program Structure,Data Types,Working with Variables and Constants, Type Conversion, Operators, Decision Making statements, Loops, Methods, Boxing and Unboxing,Arrays,Strings.

Learning Outcomes: Student will be able to

- Understand Microsoft Visual Studio environment and its program structure. (L2)
- Understand decision making and iterations in C#. (L2)
- Implement typecasting and conversion constructs. (L4)

Unit II:

File Handling and Threads-Structure, Enums, Classes, Inheritance, Abstract class,Polymorphism,OperatorOverloading,Interfaces, Namespaces,Pre-processor Directives,Exception Handling, Garbage collection,Threads-Life cycle,creation and managing threads, File Handling.

Learning Outcomes: Student will be able to

- Understand object oriented concepts with real time applications. (L2)
- Implement Threads and file handling for synchronous data processing. (L4)
- Understand error and exception handling strategies. (L2)

Unit III:

Collections and Reflections-Attributes,Reflections, Properties,Indexers, Delegates,Events,Collections,Generics,Anonymous Methods,Unsafe Codes.

.**Learning Outcomes: S**tudent will be able to

- Understand hierarchy of Collections and Reflections. (L2)
- Implement delegates and events in collections. (L4)

Unit IV:

ASP.NET – Controls- An introduction to Web Forms,MVC Architecture, Server-side controls,The ASP.NET execution model. ASP.Net Page Life Cycle,Controls-User, Navigation, Validation and Login Controls, Master Page and Content Page, Themes.

Learning Outcomes: Student will be able to

- Implement the Model-View-Controller architecture for creating web applications. (L4)
- Implement ASP life cycle through user controls and navigation. (L4)
- Understand login and validation controls in the web application. (L2)

Unit V:

ADO.NET and Session Management : Data access and data binding using ADO.NET,ASP.Net State Management-View, Session, Application, cookies and URL encoding, Web Application Security, Authentication and Authorization, Impersonation, ASP.Net provider model, Caching, Networking concepts-Web client, Web request and response, TopListener, Topclient

.**Learning Outcomes: S**tudent will be able to

- Implement ADO.NET for database accessing.(L4)
- Develop web applications with persistency and state management. (L4)
- Develop secure applications for request-response handling. (L4)

Text Books:

1. A Text book on C#- Pearson Education,S.TamaraiSelvi,R.Murugesan.
2. Programming C# 8.0: Build Cloud, Web, and Desktop Applications,Orielly Publications
3. The Complete Reference ASP.NET, Mathew Mc Donald,Mc Graw Hill

Reference Books:

1. C# in depth, manning publications, John Skeet
2. ASP.NET Core in Action, Andrew Lock,Manning publication.

Subject Code	Subject Name	L	T	P	C
R19CSS-HN3204	Natural Language Processing **(Honors Courses 3: Track-3)**	3	1	0	4

Course Objectives:

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and Pragmatics
- To gain knowledge in automated natural language generation and machine translation
- To understand language modeling

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

1. Illustrate fundamentals of basic Language features
2. Analyze the words involved in NLP
3. Outline the syntactic analysis involved in NLP
4. Utilize semantics of NLP
5. Compare different statistical approaches of NLP applications.

UNIT I:

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers forlexiconandrules, Tokenization, Detecting and Correcting Spelling errors.

Learning Outcomes:Student will be able to

1. Outline different grammar based languages **(L2)**
2. Illustrate the fundamentals of natural language processing**(L2)**

UNITII :

WORDLEVELANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Learning Outcomes:Student will be able to

1 Demonstrate N-Grams in NLP**(L2)**

2 Analyze the Different Stochastic and Transformation-based tagging (L4)

UNITIII:

SYNTACTICANALYSIS: Context-Free Grammars, Grammar rules for English, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Learning Outcomes:Student will be able to

1. Interpret CFG and PCFG in NLP **(L2)**
2. Outline the syntactic importance in NLP **(L2)**

UNITIV:

SEMANTICS ANALYSIS: Requirements for representation, First-Order Logic, Description Logics – Syntax-DrivenSemantic analysis, Semantic attachments – Word Senses, Relations between Senses,Thematic Roles, selectional restrictions – Word Sense Disambiguation

Learning Outcomes:Student will be able to

1 Understand different order logics **(L2)**

2 Understand requirenetsof semantics of NLP(**L2**)

UNITV:

DISCOURSEANALYSISANDLEXICALRESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution usingHobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer,Lemmatizer, Penn

Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, BrownCorpus, British National Corpus (BNC).

Learning Outcomes:Student will be able to

1. **U**nderstand Segmentation and Coherence**(L2)**
2. Determining statistical approaches for NLP applications (**L3**)

Text Books:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics andSpeech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing withPython, First Edition, OReilly Media, 2009.

References:

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook,Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural LanguageProcessing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and InformationRetrieval, Oxford University Press, 2008.