ANNEXURE III - B

Masters in Technology (M. Tech)
Computer Science & Engineering (CS&E)

School of Engineering & Technology
Department of Information Technology

Course Structure for M .Tech. Computer Science & Engineering
(Batch 2021 onwards)

Semester I			
S. No.	**Course Code**	**Course Title**	**Credits**
1	MTCS 101	Object Oriented Software Engineering	4
2	MTCS 102	Algorithms & Algortihmic Complexity	4
3	MTCS 103	High Performance Computer Architecture	4
4	MTCS 104 L	Algorithms & Algortihmic Complexity Lab	2
5	MTCS 105 L	High Performance Computer Architecture Lab	2
6	MTCS E***	Elective I	4
7	***	Skill Enhancement Course	4
		Total	**24**

Central University of Kashmir				
Course Title	Object Oriented Software Engineering	**Course Code**	MTCS 101	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits		**L**	**T**	**P**
Semester	1st Semester	4	0	0

Course Objectives

1. Develop models using the UML notation.
2. Apply an iterative, agile process.
3. Analyze requirements with use cases.
4. Create domain models.
5. Relate analysis and design artifacts.
6. Design object solutions with patterns and architectural layers.
7. Apply concepts to a semester-long software engineering project.
8. Document and present project deliverables.
9. Use and advanced CASE tool

Learning Outcomes

1.Discuss about software development process models.
2. CO2 Identify the contemporary issues and discuss about coding standards.
3. Recognize the knowledge about testing methods and comparison of various testing techniques.
4. Use the concept and standards of quality and getting knowledge about software quality assurance group.

Course Synopsis

1 Object Oriented Concepts and Modeling
2 Introduction to UML
3 Basic and Advanced Structural Modeling
4 Basic Behavioral Modeling
5 Architectural Modeling
6 Object Oriented Design
7 Object Oriented Analysis

Course Outline / Content

Unit	Topics	Week
1.	**Software and software engineering**: the nature of software, What is software engineering, software SDLC, software engineering as a branch of engineering profession, stake holders in software engineering, software quality, software engineering projects, activities common to software projects.	3
2.	**Review of object orientation:** What is object orientation, classes and objects, instances and variables, methods operation and polymorphism, organizing class into in heritance hierarchies, concepts that define object orientation, **Modelling with classes:** What is UML, conceptual model of UML, essentials of UML class diagrams, Associations and multiplicity, generalization, object diagram, process of developing class diagrams.	3

3.	**Modeling interactions and behavior**: Interaction diagrams, state diagrams, activity diagrams , Implementing classes based on interaction and state diagrams , **Architecture and Design software**: The process of designs, principles leading to good design principles, techniques for making good designs decisions, model driven development, software architecture.	4
4.	**Object Oriented Design** Generic components of OO Design model , System Design process , Partitioning the analysis model , Concurrency and subsystem allocation , Task Mgmt component, Data Mgmt component	3
5.	**Object Oriented Analysis** Iterative Development , Unified process & UP Phases Inception Elaboration Construction Transition, UP Disciplines **Object oriented Testing:** overview of Testing and object oriented Testing strategies	3
Text Books		
1.	Object Oriented Software Engineering ,Timothy C. Lethbridge and Robert Langaniere	
2.	Object Oriented Software Engineering by Ivar Jacobson	
3.	Software Engineering by Pressman	
4.	Applying UML and Patterns by Craig Larman	
References		
1.	Ali Bahrami, “Object Oriented Systems Development” 1st Edition, The McGraw-Hill Company, 1999.	
2.	Grady Booch, James Rumbaugh, Ivar Jacobson - "the Unified Modeling Language User Guide" - Addison Wesley, 1999.	
3.	Fairley R, “Software Engineering Concepts”, second edition, Tata McGraw Hill,New Delhi, 2003.	

Central University of Kashmir				
Course Title	Algorithms & Algorithmic Complexity	**Course Code**	MTCS 102	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester	1ST	4	0	0

Course Objectives

1. The aim of this Course is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them.

2. Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.

Learning Outcomes

Learning Outcomes: By the end of course through lectures, readings, homeworks, lab assignments and exams, students will demonstrate: - The abilities

(1) To apply knowledge of computing and mathematics to algorithm design;

(2) To analyze a problem and identify the computing requirements appropriate for its solution;

(3) To design, implement, and evaluate an algorithm to meet desired needs;

(4) To apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices.

(5) To apply design and development principles in the construction of software systems of varying complexity.

(6) To function effectively as a member of a team in order to accomplish a common goal.

Course Synopsis

Recurrence equations. Asymptotic notations for complexity classes

Algorithm design strategies such as divide and conquer, dynamic programming, greedy algorithms, backtracking and branch-bound.

Computational complexity of sorting and searching algorithm.

Course Outline / Content

Unit	Topics	Week
1.	**Introduction:** Notion of Complexity covering time complexity and space complexity. Worst case complexity, Average case complexity. Big Oh Notation. Examples of simple algorithms and illustration of their complexity. Iteration and Recursion- Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion.	4
2.	List ADT. Implementation of lists using arrays and pointers. Stack ADT. Queue ADT. Implementation of stacks and queues. Dictionaries, Hash tables: open tables and closed tables. Analysis of hashing. Skip lists and analysis.	3
3.	Binary Trees- Definition and traversals: preorder, postorder,	3

	inorder. Common types and properties of binary trees. Counting of binary trees. Huffman coding using binary trees. Binary search trees : worst case analysis and average case analysis. AVL trees. Splay trees. Priority Queues -Binary heaps: insert and delete min operations and analysis. Binomial queues.	
4.	Directed Graphs- Data structures for graph representation. Shortest path algorithms: Dijkstra (greedy algorithm) and Bellman-Ford (dynamic programming). Depthfirst search and Breadth-first search. Directed acyclic graphs. Undirected Graphs- Depth-first search and breadth-first search. Minimal spanning trees and algorithms (Prim's and Kruskal) and implementation. All pair Shortest path(Floyd-Warshall) ,Travelling salesman problem.	3
5	Sorting- Bubblesort, selection sort, insertion sort, Shell sort; Quicksort; Heapsort; Mergesort; Radix sort; Analysis of the sorting methods. Selecting the top k elements. Lower bound on sorting.	3
Text Books		
1.	T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, "Introduction to Algorithms", 2 nd Ed., PHI.	
2.	Ellis Horowitz and SartazSahani, "Computer Algorithms", Galgotia Publications.	
References		
1.	Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft, AddisonWesley Series (1983).	
2.	Data Structures and Algorithm Analysis in Java (3rd Edition) by Mark Allen Weiss, Addison Wesley, (2011).	
3.	D. E. Knuth, "The Art of Computer Programming", 2 nd Ed., Addison Wesley.	

Central University of Kashmir				
Course Title	High Performance Computer Architecture	**Course Code**	MTCS 103	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester	1st	4	0	0

Course Objectives

Objective of the course is to make students familiar with the Instruction set architecture, Different memory technologies used in a computer system, Concept of Pipelining and Interconnection Networks

Learning Outcomes

1- Student will be able to differentiate between various types of architectures like Control Driven, data driven and reduction
2- Student will be able to comprehend how Multicore processors work.
3- Topologies of Interconnection Networks
4- Students will become familiar with the latest ARM Architecture
5- Students will learn how to write parallel programmes using OpenMP

Course Synopsis

With the emergence of High performance Multi core architectures, it has become imperative to write programmes in a way that they can exploit the power of high performance machine. Traditional Sequence programmes are required to be re-implemented so that they can be divided in to muti threads to be executed on the parallel hardware

Course Outline / Content

Unit	Topics	Week
1.	Introduction to computer architecture. Software-hardware interface. Performance metrics. Performance measurement, Benchmark programs. Micro-operations, Computer Instruction, Timing and control, Instruction Cycle, Instruction Types and formats, Micro-programmed and hardware control unit, Addressing Modes, Program Control Principles of instruction set design and demonstrate the use of Armv8-A Instruction Set Architecture.	3
2.	Auxiliary memory, Main memory, Memory Address Map, Associative memory, Cache memory, Virtual Memory. Computer Arithmetic: Floating point representation. Addition , Subtraction. Multiplication and Division; Cortex-A9 Processor as case study, Identify how the MMU and TLBs work in the Cortex-A9 processor.	4
3.	Pipelining, Instruction and arithmetic pipelining, Structural Hazards, Control Hazards, Data Hazards: Forwarding versus Stalling. Vector processing. I/O interfaces, Asynchronous Data Transfer, Priority Interrupt, I/O Processor. Pipeline in the Arm10 processor.	3

4.	Multiprocessor Organization, types, Symmetric Multi Processors, Cache Coherence, Hardware solutions and MESI protocol. MultiThreading and chip multiprocessors. Multicore Organization. Interconnection Network: Multistage Cube and Omega Network.	3
5	Introduction to OpenMP, OpenMP directives, Parallel constructs, Work-sharing constructs, Data environment constructs, Synchronization constructs, Extensive API library for finer control.	3
Text Books		
1.	Computer Organisation & Architecture: Designing for performance by W. Stallings, 9th edition, PrenticeHall International edition.	
References		
1.	Computer System Architecture by M. Mano, 2001, Prentice-Hall.	
2.	Computer Organization and Design, 2nd Ed., by David A. Patterson and John L. Hennessy, Morgan 1997, Kauffmann.	
3.	Computer Organization, 5th Edi, by Carl Hamacher, Zvonko Vranesic,2002, Safwat Zaky.	

Central University of Kashmir				
Course Title	Algorithms & Algortihmic Complexity Lab	**Course Code**	MTCS 104 L	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	02	**L**	**T**	**P**
Semester	1st semester	0	0	2

Course Objectives

1. The aim of this Course is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them.

2. Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.

Learning Outcomes

Learning Outcomes: By the end of course through lectures, readings, homeworks, lab assignments and exams, students will demonstrate: - The abilities

(1) To apply knowledge of computing and mathematics to algorithm design;

(2) To analyze a problem and identify the computing requirements appropriate for its solution;

(3) To design, implement, and evaluate an algorithm to meet desired needs;

(4) To apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices.

(5) To apply design and development principles in the construction of software systems of varying complexity.

(6) To function effectively as a member of a team in order to accomplish a common goal.

Course Synopsis

Recurrence equations. Asymptotic notations for complexity classes

Algorithm design strategies such as divide and conquer, dynamic programming, Greedy algorithms, backtracking and branch-bound.

Computational complexity of sorting and searching algorithm.

Course Outline / Content

	Topics	**Week**
	1. To implement the following using array as datastructure and analyse its complexity **a. Insertion sort b. Selection sort c. Bubble sort d. Quick sort e. Merge sort f. Bucket sort g. Shell sort h. Radix sort i. Heap sort** **2. To implement Linear and Binary search and analyze its complexity** **3. To implement Matrix Chain Multiplication and analyze its complexity** **4. To implement Longest Common Subsequence problem and analyze its complexity** **5. To implement Optimal Binary Search Tree problem and analyze its complexity** **6. To implement Huffman coding and analyze its complexity** **7. To implement Dijkstra's algorithm and analyze its complexity**	**To be performed in accordance with MTCS 102**

8. To implement Bellman Ford algorithm and analyze its complexity **9. To implement DFS and BFS and analyze their complexities.** **10. To implement Travelling salesman problem and analyze its complexity**	
Text Books	
1.	T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, "Introduction to Algorithms", 2 nd Ed., PHI
2.	Ellis Horowitz and SartazSahani, "Computer Algorithms", Galgotia Publications.
References	
1.	Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft, AddisonWesley Series (1983).
2.	Data Structures and Algorithm Analysis in Java (3rd Edition) by Mark Allen Weiss, Addison Wesley, (2011).
3.	D. E. Knuth, "The Art of Computer Programming", 2 nd Ed., Addison Wesley.

Masters in Technology (M. Tech)
Computer Science & Engineering (CS&E)

School of Engineering & Technology
Department of Information Technology

Course Structure for M .Tech. Computer Science & Engineering
(Batch 2021 onwards)

Semester II			
S. No.	**Course Code**	**Course Title**	**Credits**
1	MTCS 201	Next Generation Networks	4
2	MTCS 202	Research Methodology	4
3	MTCS 203	Data Science	4
4	MTCS 204 L	Next Generation Networks Lab	2
5	MTCS 205 L	Data Science Lab	2
6	MTCS E***	Elective II	4
7	***	Ability Enhancement Course (AEC)	4
		Total	**24**

Central University of Kashmir				
Course Title	Next Generation Networks	**Course Code**	MTCS 201	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester	2nd	4	0	0

Course Objectives

- Objective of the course is to develop the insight mechanism in Next Generation Networks. The term "next-generation network" or NGN refers to important developments in telecommunication core and access networks to be deployed over the next decade. NGN enables unfettered access for users to networks and to competing service providers and services of their choice.

Learning Outcomes

You will be able to learn

- Next generation networks, hardware and software regarding Networks
- OSI/TCP layers protocols, routing Algorithms
- Link layer, transport layer protocols and mechanism.
- Application layer and network managements, remote logins.
- Wireless, Mobile and Multimedia Networks with real time protocols.
- Software Defined networks and Internet of things.

Course Synopsis

In unit first general introduction to NGN is introduced, in unit second NGN framing flow control with various protocols algorithms subnetting is introduced, in unit three application layer network management remote login is explained, in unit four WirelessMobile and Multimedia Networks with real time protocols are explained and in unit five Software Defined networks is explained fallowed by Internet of things.

Course Outline / Content

Unit	Topics	Week
1.	Introduction to Next Generation Networks, Application and implacability, Computer networks and layered architectures. Circuit Switching, Packet Switching. Datagram & Virtual Circuit network, Hubs, bridges, switches, Routers & Gateways. Asynchronous Transfer Mode: ATM layered model, switching and switching fabrics, network layer in ATM, QOS.	4
2.	Framing, Flow control DLL, Protocols: Stop and Wait Protocol, Sliding window protocol ,STP, DLC, PPP.LLC and MAC sub layer protocol, ARQ based error control, Data Link Protocols: HDLC, SLIP, PPP, CSMA/CD & CSMA/CA, 802.11 Wireless LAN, 802.15 and 802.16.Tunneling, Fragmentation, IP addressing (IPV4 & IPV6), Subnetting, CIDR/VLSM DHCP, Routing algorithms &Internet protocols: IP, ICMP,NAT,PAT, ARP, RARP, RIP, OSPF, EGP & BGP.IPv4, IPv6 ICMP. Transport layer Protocols: TCP and UDP, TCP connection management, TCP congestion control.	4
3.	Application Layer Network application architectures: Client-server, P2P and hybrid, Application layer protocols: DNS, FTP, TFTP, TELNET, SSH, HTTP and WWW, SMTP and Electronic mail, Network management and SNMP , Network File System (NFS)	2

4.	Wireless and Mobile Networks: Wireless links and network characteristics, WiFi: 802.11 wireless LANs, Cellular internet Access, mobile IP mobility management: addressing and routing, handoffs, WAP, mobility in cellular networks. Multimedia Networking: Multimedia Network Application, VoIP, Real Time protocols.	3
5.	SDN: software Defined networks, Architecture, open flow switch. Internet of things (IOT) : introduction , Application , IOT enabling Technologies, barriers .	3
Text Books/ References		
1.	Kurose, J. F. and Ross, R.W,Computer Networking, Pearson Education	
2.	Comer, D.E. and Droms, R.E, Computer Networks and Internets, Prentice-Hall.	
3.	Walrand, J. and Varaiya, P, High Performance Communication Networks, Morgan	
4.	Keshav S., "An Engineering Approach to Computer Networking", Perason Education.	
5.	Comer D., "Computer Networks and Internet".	
6.	Gallo M., Hancock W., "Computer Communications and networking Technologies", Thomson Brooks/Cole.	

Central University of Kashmir				
Course Title	Research Methodology	**Course Code**	MTCS 202	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester	II	4	0	0

Course Objectives

At the end of this course, the students should be able to:

i) understand some basic concepts of research and its methodologies
ii) identify appropriate research topics
iii) select and define appropriate research problem and parameters
iv) prepare a project proposal (to undertake a project)
v) organize and conduct research (advanced project) in a more appropriate manner
vi) write a research report and thesis
vii) write a research proposal (grants)

Learning Outcomes

i) Students should know why educational research is undertaken, and the audiences that profit from research studies.
ii) Students should be able to identify the overall process of designing a research study from its inception to its report.
iii) Students should be familiar with ethical issues in educational research.
iv) Students should know the primary characteristics of quantitative research and qualitative research.
v) Students should be able to identify a research problem stated in a study.
vi) Students should be familiar with how to write a good introduction to an educational research study and the components that comprise such an introduction.
vii) Students should be familiar with conducting a literature review for a scholarly educational study.
viii) Students should be familiar with current uses of the terms reliability and validity in educational research.

Course Synopsis

The aim of this course is to develop students' knowledge and understanding of the role and conduct of quantitative and qualitative research methods in planning [and urban design]. Intellectual and methodological debates will be discussed in order to assist students to develop informed opinions and a critical appreciation for other's research. The imperative for ethical research practice will be presented. The course equips students with the skills to review and conduct methodologically sound research as a part of their professional work. Students develop the skills to recognise and reflect on the strengths and limitations of different research methodologies, understand the links between theory and practice, critically assess research, and address ethical and practical issues. The course takes a step-by-step approach to the design and implementation of quantitative and qualitative techniques.

Students will be equipped with the knowledge and ability to undertake original research projects and develop a set of transferable workplace skills.

Course Outline / Content

Unit	Topics	Week
1.	Introduction to Scientific Research, Basics of Research, Meaning, Objectives and Significance of Research, Important Skills and Abilities for Researchers, Motivation in Research, Pros and Cons	2

	of being Researchers, Goals of Master's Research, Key Tasks for getting a Master's Degree. Finding Ideas and organising plans, Literature Search and how to read papers.	
2.	Types of research approaches, Quantitative research methods, Research methods versus methodology, Research process, Criteria of good research, Research problems, Necessity of defining the problem, literature survey for research work, arriving at directions of research, Formulation of research title, development of criteria based research proposal. Identification and formation of research problem (Hypothesis). Research design.	3
3.	Scientific Writing: Significance of report writing, Structure and Components of Research Report, Types of Report: research papers, thesis, Research Project Reports, Precautions for writing research reports, Pictures and Graphs, Citation Styles, Oral presentation. Foot notes and bibliography.	2
4.	Conducting a solid research: An overview of Research Process, Jim Gray's Criteria, The Research matrix method, Carrying out the research, Empirical vs. Theoretical Research, Team Work and Multi- Disciplinary Research. Writing and publishing papers: Publish or Perish, why publishing top quality papers is hard?, What makes a paper great? Intellectual Property Rights.A brief idea about the funding agencies. Measurement and Scaling Technique: Measurement in research, Measurement Scales, Error sources. Test of sound measurement. Meaning of Scaling and its bases of classification, Scaling techniques.	3
5.	Writing and defending a Master's thesis: Thesis and Dissertation, Thesis Organisation, Defending Thesis. Open Source softwares for research. Technical writing using LaTeX: Installation, MikTeX, Creating reports and articles, Text environment, Math environment, Figures, Tables, BibTeX - reference manager, Camera Ready Preparation.	4
Text Books		
1.	A Guide to Successful Master's and Ph.D. Degrees in Science & Engineering, Charles X. Ling and Qiang Yang, Morgan & Claypool	
2.	C.R. Kothari, Research Methodology Methods & Techniques, 2nd Edition, WishwaPrakashan Publishers.	
3.	B.L. Garg, R. Karadia, Aggarwal. An introduction to Research methodology, RBSA publishers.	
References		
1.	Donald H.Mc Burney, Research Methods, Thomas learning.	
2.	Donald R. Cooper, Pamela S. Schinder, Business Research Methods, 8/e, Tata MC grawHillCo.ltd., 2006	
3.	Misra R.P, Research Methodology – A Hand Book, Concept publishing Company, New Delhi	
4	Leslie Lamport, LaTeX: A Document Preparation System, Second Edition.	

Central University of Kashmir				
Course Title	Data Science.	**Course Code**	MTCS 203	
Degree	Master of Technology	**Branch**	Computer Science & Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester	2nd	4	0	0

Course Objectives

The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Provide you with the knowledge and expertise to become a proficient data scientist. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.Produce Python code to statistically analyse a dataset. Critically evaluate data visualisations based on their design and use for communicating stories from data.

Learning Outcomes

The students learning outcomes are designed to specify what the students will be able to perform after completion of the course:

- Explain how data is collected, managed and stored for data science;
- Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;
- Implement data collection and management scripts using MongoDB.

Course Synopsis

The course is divided into five units covering appropriate Artificial Intelligent concepts.

- Basic Concepts
- Data representations and data cleaning techniques.
- Data Analysis and Machine Learning Techniques.
- Data Visualisation.
- Applications and Recent trends.

Course Outline / Content

Unit	Topics	Week
1.	Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.	4
2.	Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.	4
3.	Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.	4
4.	Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.	4
5.	Applications of Data Science,Technologies for visualisation, Bokeh (Python).	4

	Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.	
Text Books		
1.	An Introduction to Statistical Learning: with Applications in R by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani	
2.	Big Data and Hadoop by V.K. Jain,, Khanna Book Publishing, Delhi	
3.	Data Analytics by Maheshwari, McGraw	
References		
1.	Introduction to Machine Learning with Python: A Guide for Data Scientists by Andreas C. Mueller, Sarah Guido. published by O 'Reilly.	
2.	Deep Learning (Adaptive Computation and Machine Learning series) by Ian Goodfellow , Yoshua Bengio and Aaron Courville. The MIT Press	
3.	Python Data Science Handbook by Jake Vander Plas published by O 'Reilly.	
4.	Practical Statistics for Data Scientists by Peter Bruce, Andrew Bruce & Peter Gedeck published by O 'Reilly.	

Central University of Kashmir				
Course Title	Next Generation Network Lab	**Course Code**	MTCS 204 L	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester	2nd	0	0	2

Course Objectives

- To understand Practically the basics of next generation networking.
- Learn to configure network
- Learn to incorporate defense mechanism
- Learn to configure Routing protocols.
- Learn to handle CISCO, JUNIPER, PaloAlto, CyberRoam Devices.To understand various protocols for network security to protect against the threats in the networks.

Learning Outcomes

After doing Practical work in this course, you should be able to:

- identify and classify particular examples of attacks
- identify physical points of vulnerability in simple networks
- compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.
- Able to implement defense mechanism
- Able to perform Network Configurations
- Able to handle CISCO, JUNIPER, PaloAlto, CyberRoam Devices.

Course Synopsis

List of practical's are introduced Chronologically in order to attain proficiency

Course Outline / Content

Unit	Topics	Sessions
1.	Cisco IOS Command Modes.	2
2.	Configuration Of Various Networking Devices.	3
3.	Subnetting and Subnet masking, VLSM/CIDR.	2
4.	Configuring NAT,PAT.	1
5.	Configuring ARP, RARP.	1
6.	Configuring Protocols RIP, OSPF, EGP & BGP.	5
7.	Configuring DNS, FTP, TFTP	2
8.	Configuring TELNET, SSH	1
9.	Configuring HTTP and WWW, SMTP	2
10.	Accesses List implementation and Firewall Configuration	4
11.	Network testing	3

Text Books/ References

1.	Next Generation Network Essentials and safeguarding .CISCO.
2.	Fundamentals of Computer Security Technology, Edward Amoroso, Prentice-Hall.
3.	Cryptography and Data Security ,Dorothy E. Denning, Addison-Wesley.
4.	Computers under Attack ,Peter J. Denning, Addison-Wesley.
5.	Cryptography: Theory and Practice ,Douglas R. Stinson, CRC Press.

Central University of Kashmir				
Course Title	Data Science Lab	**Course Code**	MTCS 205 L	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	2	**L**	**T**	**P**
Semester	2nd			

Course Objectives

The course should enable the students to:
Understand the Programming Language for data analytics.
Exposure on Solving of data science problems.
Understand The classification and Regression Model.

Learning Outcomes

At the end of the course students will be able to design programs using various techniques which includes:

- Data representations and data cleaning techniques in programming languages.
- Implementation of Big Data computing techniques.
- Implementation of Machine Learning Techniques

Course Synopsis

Implementation of various data cleaning and representation methods.
Implementation of various data and matrix functions
Implementation of machine learning models
Implementation of visualization function

Course Outline / Content

Unit	Topics	Week
1.	Creating and displaying Data. Matrix manipulations Creating and manipulating a List and an Array Creating a Data Frame and Matrix-like Operations on a Data Frame Merging two Data Frames Applying functions to Data Frames Using Functions with Factors Accessing the Internet String Manipulations Machine learning concepts Scaling up the models Visualization Effects Plotting with Layers Overriding Aesthetics Histograms and Density Charts Simple Linear Regression – Fitting, Evaluation and Visualization Multiple Linear Regression, Lasso and Ridge Regression	

Text Books

1.	An Introduction to Statistical Learning: with Applications in R by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani
2.	Big Data and Hadoop by V.K. Jain,, Khanna Book Publishing, Delhi
3.	Data Analytics by Maheshwari, McGraw

References

1.	Deep Learning (Adaptive Computation and Machine Learning series) by Ian Goodfellow , Yoshua Bengio and Aaron Courville. The MIT Press
2.	Python Data Science Handbook by Jake Vander Plas published by O ‘Reilly.
3.	Practical Statistics for Data Scientists by Peter Bruce, Andrew Bruce & Peter Gedeck published by O ‘Reilly.
4.	An Introduction to Statistical Learning: with Applications in R by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani

Masters in Technology (M. Tech)
Computer Science & Engineering (CS&E)

School of Engineering & Technology
Department of Information Technology

Course Structure for M .Tech. Computer Science & Engineering
(Batch 2021 onwards)

Semester III			
S. No.	**Course Code**	**Course Title**	**Credits**
1	MTCS 301	Wireless Communication	4
2	MTCS 302	Network Security	4
3	MTCS 303	Research Project Phase I	4
4	MTCS E***	Elective III	4
5	MTCS E***	Elective IV	4
6	***	Open Generic Elective (OGE)	4
		Total	**24**

Central University of Kashmir				
Course Title	Wireless Communication	**Course Code**	MTCS 301	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester	3rd	4	0	0

Course Objectives

- Wireless communications have **enabled the connection of billions of people to the Internet** so that they can reap the benefits of today's digital economy.
- It also enables economies of scale by reducing the cost of network equipment and user devices enabling affordable services.

Learning Outcomes

- Identify and discuss the fundamental operational and design problems of wireless communication systems.
- Apply basic techniques to design radio links and basic communication systems.
- Apply basic mathematical and scientific principles to solve engineering design problems.

Course Synopsis

In unit first Services and technical Challenges are introduced, In unit two Wireless propagation Channels is introduced, in unit three Wireless transceivers is introduced, in unit four Signal processing in Wireless System is introduced and in unit Five Advance Transceiver Schemes is introduced fallowed By Antennas.

Course Outline / Content

Unit	Topics	Week
1.	SERVICES AND TECHNICAL CHALLENGES Types of Services, Requirements for the services, Multipath propagation, Spectrum Limitations, Noise and Interference limited systems, Principles of Cellular networks, Milestones in wireless communication R&D	3
2.	WIRELESS PROPAGATION CHANNELS Propagation Mechanisms (Qualitative treatment), and its effects on mobile communication: Free space attenuation, Reflection and Transmission, Diffraction , Scattering by surfaces. Channel Classification, Narrowband and Wideband models.	3
3.	WIRELESS TRANSCEIVERS Structure of a wireless communication link, Modulation and demodulation – Quadrature Phase Shift Keying, $\pi/4$-Differential Quadrature Phase Shift Keying, Offset-Quadrature Phase Shift Keying, Binary Frequency Shift Keying.	2
4.	SIGNAL PROCESSING IN WIRELESS SYSTEMS Principle of Diversity, Macrodiversity, Microdiversity, Signal Combining Techniques, Transmit diversity, Equalisers- Linear and Decision Feedback equalisers, Review of Channel coding and Speech coding techniques.	4
5.	ADVANCED TRANSCEIVER SCHEMES Spread Spectrum Systems- Cellular Code Division Multiple Access Systems- Principle, Power control, Effects of multipath propagation on Code Division Multiple Access, Orthogonal Frequency Division Multiplexing . Antennas: Introduction, Antennas for Mobile	3

	Stations, Antennas for Base Stations	
Text Books/ References		
1.	Andreas.F. Molisch, “Wireless Communications”, John Wiley – India, 2006.	
2.	Simon Haykin & Michael Moher, “Modern Wireless Communications”, Pearson Education, 2007.	
3.	Rappaport. T.S., “Wireless communications”, Pearson Education, 2003.	
4.	Gordon L. Stuber, “Principles of Mobile Communication”, Springer International Ltd., 2001.	

Central University of Kashmir				
Course Title	Network Security	**Course Code**	MTCS 302	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester	2nd	4	0	0

Course Objectives

- To understand basics of Cryptography and Network Security.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.

Learning Outcomes

After studying this course, you should be able to:

- identify some of the factors driving the need for network security
- identify and classify particular examples of attacks
- define the terms vulnerability, threat and attack
- identify physical points of vulnerability in simple networks
- compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.
- Able to implement defense mechanism

Course Synopsis

In first unit introduction of security concepts is discussed out, in unit second number theory concepts encryption and decryption techniques are introduced, in unit three cryptographic approached is touched in fourth unit web security considerations are discussed and finally in unit fifth defense tools and mechanism are introduced fallowed by firewall configuration.

Course Outline / Content

Unit	Topics	Week
1.	Security: Introduction, Concepts, Threats and Risks, Attacks and its types, Security Services, Mechanisms. Malicious Software: Viruses, Worms, Trojan, spyware, Access Control: Introduction, Models (Bell-LaPadula, Biba Integrity Models), Role Based Models.	3
2.	Number theory : Basic Concepts, Divisibility Algorithm, Groups, Rings ,Field , Finite Field(GF(P) & GF(2n)) , prime numbers (Fermat's &Euler's Theorm) Cryptography: Symmetric Cryptography: Symmetric Ciphers Models, Block Ciphers :DES, AES, Symmetric Cipher Modes, Stream Ciphers: RC4	3
3.	Asymmetric cryptography: RSA. Deffie Hellman key exchange Message Authentication: MD5 and SHA 512, Elliptical Curve Cryptography, Digital Signatures, Digital Signature Standard, Public Key Infrastructure (PKI): Key Management and Distribution, Kerberos protocol.	3
4.	Web security Consideration: Secured Socket Layer and Transport layer security, Secured Electronic Transaction (SET) and Secured Mail: Pretty Good Privacy (PGP), S/MIME, Network Attacks: Buffer Overflow, IP Spoofing, TCP Session Hijacking, Sequence Guessing, DNS Cache poisoning, IPSec, VPN.	3

5.	Network Defence tools: Intrusion Detection and Prevention system, Firewall: Types of Firewalls: Packet Filtering Router, Stateful Inspection Firewall, Application Level Gateway or Proxy, Circuit level gateway, Bastion Host Firewall Configuration: Screened Host Firewall System, Screened Subnet Firewall System. Mobile platform Security Model (Android and IOS), Mobile Threats and Malware.	3
Text Books/ References		
1.	Network Security Essentials ,William Stallings, Prentice-Hall.	
2.	Fundamentals of Computer Security Technology, Edward Amoroso, Prentice-Hall.	
3.	Cryptography and Data Security ,Dorothy E. Denning, Addison-Wesley.	
4.	Computers under Attack ,Peter J. Denning, Addison-Wesley.	
5.	Cryptography: Theory and Practice ,Douglas R. Stinson, CRC Press.	
6.	Computer Crime and Computer Forensics, Dr. R.K.Tiwari,P.K.Sastri,K.V.Ravikumar, First Edition, 2002, Select Publishers	
7.	Computer Security Gollmann, Dieter, First Edition, 1999, John Wiley & Sons Ltd.	

Masters in Technology (M. Tech)
Computer Science & Engineering (CS&E)

School of Engineering & Technology
Department of Information Technology

Course Structure for M .Tech. Computer Science & Engineering
(Batch 2021 onwards)

Semester IV			
S. No.	**Course Code**	**Course Title**	**Credits**
1	MTCS 401	Research project Phase II (Dissertation)	12
		Total	**12**

List of Elective Courses

Central University of Kashmir				
Course Title	Compiler Design	**Course Code**	MTCS E001	
Degree	Master of Technology	**Branch**	Computer Science & Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		04	0	0

Course Objectives

- To learn the process of translating a modern high-level language to executable code.
- To provide a student with an understanding of the fundamental principles in compiler design and to provide the skills needed for building compilers for various situations that one may encounter in a career in Computer Science.
- To develop an awareness of the function and complexity of modern compilers.
- To apply the code generation algorithms to get the machine code for the optimized code.
- To represent the target code in any one of the code formats
- To understand the machine dependent code.
- To draw the flow graph for the intermediate codes.

Learning Outcomes

- To realize basics of compiler design and apply for real time applications.
- To introduce different translation languages.
- To understand the importance of code optimization.
- To know about compiler generation tools and techniques.
- To learn working of compiler and non compiler applications.
- Design a compiler for a simple programming language.

Course Synopsis

This Course describes the theory and practice of compilation, in particular, the lexical analysis, parsing and code generation and optimization phases of compilation, and design a compiler for a concise programming language. The course has been divided into four units each unit describes the steps used in compiler design in detail.

Course Outline / Content

Unit	Topics	Week
1.	Introduction to Compiling- Compilers-Analysis of the source program-The phases- Cousins The grouping of phases-Compiler construction tools. The role of the lexical analyzer- Input buffering Specification of tokens-Recognition of tokens-A language for specifying lexical analyzer	04
2.	Syntax Analysis- The role of the parser-Context-free grammars-Writing a grammar-Topdown parsing, Bottom-up Parsing-LR parsers-Constructing an SLR(1) parsing table. Type checking, Type Systems Specification of a simple type checker. Run-Time Environments-Source language issues-Storage organization-Storage-allocation strategies.	04
3.	Intermediate languages-Declarations-Assignment statements -	04

	Boolean expressions- Case statements Backpatching-Procedure calls.	
4.	Issues in the design of a code generator- The target machine-Run-time storage management .Basic blocks and flow graphs- Next-use information-A simple code generator-Register allocation and assignment-The dag representation of basic blocks - Generating code from DAG.	
5.	Introduction-The principle sources of optimization-Peephole optimization- Optimization of basic blocks Loops in flow graphs-Introduction to global data-flow analysis-Code improving transformations.	04
Text Books		
1.	Compilers- Principles, Techniques, and Tools",Alfred V. Aho, Ravi Sethi Jeffrey D. Ullman, , Pearson Education Asia	
2.	Modern Compiler Design,DavidGalles, Pearson Education Asia.	
References		
1.	Advanced Compiler Design &Implementation, Steven S. Muchnick,Morgan Kaufmann Pulishers,.	
2.	Crafting a Compiler with C, C. N. Fisher and R. J. LeBlanc ", Pearson Education.	
3.	Modern Compiler Design, Galles, Pearson.	

Central University of Kashmir				
Course Title	Natural Language Processing	**Course Code**	MTCS E002	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- To learn about the concepts and principles of natural language processing.
- To explore both theoretical and practical issues of natural language processing.
- To develop skills of finding solutions and building software using natural language processing techniques.

Learning Outcomes

Upon successful completion of the course, the students will be able to
CO1: Understand concept of natural language processing.
CO2: Understand various research issues in natural language processing.
CO3: Apply various tools and techniques in natural language processing.

Course Synopsis

This course starts with the basics of natural language processing including regular expressions, Speech Recognition, Grammars and Sentence structure, Morphological Processing Grammars and Logic Programming. Finally, the course also covers, Word Senses and Ambiguity, The Basic Logical form and Semantic Networks.

Course Outline / Content

Unit	Topics	Week
1.	**Unit I** **Introduction:** Natural language processing- Linguistic Background, Regular Expressions and Automata, Morphology and Finite- state Transducers, Computational Phonology and Text-to- Speech, word level Morphology, Probabilistic Models of Pronunciation and spelling, N-grams, HMMs and speech Recognition.	04
2.	**Unit II** **Grammars and Parsing:** Grammars and Sentence structure, Top-Down Parser, Bottom- up chart Parser, Transition Network Grammars, Top Down chart parsing, Finite state Models and Morphological Processing Grammars and Logic Programming.	04
3.	**Unit III** **Grammars for Natural language :** Auxiliary verbs and verb phrases , Movement phenomena in language, Handling questions in context-free Grammars, Relative clauses, The Hold Mechanism in ATNs, Gap threading	04
4.	**Unit IV** **Semantic Interpretation:** Sements and logical form, Word Senses and Ambiguity, The Basic Logical form, Language, Encoding Ambiguity in the logical form, Verb & States in Logical forms Thematic Roles, Speech acts and Embedded Sentences Defining Semantic Structure: Model Theory	04

5.	**Unit V** **Linking Syntax and Semantics:** Semantic Interpretation and Compositionality, Lexicalized Semantic Interpretation and sematic roles, Semantic Interpretation Using feature Unification, Generating Sentences from Logical Form **Ambiguity Resolution:** Selectional Restriction, Semantic Filtering Using Selectional Restrictions, Semantic Networks, Stastical Word Sense Disambiguation, Stastical Semantic Preferences Combining Approaches to Disambiguation	04
Text Books		
1.	Speech and Language Processing by Daniel Jurafsky and James H. Martin, Prentice Hall.	
2.	Natural Language Understanding by James Allen, the Benajmins/Cummings.	
References		
1.	Allen, j., Natural Language Understanding. 2Nd Edition	
2.	Jurafsky, D.& J .Martin.2000.Speech and language processing: An introduction to Natural language processing, Computational Linguistics, and speech Recognition	
3.	Christopher D. Manning and Hinrich Schutze, Foundation of Statistical Natural Language Processing.1999.MITPress	

Central University of Kashmir				
Course Title	Multimedia Technologies	**Course Code**	MTCS E003	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		04	0	0

Course Objectives

- Describe the ways in which multimedia information is captured, processed, and rendered.
- Understand different compression techniques for multimedia.
- Introduce multimedia quality of service (QoS) and to compare subjective and objective methods of assessing user satisfaction
- Analyse the utility of different networking protocols and the ability of unicast and multicast protocols to provide QoS guarantees.

Learning Outcomes

- Identify the essential features of graphics/image data types, file formats, and colour models in images and video.
- Explain the technical details of multimedia data representations.
- Explain the technical details of popular multimedia compression standards.
- Explain the principles and technical details of several wired and wireless networking protocols.
- Identify the essential issues of quality of service in multimedia networking.
- Explain technical aspects of popular multimedia web applications, including VoD and VoIP.

Course Synopsis

Multimedia Technologies is an indispensable part of modern computing environments. This course will explain the technologies underlying digital images, videos and audio contents, including various compression techniques and standards, and the issues to deliver multimedia content over the Internet.

Course Outline / Content

Unit	Topics	Week
1.	Introduction: Multimedia basics, Multimedia Information representation as Text, image, audio and video.	04
2.	Multimedia Networks, Multimedia applications, Networking terminology. Text and image compression, compression Principles.	04
3.	Audio and Video compression, MPEG, Dolby, Coding and compression. Standards for multimedia Communication. Digital communication, Enterprise Networks	04
4.	The internet and its applications, World Wide Web. Broadband ATM Networks.	04
5.	Entertainment Networks and high speed modems. Transport Protocols, Application support functions.	04

Text Books

1.	Fred Halsall, Multimedia Communications Applications, Networks, protocols and

	standards, Pearson Education
2.	Fundamentals of Multimedia, ZE-Nian li and Mark S.Drew, Pearson Prentice Hall
References	
1.	Image and video compression for Multimedia Engineering: Fundamentals, Algorithms, and standards, Yun Q. Shi, Huifang sun, CRC Press
2.	Multimedia Communication systems, K. Rammohanrao, Z.S Bolzkovic,, D.A. Milanovic, Prentice Hall.
3.	Image and video compression for multimedia Engineering: Fundamentals, Algorithms, and Standards , Yun Q. Shi, Huifung sun, CRC Press.

Central University of Kashmir				
Course Title	Optimization Techniques	**Course Code**	MTCS E004	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		04	0	0

Course Objectives

- This course is intended to provide students with a knowledge that can make them appreciate the use of various research operations tools in decision making in organizations.
- At the end of the Course participants are expected to demonstrate a working knowledge of the various OR /OM tools in making decisions as well as being able to formulate organizational problems into OR models forseeking optimal solutions.

Learning Outcomes

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

- understand importance of optimization of industrial process management
- apply basic concepts of mathematics to formulate an optimization problem
- analyse and appreciate variety of performance measures for various optimization problems

Course Synopsis

The course has been divided into five units. In Unit-I, students will be able to list the various algorithms for optimality analysisand compare and contrast linear programming methods for optimum design. Unit-II and Unit-III will cover non-linear programming and dynamic programming. Lastly, Unit-IV and Unit-V are related to Queuing Theory and Network Models (CPM and PERT).

Course Outline / Content

Unit	Topics	Week
1.	**Unit I** **Introduction to Optimization:** Engineering applications of Optimization, Statement of an Optimization problem, Classification of Optimization Problems, Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with equality Constraints, multivariable Optimization with inequality Constraints. Linear Programming: Principles of simplex Method, Simplex method in tabular form, Duality and dual simplex method.	04
2.	**Unit II** **Assignment and Transportation Problems:** Mathematical model of assignment problem, solution methods of assignment problem: Enumeration Method, Transportation method, Hungarian method. Mathematical model of transportation problem, The transportation Algorithm, Methods of solving Transportation problems: North West corner Method, Least cost Method.	04
3.	**Unit III** **Dynamic Programming:** Introduction, Developing optimal	04

	Decision Policy, Dynamic Programming Approach for Solving Linear Programming Problems, Continuous Dynamic Programming	
4.	**Unit IV** **Queuing Theory:** Probability Description of arrivals and service times, Objectives and different Characteristics of queuing system .Discrete time Queuing Systems, steady state behaviour of Markovian and Eriangian Models (MM/1, MM/CM/Ek /1)	04
5.	**Unit V** **Network Models:** Scope and Definition of Network Models, Minimal spanning Tree algorithm, Shortest- Route Problem, Maximal Flow Model, CPM and PERT.	04
Text Books		
1.	HamdyA.Taha Operations Research 8 edition	
2.	Deb K., Optimization for Engineering Design Algorithms and Examples,2nd Edition, PHI, 2012.	
3.	R.P.Sen Operations Research, Algorithms and Application	
References		
1.	S.S Rao, Engineering optimization: Theory & practice	
2.	Taha H.A "Operations Research- an Introduction", prentice Hall of India, 2003	
3.	Arora J., Introduction to Optimization Design, 2nd Edition, Elsevier Academic Press, New Delhi, 2004	

Central University of Kashmir				
Course Title	VLSI	**Course Code**	MTCS E005	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- It is intended to provide students an understanding of various contemporary techniques for the design, Simulation.
- To use modelling of the various semiconductor devices for digital VLSI circuit design.
- Emphasis on full-custom design. – Circuit and system levels and and layout verification.
- To comprehend static and dynamic CMOS logic circuits.
- Specific techniques for designing high-speed, low-power, and easily-testable circuits
- To analyse the designed digital circuits and their verification**.**
- To introduce students to basic concepts of digital VLSI chip design using the simpler VLSI technology.

Learning Outcomes

- Classify ICs, static and dynamic VLSI design techniques.
- Advanced concepts of circuit design for digital VLSI components in
- state of the art MOS technologies. Design a circuit, build and optimize a CMOS layout.
- Build upon the theoretical & mathematical models using design principles, for proper understanding of VLSI circuits.

Course Synopsis

The course will cover basic theory and techniques of digital VLSI design in CMOS technology. Topics include: CMOS devices and circuits, fabrication processes, static logic structures, chip layout, simulation and testing, low power techniques, design tools and methodologies, VLSI architecture. We use full-custom techniques to design basic cells and regular structures such as data-path and memory arrays. There is an emphasis on modern design issues in power, interconnect and clocking.

Course Outline / Content

Unit	Topics	Week
1.	Review of MOSFET operation and CMOS process flow :MOS Threshold voltage, MOSFET I-V characteristics: long and short channel, MOSFET capacitances, lumped and distributed RC model for interconnects, transmission lines, CMOS process flow, layout and design rules. Introduction to IC Technology: Lithography, Diffusion, Ionimplantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and Capacitors	04
2.	MOS Inverters, Static and Dynamic characteristics, Resistive, Depletion and Enhancement load NMOS inverters, the basic CMOS inverter, voltage transfer characteristics, logic threshold,	04

	Noise margins. Dynamic behavior, transition time, Propagation Delay, Power Consumption. MOS device layout, Transistor layout, Inverter layout, CMOS-circuits layout & simulation, Circuit Compaction, Euler's Rule, Circuit extraction and post-layout simulation.	
3.	Combinational MOS Logic Design, Static MOS design, Complementary MOS, Ratioed logic, Pass Transistor logic, Complex logic circuits, DSL, DCVSL, Transmission gate logic. Dynamic MOS design, Dynamic logic families and their performance.	04
4.	Sequential MOS Logic design: Static latches and flip-flops (FFs), dynamic latches and FFs, sense-amplifier based FFs, NORA-CMOS, Schmitt trigger, monostable and astable circuits. MOS Memory design, Design of ROM, SRAM and DRAM cells.	04
5.	Introduction to low power design, Input and Output Interface circuits. BiCMOS Logic Circuits, Introduction, Basic BiCMOS Circuit behavior, Switching Delay in BiCMOS Logic circuits. Timing fundamentals, clock distribution, jitter, self-timed circuit design, synchronizers and arbiters, basic building blocks of PLLs, clock synthesis and synchronization using PLLs.	04
Text Books		
1.	Digital Integrated Circuits Design by J.M. Rabey, Pearson Education	
2.	Kang, S. and Leblebici, Y., CMOS Digital Integrated Circuits – Analysis and Design, Tata McGraw Hill 3rd ed.	
References		
1.	aker, R.J., Lee, H. W. and Boyce, D. E., "CMOS Circuit Design, Layout and Simulation", Wiley – IEEE Press 2nd ed.	
2.	Principles of CMOS VLSI Design: A System Perspective by NHE Weste & K. Eshraghian, McGraw Hill Pub	
3.	Introduction to VLSI by Eshraghian & Pucknell, PHI.	

Central University of Kashmir				
Course Title	Software Project Management	**Course Code**	MTCS E006	
Degree	Master of Technology	**Branch**	Computer Science &Eng.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

At the end of the course, the student shall be able to:

- This course is aimed at introducing the primary important concepts of project management related to managing software development projects.
- They will also get familiar with the different activities involved in Software Project Management.
- Further, they will also come to know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.

Learning Outcomes

- ❖ Identify the different project contexts and suggest an appropriate management strategy.
- ❖ Practice the role of professional ethics insuccessful software development.
- ❖ Identify and describe the key phases of project management.
- ❖ Determine an appropriate project management approach through an evaluation of the business context and scope of the project.

Course Synopsis

• Suggesting an efficient management strategy for a business scenario.
• Demonstrate through application, knowledge of the key project management skills, such as product and work break-down structure, schedule, governance including progress reporting, risk and quality management
• Demonstrate an ability to present his/her ideas both formally and informally to a group of their peers and the management.

Course Outline / Content

Unit	Topics	Week
1.	SOFTWARE MANAGEMENT & ECONOMICS:The Waterfall Model, Conventional Software Management Performance; Evolution of Software Economics - Software economics, Pragmatic software cost estimation, Reducing software product size, Improving software processes	
2.	THE OLD AND THE NEW WAY OF PROJECT MANAGEMENT:Improving team effectiveness, Improving automation through software environment, Achieving required quality; Peer inspections – A pragmatic view, The principles of conventional software engineering, Principles of modern software management, Transitioning to an iterative process.	
3.	SOFTWARE MANAGEMENT PROCESS FRAMEWORK:Life cycle phases, The artifact sets, Management artifacts, Engineering artifacts, Pragmatic artifacts; ModelBased Software Architectures - A management perspective and A technical perspective.	

4.	PROJECT ORGANIZATION AND PLANNING:Work breakdown structures, Planning guidelines, The cost and schedule estimating process, The iteration planning process, Pragmatic planning, Line-of-Business organizations, Project organizations, Evolution of organizations; Process automation - Automation building blocks, The project environment.	
5.	PROJECT CONTROL AND PROCESS INSTRUMENTATION:The Seven-Core metrics, Management indicators, Quality indicators, Life-Cycle expectations, Pragmatic software metrics, Metrics automation, Modern project profiles, Next generation software economics, Modern process transitions	
Text Books		
1.	Managing the Software Process, Watts S. Humphrey, Pearson Education.	
2.	Software Project Management, Walker Royce, Pearson Education.	
References		
1.	Bob Hughes and Mike Cotterell, "Software Project Management", 3rd Edition, Tata McGraw Hill Edition, 2005.	
2.	Joel Henry, "Software Project Management", 1st Edition, Pearson Education, 2006.	
3.	Kieron Conway, Software Project Management, Dreamtech Press	

Central University of Kashmir				
Course Title	Expert Systems	**Course Code**	MTCS E007	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		04	0	0

Course Objectives

- To introduce the fundamentals of Knowledge Engineering and Intelligent Systems.
- To provide deep understanding of Knowledge Engineering and Intelligent Systems.
- Categorization of domain specific principles of expertise.
- Possible improvement of performance by refinement of these principles.
- Demonstrate the fundamental and advanced modules of Expert Systems especially with Searching methods, Representation of knowledge and different reasoning techniques
- Knowledge about the tools and the processes used for the creation of an Expert system.

Learning Outcomes

- Define and describe expert system and its main constituents.
- Distinguish class of problems suitable for solving with expert systems.
- Breakdown the problem and select crucial parts.
- Assemble various parts of knowledge and skills in order to devise the approach to solution.
- Design and create expert system suitable for solving particular problem.
- Knowledge about the tools and the processes used for the creation of an Expert system.

Course Synopsis

This course deals with techniques for the construction of expert systems including computer inference and knowledge acquisition; knowledge representation schemes; conceptual date analysis; plausible reasoning techniques; validation and measurement methods; production-rule programming. Students learn how to build a rule-based expert system in a variety of application areas.

Course Outline / Content

Unit	Topics	Week
1.	Overview introduction to rule- based expert systems: Background, general introduction. Forward and backward chaining, conflict resolution. Uses, structured selection, configuration, diagnosis and business rules	04
2.	Rule- based expert system: Uncertainty, fuzzy logic and belief nets. Expert system shells	04
3.	Other Expert system: Paradigms PIES example system (Pan and Tenenbaum) OOPs, frames, case-based reasoning and help desks, Recommendor systems (Cd Now case study). Scheduling (Steelmaking example: Dorn and Slany)	04
4.	Building expert systems : CLUES example system (Talebzadeh, Mandutianu and Winner), Building expert systems Discussion of shells. Knowledge Management (Wiki Web case study)	04

5.	Machine Learning and data-base mining: Data Mining Decision Trees, Neural Networks, Text Mining, Web Mining current trends in AI	04
Text Books		
1.	The Engineering of knowladge- based system, A.J. Gonzalez and .D.Dankel, Prentice Hall, 1993.	
2.	A guide to expert systems, Donald A. Watermann, Pearson publications.	
References		
1.	Introduction to knowledge systems, Stefik M., Morgan Kaufkannn	
2.	Giarratano J., Riley G., Expert systems, Principles and Programming, PWS Publising Company.	
3.	Introduction to Expert Systems, Peter Jackson, Addison-Wesley Pub (Sd), AddisonWesley Pub (Sd), 2nd edition, ISBN-10 : 0201175789, ISBN-13 : 978-0201175783	

Central University of Kashmir				
Course Title	Advanced Java & Android Programming	**Course Code**	BTCS E008	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

This course facilitates classroom and laboratory learning, letting students develop competence and confidence in android programming and understand the entire Android Apps Development Cycle, as well as it would also enable the students to independently create Android Applications.

Learning Outcomes

After completion of this course, student will be able to

- Use the development tools in the Android development environment .
- Use the major components of Android API set to develop their own apps.
- Describe the life cycles of Activities, Applications and Fragments.
- Use the Java programming language to build Android apps.
- Make UI-rich apps using all the major UI components.

Course Synopsis

The course is divided into five units covering appropriate Android Programming concepts.

- Basic android programming development environment.
- User interfaces for android applications.
- Background tasks .
- Working with data in Android and data management in databases.
- Working with APIs for sensors , locations and Maps.

Course Outline / Content

Unit	Topics	Week
1.	**Basic of Android Programming:** Introduction to Android OS, Setting up the Android Application Development Environment, Creating, Testing and Debugging Applications, Android Stack, Android applications structure, Activity life cycle, Understanding implicit and explicit intents	4
2.	**User Interface in Android:** Adaptive and responsive user interfaces, User Input Controls, Menus, Screen Navigation, Recycler View, Drawables, Themes and Styles, Fragments Fragment Life Cycle, Introduction to Material Design, Testing the user interface.	4
3.	**Background tasks:** AsyncTask, AsyncTaskLoader, Connecting App to Internet, Broadcast receivers, Services, Notifications, Alarm managers.	4
4.	**Working with data in Android:** Shared Preferences, App Setting, SQLite primer, Store data using SQLite database, Content Providers, Content Resolver, Loader	4
5.	**Sensor, Location and Maps:** Sensor Basic, Motion and Position Sensors, Location services, Google maps API, Google Places API	4

Text Books

1.	Android Programming with Kotlin for Beginners: Build Android apps by John Horton ,publisher packt

2.	Java Programming for Android Developers For Dummies (For Dummies (Computers) by Barry Burd, published by For Dummies
3.	GUI Design for Android Apps by Ryan Cohen, published by Apress Open
References	
1.	Android: A Programming Guide by J.F. DiMarzio
2.	Hello, Android: Introducing Google's Mobile Development Platform by Ed Burnett
3.	Programming android by Zigurd Mednieks
4.	Android User Interface Design: Turning Ideas and Sketches into Beautifully Designed Apps byIan G. Clifton

Central University of Kashmir				
Course Title	Computer Graphics	**Course Code**	MTCS E009	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits		**L**	**T**	**P**
Semester		4	0	0

Course Objectives

1. The course introduces the basic concepts of computer graphics.
2. It provides the necessary theoretical background and demonstrates the application of computer science to graphics.
3. The course further allows students to develop programming skills in computer graphics through programming assignments.

Learning Outcomes

On completion of the course the student should have the following learning outcomes:

1. The student understands the core concepts and mathematical foundations of computer graphics, knows fundamental computer graphics algorithms and data structures,has an overview of different modeling approaches and methods.

2. The student can use modeling software to create basic 3D scenes, can apply basic mathematics in the development of graphics applications is able to design and develop software for modern graphics hardware

3.The student is able to analyze, disseminate, and communicate visual computing solutions ,can organize and structure problem solving approaches in a team environment

Course Synopsis

1. Overview of Graphics Systems: Video Display Devices.
2. Curves and Surfaces, Line Drawing Algorithm.
3. Geometric Transformation.
4. Curves and Visible Surface Detection Methods.
5. Illumination Model and Surface Rendering.

Course Outline / Content

Unit	Topics	Week
1.	Overview of Graphics Systems: Video Display Devices , Refresh cathode ray tubes, Refresh scan displays, Random scan displays, color CRT Monitors, DVST, Flat- Panel displays, Three Dimensional viewing devices, Raster scan systems, Input Devices: Keyboards, Mouse, Track ball, Joysticks, Data Glove, Touch Panels, Light pens.	4
2.	Curves and Surfaces:Line Drawing Algorithm, DDA Algorithm, Bresenham's Line Drawing Algorithm, Bresenham's Circle Drawing Algorithm, Ellipse Drawing Algorithm, Pixel Addressing and object geometry: Screen Grid coordinates, MaintaningGoemetry properties of Displayed objects.	4
3.	Geometric Transformation: Homogeneous Coordinate System for 2D and 3D, Various 2D, 3D Transformation matrices (Translation, Scaling, Rotation, Shear), Rotation about an arbitrary point (2D), Rotation about an arbitrary axis (3D),	4

	Computing location of V.P, Clipping Algorithms, SutherlandCohen Clipping Algorithm.	
4.	Curves and Visible Surface Detection Methods:Bezier Curves, 4 point and 5 point Bezier curves using Bernstein Polynomials, B-Spline Curves, Computing control points given end slopes for a specified curve segment. Back Face Detection, Depth Buffer (Z-Buffer, ABuffer) Method, Scan Line Method, Depth Sorting Method, Area Subdivision Method.	4
5.	Illumination Model and Surface Rendering: Basic Illumination models, shading models for curve surfaces, Half tone Pattern and Dithering Techniques, Rendering, Color Models: XYZ Color Model, RGB, YIQ, CMY, HSV, HLS.	4
Text Books		
1.	Computer Graphics, D. Hearn and P. Baker, Prentice	
2.	Computer Graphics, R. Plastock and Z.Xiang, Schaum's Series, McGraw Hill.	
References		
1.	Hall3. Computer Graphics Principles &Practice, Foley et. al., Addison Wesley.	
2.	Procedural Elements for Computer Graphics, David F. Rogers, McGraw Hill.	
3.	Principles of Interactive Computer Graphics,W. Newman and R. Sproul, McGraw-Hill.	

Central University of Kashmir				
Course Title	Embedded system	**Course Code**	MTCS E010	
Degree	Master of Technology	**Branch**	Computer Science &Eng.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

Present overview structure of embedded system with pipelining.
Understand the programming languages for embedded system design.
Develop an understanding of implementation methodology of Arduino and Rasberry Pi.

Learning Outcomes

Learn the concept of structure of embedded system.
Identify the needs of Arduino/Rasberry Pi in real life applications.

Course Synopsis

After completing this course, students will have a broad and fundamental understanding of Embedded System.Topics range from an overview of Basics of Embedded System, ARM processor's introduction, programs based on ARM processor using Embedded C, Overview of Real Time Embedded System.

Course Outline / Content

Unit	Topics	Week
1.	Intel 8051 Micro controller: Basic differences between Microprocessors and Microcontroller. Introduction to Intel 8051 Microcontroller, architecture, registers, Internal and External Memory. Instruction Set. On Chip Counters / Timers, Serial I/O, Interrupts and their use. Assembly language programming.	
2.	Atmel And PIC Microcontrollers: Introduction to Atmel and PIC C6X microcontrollers, architecture, registers, Internal and External Memory, Instruction Set, On Chip Counters / Timers, Serial I/O, Interrupts and their use. PWM, Watch dog Timer, ISP, IAP features. Assembly language programming.	
3.	ARM7TDMI (Advanced RISC Machines): ARM Architecture, Cortex-M3 Basics, Exceptions, Instruction Sets, NVIC, Interrupt Behaviour, Cortex-M3/M4 Programming, Exception Programming, Memory Protection Unit and other Cortex-M3 features, STM32L15xxx ARM Cortex M3/M4 Microcontroller Memory and Peripherals, Development & Debugging Tools..	
4.	Open Source Embedded Development Board (Arduino): Overview of open source embedded development board (Arduino), block diagram, pins of embedded development board, features of open source tool used for programming a development board, programming of embedded development board, Interface Serial Port with embedded development board, Program Raspberry Pi: a credit-card sized computer, Python programming for Raspberry Pi, Interacting and configuring the RPi OS, Porting of Linux Kernel and booting RPi..	
5	CASE STUDIES: Design of Embedded Systems using the Microcontroller– 8051/ Amtel/ Arduino/ Raspberry Pi, for applications in the area of Communications, Automotives, and industry	

Text Books/ References	
1.	Raj Kumar, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw Hill, Third Reprint, 2003
2.	John Catsoulis, O’Reilly, “Designing Embedded Hardware”, First Indian Reprint, 2003.
3.	David E. Simon, “An Embedded Software Primer”, Pearson Education Asia, Fifth Indian Reprint, 2002
4.	Michael Barr, O’Reilly, “Programming Embedded Systems in C and C ++”, 1999
5.	J.W. Valvano, “Embedded Microcomputor System: Real Time Interfacing”, Brooks/Cole, 2000

Central University of Kashmir				
Course Title	Cloud Computing	**Course Code**	MTCS E012	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- To learn how to use Cloud Services
- To implement Task Scheduling algorithms
- To implement Virtualization
- To describe the security aspects in cloud
- To build Private Cloud and Broadly educate to know the impact of engineering on legal and societal issues involved

Learning Outcomes

- Ability to identify core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing
- Students identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud
- Students Analyze various cloud programming models and apply them to solve problems on the cloud
- Students will integrate the core issues of cloud computing such as security, privacy, and interoperability

Course Synopsis

The course is divided into five units.
Unit-I and Unit-II introduces the core concepts of cloudcomputing**,** cloud deployment model, and types of cloud services. In Unit-IV students will work with cloud storage systems and learn to develop different applications in several programming paradigms. Lastly, in Unit IV and Unit-V students will learn about Cloud security challenges, Security of virtualization, Discovering Cloud Services and tools – Amazon EC2, Google App Engine, and IBM Clouds.

Course Outline / Content

Unit	Topics	Week
1.	**Unit I: INTRODUCTION** Cloud Computing – Evolution of Cloud Computing, the role of networks in Cloud computing, essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Cloud cube model, Advantages and Disadvantages of Cloud Computing.	04
2.	**Unit II: Cloud Services and Data in Cloud** Web-Based Application – Pros and Cons of Cloud Service Development. Types of Cloud Service Development – Software as a Service, Platform as a Service, Infrastructure as a Service. Storage system architecture, Big data, Virtualized Data Centre (VDC) architecture	04

3.	**Unit III: Virtualization, Server, Storage and Networking** Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization technologies and architectures, Hypervisors: KVM, Xen, Different hypervisors and features.	04
4.	**Unit IV: Cloud Security** Cloud Security risks, Security, Privacy, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risk posed by a management OS, Trusted virtual machine monitor.	04
5.	**Unit V: QoS [Quality of Service] of Cloud and Cloud Patterns** Taxonomy and survey of QoS management and service, Selection methodologies for cloud computing, Auto scaling, Load balancing in Cloud. Discovering Cloud Services and tools – Amazon EC2, Google App Engine, IBM Clouds	04
Text Books		
1.	Cloud Computing: A Hands-On Approach 1st Edition.	
2.	Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice (O'Reilly)) 1st Edition.	
References		
1.	Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication	
2.	Borko Furht, "Handbook of Cloud Computing", Springer	
3.	Venkata Josyula,"Cloud computing – Automated virtualized data center", CISCO Press	
4.	Cloud computing: Data Intensive Computing and Scheduling by Chapman Hall/CRC	

Central University of Kashmir				
Course Title	Advanced Object Oriented Programming System (OOPs)	**Course Code**	MTCS E014	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

1. To apprise students of various programming techniques along with respective merits and demerits of each technique.
2. To introduce basics terminology and design principles associated with OOPs and constructs in C++ to support those.
3. To discuss the principles of abstraction and encapsulation with emphasis on silent functions written by compiler, const-pass-by-reference, issues with friend functions, handling of pointer-type-variables in copy cotr, static data members and similar c++ constructs.
4. To discuss the principles of inheritance and polymorphism with emphasis on virtual and non-virtual functions, open and close principle, Liskcov's substitution principle, virtual dotr, private inheritance, virtual base classes and similar c++ constructs.
5. To familiarize students with compile time polymorphism and code sharing with c++ templates.
6. To make students understand the difference between error and exception handling with proper language constructs for the same.
7. To introduce basic UML design notations, static and dynamic models elements for object oriented system design.

Learning Outcomes

a.The students will be able to decide which programming technique to use in a given design situation based on the respective merits and demerits.
b. The students will be able to design clean interfaces for the classes using the abstraction design principle.
c. The students will be able to separate out the interfaces from the implementation during the class design by applying the abstraction and encapsulation principles.
d. The students will be able to understand the design cost involved for using c++ constructs like passing parameters by value or by reference, deep copy cotr, silent function writing by compiler and friend functions.
e. The students will be able to use inheritance correctly for writing "is-a" kind of relationships based programs and not mere for code reuse.
f. The students will be able to write polymorphic programs with clear understanding of inheritance of interfaces v/s inheritance of default implementation v/s inheritance of static implementation. g. The students will be able to handle issues with multiple inheritance, memory leak issue for not using virtual dotr, issue with inheritance of non-virtual function.

Course Synopsis

The course has been divided into five units.
In Unit-I and Unit-II, the students will learn about various programming paradigms, articulate the principles of OOP, essential features and elements of OOP.
Unit-III and Unit-IV are related to constructors, destructors, inheritance and its types. Finally, Unit-V will highlight the concepts of UML, aggregation and use case diagrams.

Course Outline / Content

Unit	Topics	Week

1.	**Programming Techniques- A Survey** Introduction to programming paradigms – unstructured programming, structured, procedural, and modular programming; drawbacks of structured programming; Object Oriented programming. **Classes and Objects** Introduction to objects; classes – declaration in C++, abstraction and encapsulation, creating objects; array of objects; objects as function arguments, scope resolution operator, static data members; properties of classes and objects.	04
2.	**Functions: advanced concepts** Polymorphism, Function overloading; inline functions; friend functions- Member functions of a class as friends of another class, Friend Function as a bridge between two classes; friend classes; recursion – types of recursion: linear, binary, tail recursion	04
3.	**Constructors and Destructors** Constructors – types of constructors: default, user defined, parameterized, copy constructors, and constructors with default arguments; rules for constructor definition and usage; destructors - rules for destructor definition and usage. **Inheritance: Extending classes** Introduction to code reuse; containership-aggregation; inheritance – visibility modes, 'Open Close Principle'(OCP) types of inheritance: multilevel, multiple inheritance; function overriding – virtual functions, 'Liskov's Substitution Principle' (LSP), pure virtual functions; roles of constructors and destructors in inheritance; virtual base class –graph inheritance.	04
4.	**Templates: code sharing (Genericity):** Introduction to code sharing; templates; generic classes; templates with more than one generic parameter; **Exception handling** Introduction – traditional error handling; exception handling in C++ - 'try, throw, and catch blocks', multiple throw and multiple catch blocks, throwing objects; situations of usage of exception handling.	04
5.	**Introduction to UML** Introduction – static model, dynamic model; class diagrams – relationship among classes: composition – association & aggregation, multiplicity, generalization – inheritance, hierarchy of classes, dependency; use case diagrams; behaviour diagrams: interaction diagrams – sequence and collaboration diagrams, state chart diagrams, activity diagrams; implementation diagrams: component and deployment diagrams.	04
Text Books		
1.	E. Balagurusamy, "Object Oriented Programming with C++", TMH.	
2.	Robert Lafore, "Object Oriented Programming in C++	
3.	Bjarne Stroustrup, "The C++ Programming Language", 1e: third edition	
References		
1.	A.K.Sharma, Kavita Kapur, " Introductory Computer Science with C++, Vol. II", Dhanpat Rai Publications	

2.	Herbert Schield “The Complete Reference in C++” TMH.
3.	Donovan ,”Systems Programming”, Tata McGraw Hill.

Central University of Kashmir				
Course Title	MTCS E015	**Course Code**	Image Processing	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

This course provides an introduction to basic concepts, methodologies and algorithms of digital image processing focusing on the following two major problems concerned with digital images:
(1) image enhancement and restoration for easier interpretation of images, and
(2) image analysis and object recognition.

The primary goal of this course is to lay a solid foundation for students to study advanced image analysis topics such as computer vision systems, biomedical image analysis, and multimedia processing & retrieval.

Learning Outcomes

Students are able to
1: understand the need for image transforms different types of image transforms and their properties.
2: develop any image processing application.
3: understand the rapid advances in Machine vision.
4: learn different techniques employed for the enhancement of images.
5: learn different causes for image degradation and overview of image restoration techniques.
6: understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
7: learn different feature extraction techniques for image analysis and recognition

Course Synopsis

1. Introduction and Fundamentals
2. Image Enhancement.
3. Color Image Processing.
4. Registration.
5. Feature Extraction

Course Outline / Content

Unit	Topics	Week
1.	Introduction and Fundamentals: Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization. Image Enhancement in Spatial Domain: Introduction; Components of Image Processing System, Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter,	4

	Ordered Statistic Filter; Sharpening – The Laplacian.	
2.	Image Enhancement in Frequency Domain: Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian Highpass Filters; Homomorphic Filtering. Image Restoration: A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.	4
3.	Color Image Processing: Color Fundamentals, Color Models, Color Transformation, Smoothing and Sharpening, Color Segmentation. Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening	4
4.	Registration: Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth Segmentation: Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following, Edge Elements Extraction by Thresholding, Edge Detector Performance, Line Detection, Corner Detection.	3
5.	Feature Extraction: Representation, Topological Attributes, Geometric Attributes Description: Boundary-based Description, Region-based Description, Relationship. Object Recognition: Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching	3
Text Books		
1.	Rafael C. Gonzalvez and Richard E. Woods, Digital Image Processing 2nd Edition, Published by: Pearson Education.	
2.	2) R.J. Schalkoff, Digital Image Processing and Computer Vision, Pubished by John Wiley and Sons, NY. l	
References		
1.	William K Pratt, Digital Image Processing John Willey	
2.	Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, Image Processing Analysis and Machine Vision –Thompson Learniy.	
3.	A.K. Jain, PHI, New Delhi (1995)-Fundamentals of Digital Image Processing	

Central University of Kashmir				
Course Title	System Analysis and Design	**Course Code**	MTCS E016	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- The course covers the development of information systems and of their software components. Students gain experience in requirements elicitation and modelling and systems analysis and feasibility estimation within a system development project setting aimed at developing an event-driven information system
- System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose.

Learning Outcomes

- On completion of this course the student should be able to: Explain what systems are and how they are developed.
- Explain the need for and value of a formalized step-by-step approach to the analysis, design, and implementation of computer information systems. Use tools and techniques for process and data modeling.
- System analysis is conducted for the purpose of studying a **system** or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose.

Course Synopsis

In unit first Modern approaches to system Analysis and development is introduced , in unit second System concepts structured technique is introduced, in unit three System requirements specification analysis is introduced, in unit four detailed modeling is explained and in unit five system control audit trials fallowed by management techniques is explained.

Course Outline / Content

Unit	Topics	Week
1.	Modern approach to system Analysis and Development, role of engineer in system development, Types of information system. System development methodology: system development life cycle, Requirement Analysis, Feasibility study, System Analysis and system Design, Link program Testing, Conversion And Installation, System review And Evaluation, Maintenance, Prototyping.	4
2.	**Unit II** System Concepts: Components of A System, Open System, closed System. Identifying And Selecting System Development project, Feasibility study Operational, Technical, Economical. Tools for Analysis And Design of software systems. Methodology Available: Need for Structured Techniques Available. Methods of system analysis, system development life cycle, structured approach, development tools.	4
3.	**Unit III** System requirement Specifications And Analysis: Documentation	2

	techniques for System Analysis. Context Diagram or Activity diagram Data flow Diagram. Activity Sheets, Data flow Sheets, Data Stores Sheets, Data item Sheets, Data Dictionaries; Decision Trees And Tables; Expansion, Explosion And normalization.	
4.	Detailed Design: Modulation, Module Specification; File Design; Data Base Design; Dialog (User Interface) Design, System Control And Quality Assurance; Documentation Tools, testing Techniques Available	2
5.	System Control And Audit Trails; System Administration And Training, Final Installation and Maintenance. Hardware:- Acquisition, Benchmarking, Vendor Selection. Management Techniques for managing software products.	2
Text Books/ References		
1.	Jeffery. Hoffer," Modern System Analysis And Design", Person Edu., New Delhi.	
2.	Awadh. Elias M. Systems Analysis and Design. Latest edition., New delhi prentice Hall of India. 1990.	
3.	Coad,Peter and Edward Yourdon. Object- Oriented Analysis.. Englewood cliff, New jersey, Yourdon Press.	
4.	Hawryszkiewyez, I.T. Introduction to System Analysis and Design. Prentrice Hall of India.	
5.	Macro. T.D Structure Analysis and Systems specifications New Delhi, Yourdon press.	

Central University of Kashmir				
Course Title	E-commerce	**Course Code**	MTCS E017	
Degree	Master of Technology	**Branch**	Computer Science &Eng.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

1. Discuss fundamentals of e-commerce, types and applications.
2. Evaluate the role of the major types of information systems in a business environment and their relationship to each other
3. Assess the impact of the Internet and Internet technology on business electronic commerce and electronic business
4. Identify the major management challenges for building and using information systems and learn how to find appropriate solutions to those challenges.
5. Learn strategies for e-commerce, Mobile Commerce, Wireless Application Protocol, WAP technology and Mobile Information devices.

Learning Outcomes

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

1. Analyze the impact of E-commerce on business models and strategy.
2. Describe the major types of E-commerce.
3. Explain the process that should be followed in building an E-commerce presence.
4. Identify the key security threats in the E-commerce environment.
5. Describe how procurement and supply chains relate to B2B E-commerce.

Course Synopsis

Focuses on the three major driving forces that permeate all aspects of e-commerce: business development and strategy, technological innovations, and social and legal issues and impacts. Covers E-commerce technology infrastructure, business concepts, social issues and real world experiences.

Course Outline / Content

Unit	Topics	Week
1.	Overview of developments in Information Technology and Defining E-Commerce: The scope of E commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E Commerce Architecture.	
2.	Consumer Oriented E Commerce E-Retailing: Traditional retailing and e retailing, Benefits of e retailing, Key success factors, Models of e retailing, Features of e retailing. E services: Categories of e-services, Web-enabled services, match making services, Information-selling on the web, e entertainment, Auctions and other specialized services. Business to Business Electronic Commerce	
3.	Electronic Data Interchange: Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI	

	Agreements, EDI Security. Electronic Payment Systems, Need of Electronic Payment System: Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for credit card payment. Digital economy: Identify the methods of payments on the net – Electronic Cash, cheques and credit cards on the Internet.	
4.	Security in E Commerce Threats in Computer Systems: Virus, Cyber Crime Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.	
5.	Issues in E Commerce Understanding Ethical, Social and Political issues in E-Commerce: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection, Governance.	
Text Books/ References		
1.	Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.	
2.	RaviKalakota, Andrew B. Whinston, "Electronic Commerce-A Manager's guide", Addison-Wesley.	
3.	. Efraim Turban, Jae Lee, David King, H.Michael Chung, “Electronic Commerce–A ManagerialPerspective", Addison-Wesley	
4.	Elias M Award, “Electronic Commerce from Vision to Fulfilment”, 3rd Edition, PHI, Judy Strauss, Adel El-Ansary, Raymond Frost, “E-Marketing”, 3RDEdition, Pearson Education.	

Central University of Kashmir				
Course Title	MTCS E018	**Course Code**	Operation Research	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

The main objectives of the course are as follows:

1. Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
2. Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry.
3. Skills in the use of Operations Research approaches and computer tools in solving real problems in industry.
4. Mathematical models for analysis of real problems in Operations Research.

Learning Outcomes

1 Be able to understand the application of OR and frame a LP Problem with solution – graphical and through solver add in excel (software).
2 Be able to build and solve Transportation and Assignment problems using appropriate method.
3 Be able to design and solve simple models of CPM and queuing to improve decision making and develop critical thinking and objective analysis of decision problems.
4 Be able to solve simple problems of replacement and implement practical cases of decision making under different business environments.
5 Enables to take best course of action out of several alternative courses for the purpose of achieving objectives by applying game theory and sequencing models.

Course Synopsis

1. INTRODUCTION TO OR AND LINEAR PROGRAMMING.
2. TRANSPORTATION & ASSIGNMENT MODELS
3. NETWORK ANALYSIS & QUEUING THEORY.
4. DECISION THEORY AND REPLACEMENT MODELS
5. GAME THEORY AND SEQUENCING

Course Outline / Content

Unit	Topics	Week
1.	INTRODUCTION TO OR AND LINEAR PROGRAMMING Operation Research – Introduction, OR Models, Areas of Applications - Linear Programming (L.P.) - Formulation of L.P. Problem - Graphical Method - Excel solver – Minimization & Maximization Problems	
2.	TRANSPORTATION & ASSIGNMENT MODELS Transportation Models - Balanced / Unbalanced, Minimization / Maximization - The Northwest Method, The Lowest Cost Method – Vogel‘s Approximation Method - The Stepping Stone Method – Modified Distribution (MODI) Method - Cases of degeneracy. Transportation problem with TORA . The Assignment Model	

	(Hungarian Method) - Basic Assumptions	
3.	NETWORK ANALYSIS & QUEUING THEORY Construction of Network – Rules & Precautions - C.P.M. & P.E.R.T. Networks - Obtaining of Critical Path - Time estimates for activities - Probability of completion of project - Determination of floats (total, free, independent & interfering). Queuing Theory - Single and Multi - Channel Models	
4.	DECISION THEORY AND REPLACEMENT MODELS Decision making under risk – Decision trees – Decision making under uncertainty. Application of simulation techniques for decision making. Replacement Models - Replacement of Items that Deteriorate whose maintenance costs increase with time without change in the money value - Replacement of items that fail suddenly - Individual replacement policy & group replacement policy.	
5.	GAME THEORY AND SEQUENCING Game Theory – Definition – Saddle Point - Two Person Zero Sum Game - Pure and Mixed Strategies - Algebraic Solution Procedure - Graphical Solution – Principle of Dominance . Sequencing Problem - Processing of n Jobs through Two Machines and m Machines - Graphical Method of Two Jobs m Machines Problem.	
Text Books		
1.	1. KantiSwarup, P K Gupta, Man Mohan, Operations Research, Sultan Chand &Sons , 2014.	
2.	Sharma J K - Operations Research, Pearson 8.	
References		
1.	An Introduction to Management Science: Quantitative Approach to Decision Making, South Western, 13th Edition, 2012.	
2.	Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co, 2007.	
3.	. Anderson, D.R., Sweeney, D.J., Williams, T.A, Martin, K,	

Central University of Kashmir				
Course Title	Cyber Forensics	**Course Code**	MTCS E019	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- To study the fundamentals of Computer Forensics
- To learn, analyze and validate Forensics Data
- To study the tools and tactics associated with Cyber Forensics

Learning Outcomes

It enables the students to gain in-depth **knowledge** in the field of Computer forensics & Cyber Crime. Learning Outcomes: After completion of the course the students will be able to learn investigation tools and techniques, analysis of data to identify evidence, Technical Aspects & Legal Aspects related to cyber crime

Course Synopsis

Field has been introduced chronologically to have theoretical as well as practical insight. Divided into five units, First unit includes general introduction of field and criminal aspects, In Second units evidence verification authentication is discussed , in third unit Analysis and validation is explained in fourth unit tools and mechanism dealing with cyber forensics is introduced and finally in fifth unit elementary approach for practices is introduced followed by mobile forensics.

Course Outline / Content

Unit	Topics	Week
1.	Introduction: Crime, Cyber Crime, internet and security backdrop of crime. What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources, Computer Forensics Services, Forensics Methodology, Steps taken by Computer Forensics Specialists. Computer Forensics Evidence and Capture: Data Recovery Defined -Data Back-up and Recovery-The Role of Back-up in Data Recovery - The Data- Recovery Solution	4
2.	Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options obstacles, Types of Evidence - The Rules of Evidence Volatile Evidence ,General Procedure - Collection and Archiving, Artifacts. Digital Evidence: Preserving the Digital Crime Scene - Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication.	3
3.	Computer Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data. addressing data-hiding techniques. Network forensics overview, performing live acquisitions, developing standard procedures for network forensics. Processing Crime and Incident Scenes: Identifying digital evidence. seizing digital evidence at the scene, storing digital evidence, obtaing a digital hash, reviewing a case.	2
4.	Current Computer Forensic tools: Computer forensic tools, Computer Forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail	2

	Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in email, investigating e-mail crimes and violations.	
5.	Practical Approaches: Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones arid mobile devices. Problem Asserted Activity Approach for performing Cyber Forensic for Crime Investigation.	3
Text Books/ References		
1.	Computer Forensics, Computer Crime Invistigation by Jhon R. Vacca, Firewall Media, New Delhi.	
2.	Computer Forensics and Investigations by Nelson. Phillips Enfinger.Steuart, CENGAGE Learning	
3.	MariE-Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", Jones & Bartlett Learning; 2nd Edition, 2014.	
4.	MajidYar, "Cybercrime and Society", SAGE Publications Ltd, Hardcover, 2nd Edition, 2013..	
5.	Robert M Slade, "Software Forensics: Collecting Evidence from the Scene of a Digital Crime", Tata McGraw Hill, Paperback, 1st Edition, 2004	

Central University of Kashmir				
Course Title	Multicore Architecture and Programming	**Course Code**	MTCS E020	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- Understand the Multi-core Architecture and working.
- Understand the challenges in parallel and multi-threaded programming.
- Learn about the various parallel programming paradigms, and solutions.
- Learn about the Intel multi-core architectures

Learning Outcomes

- Program Parallel Processors.
- Develop programs using OpenMP and MPI.
- Compare and contrast programming for serial processors and programming for parallel processors.

Course Synopsis

This course provides an introduction to Multi-Core Architecture and a complete survey of the importance of parallelism, threading concepts, multi-threading methodology and programming with threads. The course also covers an introduction to parallel programming including topics such as Data Dependencies, Data Races, Synchronization or Locking Concepts, Deadlocks and also provides a manual technique for mapping out data dependencies in an algorithm using a dependency graphs. The course also includes an overview of performance analysis for Multi-Core platforms.

Course Outline / Content

Unit	Topics	Week
1.	Single core to Multi-core architectures – SIMD and MIMD systems. Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. System Overview of Threading : Defining Threads, System View of Threads, Application Programming Models and Threading, Virtual Environment: VMs, Runtime Virtualization.	04
2.	Fundamental Concepts of Parallel Programming :Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives. Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features	04

3.	OpenMP: A Portable Solution for Threading : Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, , , Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance..	04
4.	Solutions to Common Parallel Programming Problems : Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture.	04
5.	PARALLEL PROGRAM DEVELOPMENT: 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.	04
Text Books		
1.	Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006	
2.	Darryl Gove, ―Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011	
References		
1.	Shameem Akhter and Jason Roberts, ―Multi-core Programming, Intel Press, 2006.	
2.	Michael J Quinn, ―Parallel programming in C with MPI and OpenMP‖, Tata McGraw Hill, 2003.	

Central University of Kashmir				
Course Title	Artificial Intelligence	**Course Code**	MTCS E021	
Degree	Master of Technology	**Branch**	Computer Science & Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Specifically to gain a historical perspective of AI and its foundations. Also, become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.Explore the current scope, potential, limitations, and implications of intelligent systems.

Learning Outcomes

Upon successful completion of this course, the student shall be able to:

- Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks, game playing models and other machine learning models.
- Demonstrate proficiency in applying scientific method to models of machine learning.
- Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Course Synopsis

The course is divided into five units covering appropriate Artificial Intelligent concepts.

- Searching techniques.
- Genetic algorithms and Game playing techniques.
- Knowledge representations
- Expert systems, and
- Machine Learning Models

Course Outline / Content

Unit	Topics	Week
1.	Introduction: Intelligence , Artificial Intelligence. Turing Test . History of AI . Characteristics of AI Computing . Applications of AI. AI Languages . Intelligent Agents. Problem Solving . State Space Representation. Production System. Classical AI Problems and solution. Searching for solutions, uniformed search strategies – Breadth first search, depth first search, Depth limited search, Iterative-deepening depth first search bi-direction search - comparison.	4
2.	Heuristic search : Search with information Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions. Local search Algorithms: Hill climbing, simulated, annealing search, local beam search, Genetic algorithms. Constrain satisfaction problems: Backtracking search for CSPs	4

	local search for constraint satisfaction problems. Game Playing : Adversial search, Games, minimax algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, cutting of search.	
3.	Knowledge Representation Schemes : Logical , Procedural , Network and Structural schemes. Propositional Logic (PL) : Syntax and Semantic rules . Reasoning in PL. Inference Rules. Resolution in PL. First Order Predicate Logic (FOPL) : Syntax and Semantic rules. Inference rules. Resolution in Predicate logic. Reasoning: Inductive , abductive and deductive reasoning . Forward and backward reasoning. Reasoning with uncertain knowledge- Probabilistic reasoning. Bayes' rule (statistical reasoning).	4
4.	Expert System: Architecture . Examples of Expert system. Applications. Building Expert system. Expert system tools. Machine Learning : Models of learning. Machine learning through Game playing . Inductive learning. Decision trees. Decision list. Ensemble learning. FOL descriptions. Role of Knowledge. Inductive logic programming. Learning by analogy.	4
5.	Neural Network: Characteristics. Neuron Model. Neural network directed graphs, Feedback. Neural network architecture.. AI and neural network (knowledge , reasoning and learning.) Learning neural networks and neurons.(memory based Hebbian competition, Boltzmann). Supervised and unsupervised. Application of NNW. Deep Learning.	4
Text Books		
1.	Introduction to Artificial Intelligence – RajendraAkerkar, PHI.	
2.	Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).	
3.	PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education	
4.	R.O. Duda, Hart, Stork (2001) Pattern Classification 2nd Edition, John wiley, New York.	
References		
1.	Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/Pearson Education.	
2.	Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition.	
3.	Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.	
4.	Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann.	
5.	Artificial Intelligence and Expert Systems – Patterson PHI	
6.	Shinghal (2006) Pattern Recognition : Technique and Applications, Oxford University Press,New Delhi	

Central University of Kashmir				
Course Title	Artificial Neural Network	**Course Code**	MTCS E023	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

Define what is Neural Network and model a Neuron and Express both Artificial Intelligence and Neural Network. Analyze ANN learning, Error correction learning, Memory-based learning, Implement Simple perception, Perception learning algorithm, Modified Perception learning algorithm, and Adaptive linear combiner, Continuous perception, learning in continuous perception.

Analyze the limitation of Single layer Perceptron and Develop MLP with 2 hidden layers, Develop Delta learning rule of the output layer and Multilayer feed forward neural network with continuous perceptions.

Learning Outcomes

- Explain the basic concepts in Neural Networks and applications.
- Discuss feed forward networks and their training issues.
- Distinguish different types of ANN architectures.
- Explain the deep learning concepts using Back Propagation Network.
- Discuss Convolutional Neural Network models to Object.

Course Synopsis

This course covers the fundamentals from Artificial Neural Network to the current trending topic of Convolution Neural Network.

Deep Learning is one of the most exciting and promising segments of Artificial Intelligence and machine learning technologies.

Applications in computer vision, speech analysis, healthcare, agriculture, and understanding climate change etc.

Thus this course aims to provide basic knowledge about the deep learning.

Course Outline / Content

Unit	Topics	Week
1.	NTRODUCTION TO ARTIFICIAL NEURAL NETWORKS: Fundamentals Of Neural Networks –Model of Artificial Neuron –Neural Network Architectures –Learning Methods – Taxonomy Of Neural Network Architectures –Applications	4
2.	FEED FORWARD NEURAL NETWORKS: Perceptron Models: Discrete, Continuous and Multi-Category –Training Algorithms: Discrete and Continuous Perceptron Networks –Limitations of the Perceptron –Model. Credit Assignment Problem –Generalized Delta Rule, Derivation of Back propagation (BP) Training, and Summary of Back propagation Algorithm –Kolmogorov Theorem.	4
3.	OTHER ANN ARCHITECTURES: Associative Memory – Exponential BAM –Associative Memory For Real Coded Pattern , Neural Networks Based On Competition –Kohenen Self Organizing Maps –Learning Vector Quantization.	4
4.	DEEP LEARNING: Deep Feed Forward network, regularizations, training deep models, dropouts, Training Deep	4

	Neural Networks using Back Propagation-Setup and initialization issues, vanishing and exploding Gradient problems, Gradient-Descent Strategies.	
5.	CONVOLUTIONAL NEURAL NETWORK: Convolutional Neural Network, Basic structure of Convolutional Network, Case studies: Alex net, VGG-Net, GoogLeNet, Applications of CNN– Object Detection, Content based image Retrieval.	4
Text Books		
1.	CharuC.Aggarwal "Neural Networks and Deep learning" Springer International Publishing, 2018.	
2.	Satish Kumar, "Neural Networks, A Classroom Approach",Tata McGraw -Hill, 2007.	
3.	Simon Haykin, "Neural Networks, A Comprehensive Foundation", 2nd Edition, Addison Wesley Longman, 2001.	
References		
1.	Bishop, Christopher M. Pattern Recognition and Machine Learning. Springer, 2006.	
2.	Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000.	

Central University of Kashmir				
Course Title	Logic Programming	**Course Code**	BTCS E025	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

To further the state of the art on the theoretical and practical aspects of developing declarative programming tools in logic programming for IOT data analysis . To introduce basics of functional programming and constraint logic programming for nodes in IOT. Introduction into formal concepts used as a theoretical basis for both paradigms, basic knowledge and practical experience.

Learning Outcomes

On completion of the course the student should be able to

- Understanding of the theory and practice of functional and logic programming For IOT.
- The ability to write functional and logic programs for nodes in IOT.
- The ability to solve problems in and using functional and logic programming.

Course Synopsis

The course is divided into five units covering appropriate logic programming concepts.

- Proposition logic.
- Natural Deduction and Axiomatic Propositional logic.
- Knowledge about Predicate logic.
- Semantic Tableaux & Resolution in Predicate Logic.
- Lazy and Eager Evaluation strategies.

Course Outline / Content

Unit	Topics	Week
1.	**Proposition Logic:** Introduction of logic and Functional Paradigm, Propositional Concepts, Semantic Table , Problem Solving with Semantic Table.	4
2.	**Natural Deduction and Axiomatic Propositional Logic:** Rules of Natural Deduction, Sequent Calculus, Axiomatic Systems, Meta theorems, Important Properties of AL, Resolution, Resolving Arguments	4
3	**Introduction to Predicate Logic**: Objects, Predicates and Quantifiers, Functions, First Order Language, Quantifiers, Scopeand Binding, Substitution, An Axiomatic System for First Order Predicate Logic, Soundness and Completeness, Axiomatic Semantic and Programming.	4
4.	**Semantic Tableaux & Resolution in Predicate Logic:** Semantic Tableaux, Instantiation Rules, Problem-solving in Predicate Logic, Normal forms, Herbrand Universes and H-interpretation, Resolution, Unification, Resolution as a computing Tool, Nondeterministic Programming, Incomplete Data Structure, Second Order Programming in Prolog, Logic Grammars: Definite Clause Grammar, A Grammar Interpreter.	6

5.	**Lazy and Eager Evaluation strategies:** Evaluation Strategies, Lazy Evaluation: Evaluation Order and strictness of function,Programming with lazy evaluation, Interactive functional program, Delay of unnecessary Computation, Infinite Data Structure, Eager Evaluation and Reasoning.	4
Text Books		
1.	Logic and Prolog Programming, by Saroj Kaushik . New Age International ltd	
2.	Programming Logic and Design by Joyce Farrell. Course Technology.	
References		
1.	The Essence of Logic by John Kelly . Prentice-Hall India.	
2.	Logic for Computer Science Foundations of Automatic Theorem Proving by Jean H. Gallier. Dover Publications.	
3.	An Inductive Logic Programming Approach to Statistical Relational Learning by K. Kersting. IOS Press	
4.	An Introduction to Logic Programming Through Prolog by J. M. Spivey, Michael Spivey. Prentice Hall.	

Central University of Kashmir				
Course Title	Advanced Graph Theory	**Course Code**	MTCS E026	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

1. Students will achieve command of the fundamental definitions and concepts of graph theory.
2. Students will understand and apply the core theorems and algorithms, generating examples as needed, and asking the next natural question.
3. Students will work on clearly expressing mathematical arguments, in discussions and in their writing.
4. Students will become familiar with the major viewpoints and goals of graph theory: classification, extremality, optimization and sharpness, algorithms, and duality.
5. Students will be able to apply their knowledge of graph theory to problems in other areas, possibly demonstrated by a class project.

Learning Outcomes

On successful completion of the course, the students should be able to:
Understand the basic concepts and fundamental results in matching, domination, coloring and planarity.
Construct examples and proofs pertaining to the basic theorems.
Apply the theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.
Reason from definitions to construct mathematical proofs.
Write graph theoretic ideas in a coherent and technically accurate manner.
Obtain a solid overview of the questions addressed by graph theory and will be exposed to emerging areas of research.

Course Synopsis

1. Definition and introductory concepts
2.Counting and Bijections
3. Maximum Matchings.
4. Drawings in the Plane.
5.Colourings

Course Outline / Content

Unit	Topics	Week
1.	Definition and introductory concepts, Graphs as Models, Matrices and Isomorphism, Decomposition and Special Graphs, Connection in Graphs, Bipartite Graphs, Eulerian Circuits. Counting and Bijections, Extremal Problems, Graphic Sequences, Directed Graphs, Vertex Degrees, Eulerian Digraphs, Orientations and Tournaments.	4
2.	Properties of Trees, Distance in Trees and Graphs, Enumeration of Trees, Spanning Trees in Graphs, Decomposition and Graceful Labellings, Minimum Spanning Tree, Shortest Paths.	3

3.	Maximum Matchings, Hall's Matching Condition, Min-Max Theorem, Independent Sets and Covers, Maximum Bipartite Matching, Weighted Bipartite Matching, Tutte's 1-factor Theorem, Domination.	3
4.	Drawings in the Plane, Dual Graphs, Euler's Formula, Kuratowski's Theorem, Convex Embeddings, Coloring of Planar Graphs, Thickness and Crossing Number.	3
5.	Colourings, Characterisation of Line3 Graphs, Necessary Conditions of Hamiltonian Cycles, Sufficient Conditions of Hamiltonian Cycles, Cycles in Directed Graphs, Tait's Theorem, Grinberg's Theorem, Flows and Cycle Covers.	3
Text Books		
1.	D.B. West, *Introduction to Graph Theory*, New Delhi: Prentice-Hall of India, 2011.	
References		
1.	R. J. Wilson, *Introduction To Graph Theory*, Edinburgh: Oliver and Boyd, 1979.	
2.	B. Bollabas, Modern Graph Theory, Springer, New Delhi, 2005.	
3.	R. Balakrishnan and K Ranganathan, *A Text Book of Graph Theory*, New Delhi: Springer, 2008.	

Central University of Kashmir				
Course Title	Advanced Engineering Mathematics	**Course Code**	MTCS E027	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Outline / Content

Unit	Topics	Week
1.	Discrete Mathematics Propositional and first order logic, Sets, relations, functions, partial orders and lattices. Groups	
2.	Discrete Mathematics Graphs: connectivity, matching, Coloring. Combinatorics: Counting, recurrence relations, generating functions	
3.	Linear Algebra Matrices, determinants, system of linear equations, eigenvalues and eigenvectors.	
4.	Calculus Limits, Continuity and differentiability. Maxima and minima. Mean value theorm	
5	Calculus Integration, Integration as anti derivative, Rules for calculating integrals, integrating power of x and other elementary functions. chain rule	

References

1.	Advanced Engineering Mathematics by E.Kreyzig.
2.	Advanced Engineering Mathematics by H.K. Dass.
3.	Ordinary and partial Differential equation, M.D.Raisingania, S.Chand.
4.	Linear Algebra,Hoffmann&Kunze, Prentice-Hall.
5.	Integral Calculus by Shanty Narayan.
6.	Integral Calculus by Chopra and Kochher

Central University of Kashmir				
Course Title	Formal Language and Automata Theory	**Course Code**	MTCS E028	
Degree	Master of Technology	**Branch**	Computer Science & Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

1. Gain the knowledge of basic kinds of finite automata and their capabilities.
2. To understand theuse and applicability regular and context-free languages
3. Gain the knowledge of describing and changing language to regular expressions and grammars.
4. To understand the time and space complexity for p and np problems.
5. Constructing the Turing machine for Recursive languages.

Learning Outcomes

1. To use basic concepts of formal languages of finite automata techniques
2. To Design Finite Automata's for different Regular Expressions and Languages
3. To Construct context free grammar for various languages
4. To solve various problems of applying normal form techniques, push down automata and Turing Machines

Course Synopsis

1. To study about the concepts of automata, formal languages, grammar, computability and decidability.
2. To understand howcomplex machine that we call a computer can be represented in an elegant and simple view.
3. To understand how Automata Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems.
4. To understand how Automata theory has direct bearing on practice:
   Such as Automata on circuit design, compiler design, and search algorithms;
   Formal Languages and Grammars on compiler design;
   and Complexity on cryptography and optimization problems in manufacturing, business, and management.
5. Last, but not least, research oriented students will make good use of the Automata theory studied in this course.

Course Outline / Content

Unit	Topics	Week
1.	Basic Concepts: Symbols, Strings, Langua g e, Formal Langua g e, Natural Language. Basic Machine and Finite State Machine. FSM without output: Definition and Construction- DFA, NFA, NFA with epsilonMoves, Minimization Of FA, Equivalence of NFA and DFA, Conversion of NFA with epsilon moves to NFA, Conversion of NFA With epsilon moves to DFA. FSM with output: Definition and Construction of Moore and Mealy	3

	Machines, Inter- conversion betwee n Moore and Mealy Machines. Regular Expressions: Definition and Identities of Regular Expressions, Construction of Regular Expression of the given L, Construction of Langua g e from the RE, Construction of FA from the given RE using direct method, Conversion of FA to RE using Arden's Theorem, Pumping Lemma for RL, Closure properties of RLs, Applications of Regular Expressions.	
2.	Introduction, Formal Definition of Gramm a r, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, derivation trees, Context Free Languag e s, Ambiguous CFG, Removal of ambiguity, Simplification of CFG, Normal Forms, Chomsky Hierarchy, Regular gramm a r, equivalence of RG (LRG and RLG) and FA. Push Down Automata: Introduction and Definition of PDA, Construction (Pictorial/ Transition diagra m) of PDA, Instanta n e o u s Description and ACCEPTANCE of CFL by empty stack and final state, Deterministic PDA Vs Nondete r ministic PDA, Closure properties of CFLs, pumping lemma for CFL.	3
3.	Formal definition of a Turing machine, Recursive Languag es and Recursively Enume ra ble Languag es, Design of Turing machines, Variants of Turing Machines: Multi- tape Turing machines, Universal Turing Machine, Nondete r ministic Turing machines. Comparisons of all automata.	3
4.	Decidability: Decidable problems concerning regular langua g e s, Decidable problems concerning context- free languag e s, Un-decidability, Halting Problem of TM.	3
5.	Time Complexity: Measuring Complexity, The Class P, The Class NP, Examples of problems in NP, NP- completeness.	3
Text Books		
1.	Michael Sipser, Introduction to the Theory of Computation, CENGAGE Learning, 3rdEdition ISBBN13:978-81-315-2529-63.	
2.	Hopcroft Ulman, Introduction to Automata Theory, Languages and Computations, Pearson Education Asia, 2nd Edition, ISBN: 9788131720479. 8458-7.	
References		
1.	Vivek Kulkarni, Theory of Computation, Oxford University Press, ISBN-13: 978-0-19-80	
2.	Daniel Cohen, Introduction to Computer Theory, Wiley India, ISBN: 9788126513345,2ed	
3.	Kavi Mahesh, Theory of Computation: A Problem Solving Approach, Wiley India, ISBN: 9788126533114 9. Basavaraj S.Anami, Karibasappa K.G, Formal Languages and Automata Theory, Wiley India, ISBN: 9788126520107	

Central University of Kashmir				
Course Title	Modeling & Simulation	**Course Code**	MTCS E029	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- The course aims to teach the generic (*i.e.*, tool and application domain independent) concepts of modelling and simulation.
- Deep understanding of the concepts of modelling and simulation of dynamic systems using a variety of formalisms.
- Able to build modelling and simulation systems. This will give ample background to understand and use existing modelling and simulation systems. The course presents general modelling and simulation principles by applying them to concrete problems.

Learning Outcomes

At the end of the course, the student should know:

- Models, model properties and some modelling tools
- Understand how to manipulate models / model approximations to change their class
- Methods for generating random variables and Validation of random numbers
- Language-System modelling
- Identify the different types of simulations.

Course Synopsis

In the course, a bird's eye view of the state-of-the-art in modelling and simulation is presented.

Firstly, there will be introduction to systems (types, system modelling), Methods for generating random variables (Mathematical and Statistical Models), Comparison of programming languages. And lastly, there will be analysis, validation and verification of input and output simulated data, and Case study for developing simulation models.

Course Outline / Content

Unit	Topics	Week
1.	**Unit I:** Introduction-Systems, System types, System Modeling, Types of system modelling, Classification and comparison of simulation models, attributes of modelling, Comparison of physical and computer experiments, Application areas and Examples	04
2.	**Unit II:** Mathematical and Statistical Models- Probability concepts, Queuing Models, Methods for generating random variables and Validation of random numbers**.**	03
3.	**Unit III:** Language-System modelling, programming languages, comparison of languages, Identifying and selection of programming language, feasibility study of programming language for the given application	03
4.	**Unit IV:** Experiments-Simulation of different systems, Analysis, validation and verification of input and output simulated data, study of alternate techniques.	03
5.	**Unit V:** Case study-Developing simulation model for information	03

	centers, inventory systems and analysis of maintenance systems**.**	
Text Books		
1.	Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010	
2.	Averill M. Law, W David Kelton: Simulation Modeling & Analysis, Second Edition,McGraw-Hill International Editions.	
References		
1.	Geoffrey Gordon, "System Simulation", Second edition, Prentice Hall, India, 2002. 2. Jerry Banks and John S.Carson, Barry L.Nelson, David M.Nicol, "Discrete Event System Simulation", Third edition, Prentice Hall, India, 2002.	
2.	Robert E. Shannon, "System Simulation The art and science", Prentice Hall, New Jersey, 1995.	
3.	D.S. Hira, "System Simulation", S.Chand and company Ltd, New Delhi, 2001	

Central University of Kashmir				
Course Title	Advanced computer vision	**Course Code**	MTCS E030	
Degree	Master of Technology	**Branch**	Computer Science &Eng.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- To review image processing techniques for computer vision
- To illustrate shape and region analysis
- To describe Hough Transform and its applications to detect lines, circles, ellipses
- To discuss three-dimensional image analysis techniques
- To discuss motion analysis
- To explore some applications of computer vision algorithms

Learning Outcomes

Able to demonstrate knowledge and understanding of Human and computer vision systems.
Understand current approaches to image formation and image modeling.
Analyze and design a range of algorithms for image processing and computer vision
Develop and evaluate solutions to problems in computer vision

Course Synopsis

After completing the course, students will able to:
1: Describe different image representation, their mathematical representation and different their data structures used. K2
2:Classify different segmentation algorithm for given input K2
3:Create a 3D object from given set of images K3
4: Detect a moving object in video using the concept of motion analysis K3
5: Recognize the object using the concept of computer vision K4

Course Outline / Content

Unit	Topics	Week
1.	The image, its representations and properties – image representations a few concepts, Image digitization, Digital image properties, Color images, Cameras: an overview. Mathematical and physical background – Linear integral transforms, Images as stochastic processes, Image formation physics.	
2.	Data structures for image analysis- levels of image data representation, traditional image data structures, and Hierarchical data structures. Image understanding-fitting via random sample consensus, point distribution model	
3.	Segmentation II – Mean Shift Segmentation , Active contour models – snakes, Geometric deformable model – level sets and geodesic active contours, Fuzzy connectivity, Towards 3D graph – based image segmentation, Graph cut segmentation	
4.	3 D Vision Geometry – 3 D Vision tasks, basics of projective geometry, A Single perspective camera, Scene reconstruction from multiple views, two camera stereopsis, Use of 3D vision Shape from X, Full 3D objects, 3D model-based vision, 2D view-based representations of a 3D scene	

5.	Motion Analysis- Different Motion Analysis methods, Optical flow, analysis based on correspondence of interest points, Detection of specific motion patterns, video tracking .	
Text Books/ References		
1.	Milan Sonka, Vaclav Hlavac, Roger Boyle, ”Digital Image Processing and Computer Vision” Cengage Learning, 1st Edition, 2008	
2.	Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.	
3.	Digital image processing, by Gonzales Woods 3rd Edition, Pearson Education.	
4.	Fundamental of Digital Image Processing by Anil K. Jain, PHI Pub.	

Central University of Kashmir				
Course Title	Distributed Computing	**Course Code**	MTCS E031	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- To introduce concepts related to distributed computing systems.
- To understand the working of Distributed system in detail.
- To focus on performance and flexibility issues related to systems design decisions.
- Understand the importance of security in distributed systems
- To introduce the most important basic results in the area of distributed algorithms.

Learning Outcomes

- List the principles of distributed systems and describe the problems and challenges associated with these principles.
- Understand Distributed Computing techniques, Synchronous and Processes.
- Apply Shared Data access and Files concepts.
- Design a distributed system that fulfills requirements with regards to key distributed systems properties.
- Understand Distributed File Systems and Distributed Shared Memory.
- Apply Distributed web-based system.

Course Synopsis

This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission. The structure of distributed systems using multiple levels of software is emphasized. Specific topics include: distributed algorithms, distributed file systems, distributed databases, security and protection, and distributed services.

Course Outline / Content

Unit	Topics	Week
1.	Distributed Computing-introduction, history; Distributed Computing system: Strength and weaknesses, Different forms of Computing: Minicomputer model, workstation model, workstation server model, Cluster:-definitions, cluster computer system architecture, Windows cluster, distributed Computing System models: Distributed operating system, Introduction to DCE, architecture of Distributed Applications,. Frameworks, and component, Message passing:-Features, Issues in IPC by Message passing, synchronization.	04
2.	Group Communication: Unicasting versus multicasting, Multicast API, Connectionless versus connection oriented Multicast Reliable multicast versus unreliable multicast API, Reliable multicast API, Ordering and their implementation: Absolute, causal, Consistant Distributed Computing Paradigms, Client-server paradigm, Peer to Peer paradigm. Message system paradigm Remote Procedure call model, Network services	04

	Paradigm	
3.	Remote Procedure Calls(RPC): Introduction, RPC model its transparency, implementation, stub generation, RPC messages, Marshalling Arguments and result, server management Call semantics, Communication protocols for RPCs, Complicated RPCs, client server binding special RPCs, RPC in heterogeneous environment, Light weight RPC, Datagram Socket API, Stream mode Socket API, sockets with non blocking I/O Operations Secure Socket API Client server paradigm issues, software engineering issues for a network service, Connection Oriented and connectionless Servers Iterative servers and concurrent server, stateful servers	04
4.	Synchronization :Mutual exclusion, deadlock, election algorithm, Resource Management: Introduction, desirable features of a good global scheduling algorithm, task assignment approach, load balancing approach, Load sharing approach; Process management: introduction, Process migration, threads	04
5.	Distributed file system: introduction, desirable features of a good DFS, file models, File accessing models, file sharing semantics, file caching semantics, file replication, fault tolerance, atomic transaction, design principles, Distributed object: Message passing versus distributed objects, distributed object architecture, distributed object system, RPC, remote method invocation, RMI architecture API for RMI,RMI application, comparison of RMI and socket API, Client Call back, Stubdownloading, RMI security manager	04
Text Books		
1.	Distributed Computing Principles and Application, M.L.Liu, Pearson Education	
2.	Distributed Computing : Concepts and Application, M L Liu, Addison Wesley	
References		
1.	Distributed System Concepts and design, Couloouris, Pearson education	
2.	Distributed System, Principles and paradigm , Tanenbaum,PHI	
3.	Distributed Operating system, Pradeep k Singha, PHI	

Central University of Kashmir				
Course Title	BioInformatics	**Course Code**	MTCS E032	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- The field of computer science called bioinformatics is used to analyze whole-genome sequencing data. This involves algorithm, pipeline and software development, and analysis, transfer and storage/database development of genomics data. quality control and data grooming; genome assembly and/or variant calling.
- Bioinformatics illustrate a unique interdisciplinary approach to computing in modern biology. They combine Computer Science, Information Engineering, Mathematics, and Statistics to analyze and interpret biological data.

Learning Outcomes

- knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics.
- existing software effectively to extract information from large databases and to use this information in computer modeling.

Course Synopsis

Unit one presents General introduction to genomes, in unit two databases and tools are introduced, in unit three sequencing alignment Phylogentic Trees is introduced, in unit Four mapping and Sequencing is introduced and in unit five Stings and Evolition tress are introduced fallowed by Phylogenetic alignment.

Course Outline / Content

Unit	Topics	Week
1.	Introduction: genomes - diversity size and structure - proteins proteonomes - Information Content in Biological sequences - Production of molecular function and structure.	4
2.	Internet resources and public data bases: databases and tools - sequence similarity searches - Alignment - Production sewer - Molecular Biology Software - BLAST-FASTA-BLOSUM.	3
3.	Sequence Comparison in Biology: global alignment - local alignment - gaps . Multiple Sequence Alignment, Phylogentic Trees.	2
4.	Mapping and Sequencing :DNA mapping and sequencing problems - Mapping and genome project - Large-scale sequence and sequence assembly - shotgun sequencing.	2
5.	Stings And Evolutionary Trees: Ultra metric Trees and distances - Maximum parsimony - stenes trees - phylogenetic alignment.	4

Text Books/ References

1.	Edwards, David; Stajich, Jason; Hansen, David, Bioinformatics : Tools and Applications
2.	Mount D.W, Bioinformatics. Sequence and Genome Analysis , Cold Spring Harbar, New York
3.	Bioinformatics: A practical guide to the analysis of genes and proteins, John Wiley & Sons, New York.
4.	Attuvod T.K. Smith D.J. Parry, Introduction to Bioinformatics , Addison Wesley .
5.	Higgins Des, Taylor, Bioinformatics: sequence structure and data banks ,Oxford

	Univ. Press, Oxford

Central University of Kashmir				
Course Title	Computer Based Numerical Techniques	**Course Code**	MTCS E033	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Outline / Content

Unit	Topics	Week
1.	Errors and Finite Differences Error & their analysis, Computer arithmetic, Floating-point number operation. Finite differences: Difference operator, Difference tables, Factorial polynomials, Summation of series.	
2.	Interpolation Newton's formula, Gauss, Stirling's and Bessel's formula for equal interval, Lagrange's formula and Newton's divided difference formula for unequal interval.	
3.	Algebraic & Transcendental Equations Bisection method, Iteration method, False Position method, Newton-Raphson method, Rate of convergence of methods, Solution of simultaneous equations by Gauss-Seidel's method.	
4.	Numerical Differentiation & Integration Introduction, Numerical differentiation, Numerical integration by Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Boole's & Weddle's rule, Euler-Maclaurin's formula.	
5	Solution of Ordinary Differential Equations Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta method.	

References

1.	Introductory Method of Numerical Analysis : Sastry, PHI, New Delhi
2.	Numerical Methods : Balaguruswamy, TMH, New Delhi.
3.	Q.S. Ahmad, Z.Khan&S.A.Khan, Numerical and Statistical Techniques, Ane Books Pvt. Ltd., New Delhi.
4.	Numerical Methods for Scientific & Engineering Computations: Jain, Iyengar, Jain, New Age International Publication, New Delhi.
5.	Numerical Methods : P. Kandasamy, S. Chand & Company, New Delhi.

Central University of Kashmir				
Course Title	Enterprise Resource planning	**Course Code**	MTCS E034	
Degree	Master of Technology	**Branch**	Computer Science &Eng.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

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

1. Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management.
2. Describe basic concepts of erp systems for manufacturing or service companies.
3. Analyze the technical aspect of telecommunication systems, internet and their roles in business environment.
4. Develop skills necessary for building and managing relationships with customers, and stakeholders

Learning Outcomes

1 Discuss Supply chain and resource management.
2 Identify scope and benefits of ERP
3 Demonstrate Integrated data model
4 Differentiate between CRM and e-CRM

Course Synopsis

This course includes :

1. Overview, accommodating variety
2. Integrated management information, integration
3. Scope, Technology and benefits of ERP, The modern enterprise
4. Supply chain and resource management, Integrated data model
5. Significance and principles of business engineering
6. BRP, ERP and IT business engineering with IT
7. ERP and management concerns, Building an MIS
8. Business as a system, Core process in a manufacturing company
9. Entities for data model in a manufacturing company
10. Extended ERP

Course Outline / Content

Unit	Topics	Week
1.	Introduction ERP Overview, Accommodating variety, Integrated management information, integration, Supply chain and resource management, Integrated data model scope, Technology and benefits of ERP & the modern enterprise	
2.	Business modelling for ERP Overview, Concept, Significance and principles of business engineering, BRP, ERP and IT business engineering with IT, ERP and management concerns, Building an MIS, Business as a system, Core process in a manufacturing company, Entities for data model in a manufacturing company, Extended ERP.	

3.	ERP implementation Overview, Role of consultants, Vendors and Users, Customization, Precautions, Post implementation options, ERP implementation methodology and guidelines for ERP implementation, Mercedes Benz, KeeHin Industries, Bull Electronics Angers Plant manufactures, Twentieth Century companies, Ameritech, Essar steel, Jindal Iron and steel company Ltd., Goderej soaps and associate companies, IREDA, Comparison and Conclusions.	
4.	Introduction to CRM & Automation Definition of CRM technology, CRM technology components, Customer life style, customer interaction, Introduction to eCRM: difference between CRM &eCRM, features of eCRM. Sales Force Automation (SFA) : Definition & need of SFA, Barriers to successful SFA, SFA functionality, technological aspect of SFA: data synchronization, flexibility & performance, Reporting tools.	
5.	Call Centers Mean Customer Interaction The functionality, Technological implementation, what is ACD (automatic call distribution), IVR (interactive voice response), CTI (computer telephony integration), Web enabling the call center, Automated intelligent call routing, Logging & Monitoring	
Text Books/ References		
1.	Vinod Kumar Garg, N. K. Venkita Krishna, Enterprise resource planning, 2nd Edition , PHI, 2003.	
2.	Paul Greenberg, CRM at the Speed of Light: Social CRM Strategies, Tools, and Technologies for Engaging Your Customer, 4th Edition, McGraw Hill, 2009	
3.	Alexis Leon, Enterprise resource planning, 2nd Edition, McGraw Hill, 2008	
4.	Buttle, Francis, Customer Relations Management, 2nd edition, Elsevier Publishing, 2009	

Central University of Kashmir				
Course Title	Reconfigurable computing	**Course Code**	MTCS E035	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- To understand the need for reconfigurable computing.
- To expose the students to various device architectures.
- To examine the various reconfigurable computing systems.
- To understand the different types of compute models for programming reconfigurable
- architectures.
- To expose the students to HDL programming and familiarize with the development environment.
- To expose the students to the various placement and routing protocols.

Learning Outcomes

- Identify the need for reconfigurable computing architectures
- Map the design to reconfigurable platform by placement and routing methodologies
- Develop applications with FPGA
- Discuss the architecture of FPGAs.
- Point out the salient features of different reconfigurable architectures
- Construct reconfigurable computers for the given applications

Course Synopsis

The course provides the in depth knowledge about the fundamentals of reconfigurable computing and architectures. The course gives insights of the performance trade-off involved in designing a reconfigurable computing and discusses how to utilize them for solving challenging computational problems. The course deals with both theoretical and application level knowledge of the reconfigurable computing.

Course Outline / Content

Unit	Topics	Week
1.	DEVICE ARCHITECTURE :General Purpose Computing Vs Reconfigurable Computing – Simple Programmable Logic Devices – Complex Programmable Logic Devices – FPGAs – Device Architecture - Case Studies.	04
2.	RECONFIGURABLE COMPUTING ARCHITECTURES AND SYSTEMS : Reconfigurable Processing Fabric Architectures – RPF Integration into Traditional Computing Systems – Reconfigurable Computing Systems – Case Studies – Reconfiguration Management.	04
3.	PROGRAMMING RECONFIGURABLE SYSTEMS: Compute Models - Programming FPGA, Mapping Designs to Reconfigurable Flatforms – Technology Mapping, Applications in HDL – Compiling C for Spatial Computing – Operating System Support for Reconfigurable Computing.	04
4.	MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS The Design flow - Technology mapping – FPGA placement :	04

	Placement Algorithms, FPGA Routing, ,Data path composition – Path finder algorithm: circuit graph model, Negotiated congestion router, Negotiated Congestion / Delay router, Applying A* to path finder – Configuration bitstream generation	
5.	APPLICATION DEVELOPMENT: Strengths and weaknesses of FPGA - Application characteristics and performance - General implementation strategies - Implementing arithmetic in FPGAs – Distributed arithmetic – CORDIC architectures for FPGA computing - Hardware / software partitioning	04
Text Books		
1.	Scott Hauck and Andre DeHon, "Reconfigurable Computing – The theory and practice of FPGA-based computation", Elsevier / Morgan Kaufmann publishers, 2011.	
2.	Christophe Bobda, "Introduction to Reconfigurable Computing: Architectures, algorithms and applications", Springer, 2010	
References		
1.	"Reconfigurable Computing: From FPGAs to Hardware/Software Co-design" 2011 Edition by Joao Cardoso (Editor), Michael Hübne, Springer	
2.	Maya B. Gokhale and Paul S. Graham, "Reconfigurable Computing: Accelerating computation with fieldprogrammable gate arrays", Springer, 2005.	
3.	Nicole Hemsoth, Timothy Prickett Morgan,"FPGA Frontiers: New Applications in Reconfigurable Computing", 2017, Next Platform.	

Central University of Kashmir				
Course Title	Management Information Systems	**Course Code**	MTCS E036	
Degree	Master of Technology	**Branch**	Computer Science & Engg.	
Course Type	Theory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		04	0	0

Course Objectives

It is a discipline which focuses on the management of information and communications technology elements within business organizations. As an MIS student, you can expect to gain an understanding of computer databases, networks, computer security, but also learn how to help people better use technology and being an Entrepreneur how you will incorporate IT in business

Learning Outcomes

- Describe managing the digital firm evaluate the role of information systems in today's competitive business environment.
- Define an information system from both a technical and business perspective and distinguish between computer literacy and information systems literacy.
- Assess the relationship between the digital firm, electronic commerce, electronic business and internet technology.
- Interpret information systems in the enterprise
- Analyze the role played by the six major types of information systems in organizations and their relationship to each other.
- Describe the types of information systems supporting the major functional areas of the business.
- Assess the relationship between organizations, information systems and business processes, including the processes for customer relationship management and supply chain management.
- Explain how enterprise systems and industrial networks create new efficiencies for
- Distinguish the classical and contemporary models of managerial activities and roles.
- Evaluate the role of information systems in supporting various levels of business strategy.
- Identify appropriate strategies to manage the system implementation process. Analyze the principal causes of information system failure.

Course Synopsis

- it has been divided into five units in each unit student will get to know about aspects of management information System to be used in real life.

Course Outline / Content

Unit	Topics	Week
1.	Foundations of Information systems and Management: Introduction, Components and resources and types of information systems and activities. Introduction to MIS and approaches to Management, MIS as a support to and a tool for management Process, Organization structure and Strategic Management of Business: Concept of Corporate Planning, Essentiality of strategic planning, development and types of strategies, MIS for Business Planning.	04
2.	Applications of MIS: Manufacturing Sector: Introduction, Personal, Accounting, Finance, Production, Materials and	04

	Marketing Management, MIS Applications in Banking and Insurance Sector. Service Sector: MIS applications in service industry. Cross-Functional Enterprise Systems. Implementation Challenges: Integration, implementing IT, Change Management.	
3.	Decision support systems: Concept, Using Decision Support systems, Introduction to Artificial Intelligence. Security and Ethical Challenges, fault-tolerant systems, Cultural, political and Geo-economic challenges, global business/it strategies, applications, platforms and Data access issues	4
4.	Technology of Information Systems : Introduction – Data Processing – Transaction Processing – Application Processing – Information System Processing – TQM of Information Systems – Human Factors and User Interface – Real Time Systems and Design ; Programming Languages for System Coding; Case tools and I-Case.	4
5.	Business Process Reengineering (BPR): Business process, MIS and BPR. Business process reengineering Vs Software Reengineering. Business Process Outsourcing: What is BPO? Voice BPO i.e. Call center, non-voice BPO, Scope of BPO, challenges in BPO management etc.	4
Text Books/Refrences		
1.	O'Brien J., "Management Information Systems" Tata McGraw-Hill Publishing Company Limited.	
2.	Jawadekar W., "Management Information Systems", Tata McGraw-Hill Publishing Company Limited.	
3.	Kenneth C Laudon," Management Information Systems", Pearson Education.	
4.	V Rajaraman,"Analysis and design of Information Systems", PHI Learning Pvt. Ltd.	
5.	Rahul DE ,"MIS:Management Information Systems in Business, Government and Society" , Wiley Publications	

Central University of Kashmir				
Course Title	Advanced Microprocessor	**Course Code**	MTCS E037	
Degree	Master of Technology	**Branch**	Computer Science &Eng.	
Course Type	Theory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- To understand architectural features of 8086 microprocessors
- To understand various peripheral devices and different components interfacing with it along with 8051 microcontroller
- To understand architectural features of advanced processors and microcontrollers
- To learns necessary programming skills to develop applications.

Learning Outcomes

At the end of the course, the students should be able to

1. Understand the necessity, features and architecture of 8086.
2. Analyze the addressing modes and understand the functions of 8086 instructions.
3. Write simple assembly language programs.
4. Understand the need and handling of interrupts in 8086 and features of peripheral ICs.
5. Explain the architecture of generic advanced microprocessor and features of advanced microprocessors.

Course Synopsis

1. Study of architecture and programming of 8086 microprocessor
2. Study of features of different peripheral devices and standard buses
3. Know the features of advanced microprocessors.

Course Outline / Content

Unit	Topics	Week
1.	DESIGN OF MICROPROCESSOR: Design of basic microprocessor architectural Concepts: Microprocessor architecture, word Lengths, addressable memory, and Microprocessors speed architectural characteristics, registers, instruction, and memory addressing architecture, ALU, GPR's Control logic & internal data bus. MICROPROCESSOR INSTRUCTIONS & COMMUNICATION: Instruction Set, Mnemonics, Basic Instruction Types, Addressing modes, Microprocessor I/O connecting I/O put to Microprocessor, Polling and Interrupts, Interrupt and DM. Controller	
2.	ADVANCEDMICROPROCESSOR: Advanced microprocessors: Intel X86 family of advanced Microprocessor, programming model of 86 families, X86 addressing modes, instruction set, and hardware. HIGH PERFORMANCE CISC ARCHITECTURE (PENTIUM): The software model, functional description, CPU pin descriptions, RISC concepts, bus operations, super scalar architecture, pipe-lining, Branch prediction.	
3.	PENTIUM PROCESSOR: The instruction and caches, Floating point unit, protected mode operation, Segmentation, paging, multitasking, Exception and interrupts, Input / Output, Virtual 8086 model, Interrupt processing, INSTRUCTIONS & PROGRAMMING WITH PENTIUM PROCESSOR: Instruction	

	types, Addressing modes, Processor flags, Instruction set, Basic programming the Pentium Processor.	
4.	PENTIUM PROCESSOR I/O: Data Communication, parallel I/O serial communication, Serial interface and UART modems, I/O devices, D/A, A/D interface, special I/O devices.	
5.	DEVELOPING PENTIUM PROCESSOR BASED APPLICATIONS: Introduction to the Design Process, Preparing the specifications, Developing a design, Implementing and Testing and design, Regulatory Compliance Testing, design tool for Development	
Text Books/ References		
1.	Managing the Software Process, Watts S. Humphrey, Pearson Education.	
2.	Microprocessors and Interfacing, D.V. Hall, TMH, 2nd Edition, 2006.	
3.	Advanced Microprocessors and Peripherals Architectutes, Programming and Interfacing , Ray A.K. and Bhurchandi, TMH, 2002	
4.	Microprocessor basedsystemdesignUBS, Rafiquzzman, Wiley-Interscience, 5th Edition, 2005.	
5.	Advanced Microprocessor, Daniel Tabak, TMH, 2nd Edition, 2012.	

Central University of Kashmir				
Course Title	Web Technology	**Course Code**	MTCS E038	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		3	0	1

Course Objectives

- To impart basic understanding of the methods and techniques of developing websites.
- Develop skills in analyzing the usability of a website.
- Learn techniques of responsive web design.

Learning Outcomes

At the end of this course, the students will able to do the following:
1. Understand the basic principles of web designing
2. Build an attractive websites for various applications as per the requirements
3. Build dynamic web pages using JavaScript
4. Understand the concepts of server side programming

Course Synopsis

The course has been divided into five units:
In Unit-I and Unit-II the students will learn the language of the web: HTML and CSS and will develop basic programming skills using JavaScript and advanced CSS.
Unit-III and Unit-IV are related to server-side language-ASP.Net, and deals with connection to server and execution of SQL statements. And lastly, there will be an overview of .net core, MVC design pattern and routing techniques.

Course Outline / Content

Unit	Topics	Week
1.	**Unit-I: HTML & CSS** Basic concepts related to web. Webservers, web browser, static & dynamic web pages, DNS. Client- Server architecture of Web. Introduction to HTML: History, structure of HTML document, creating & executing HTML. Tags of HTML. Head and Body Section, Text formatting, Lists, Tables and Division. Hyperlinks, images, audio and video. Understanding Form and form elements. Creating CSS, applying CSS to HTML documents, CSS Rules, Classes, CSS types.	04
2.	**Unit II: JavaScript** Client side Vs Server side Technology , Java Script: Constants, Variables and datatypes, Operators, JavaScript constructs, JavaScript Objects, Window Object, document object, Event Handling & Form Validation: onClick, onChange, onLoad, onSelect, onSubmit, onMouseOver, onFocus, onBlur, Validation of text box entries. Accessing checkboxes, radio buttons and Dropdown lists etc. using DOM	04
3.	**Unit III: ASP.Net (WebForms)** Introduction to ASP.net, Features, Structure of Webform, code behind, Webserver Controls (Textbox, Label, Button, CheckBox, CheckBoxList, DropDownList, Hyperlink, Image, ImageButton, LinkButton, ListBox, RadioButton, RadioButtonList). Validation	04

	Controls. Masterpages. Viewstate and postback. Querystring, Cookies, Session and Application. Web.config and Global.asax files	
4.	**Unit-IV: ADO.Net** Data Access with ADO.Net: Database Access Using Wizard, Database Access Using Code, DataProvider, OLEDB, ODBC, Connection Object, Command Object (ExecuteNonQuery, ExecuteQuery, and Execute scalar), and Datareader. Databinding. Understanding the role of Dataset, Data Adapter, creating connections, connecting to Data Base, closing an open connection, Executing SQL statements with connection object – creating, inserting, updating, deleting database table.	04
5.	**Unit-V: ASP.Net(Core) MVC** **.**Net Core Overview, ASP.Net (Core) features, MVC Design Pattern, Model, View and Control. Action Methods and Results, Passing Data to view from Controller (ViewData, ViewBag). Layout view. Routing Technique (Conventional & Attribute Routing) in ASP.Net (Core) MVC. inprocess and out of Process hosting, Entity Framework	04
Text Books		
1.	Mastering HTML, CSS & JavaScript Web Publishing, Laura Lemay	
2.	Mugilan T. S. Ragupathi Learning ASPNET Core MVC Programming, Packt Publishing Limited	
3.	Teach Yourself ASP.NET in 21 Days (2nd Edition), Sams Publishing; 2 edition (August 22, 2002)	
References		
1.	Completer Reference HTML - Thomas A. Powell ,TMH	
2.	John R. Larsen, Get Programming with JavaScript, Dreamtech Press	
3.	ASP.NET 4 Unleashed, Stephen Walther, Kevin Scott Hoffman, Nate Scott Dudek, Sams Publishing	
4.	Applied Microsoft .Net Frame Work Programming, Jeffrey Richter, Microsoft Press.	
5.	Dino Esposito, Programming ASP.NET Core, PHI LEARNING PVT. LTD.	

Central University of Kashmir				
Course Title	Big Data	**Course Code**	MTCS E039	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	4	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools.

Learning Outcomes

After completion of course, students would be:

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, and Hive for big data analytics.

Course Synopsis

The course is divided into five units covering appropriate Artificial Intelligent concepts.

- Introduction to big data analytics and its applications.
- Introduction no NoSQL.
- Data format techniqiues and hadoop.
- Mapreduce techniques.
- Hbase, Cassandra and Hive.

Course Outline / Content

Unit	Topics	Week
1.	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	4
2.	Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, harding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	4
3.	Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	4
4.	MapReduce workflows, unit tests with MRUnit, test data and	4

	local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, MapReduce types, input formats, output formats.	
5.	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Hadoop integration. Hive, data types and file formats, HiveQL data definition	4
Text Books		
1.	Big Data Fundamentals: Concepts Drivers: Concepts, Drivers and Techniques by Erl, Khattak and Buhler, Pearson Education India	
2.	Big Data and Hadoop by V. K. Jain, Khanna Publishing.	
3.	Big Data: A Revolution That Will Transform How We Live, Work, and Think by Viktor Mayer-Schönberger, Kenneth Cukier. Eamon Dolan/Houghton Mifflin.	
References		
1.	Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses by Michael Minelli, Michelle Chambers, and Ambiga Dhiraj. Wiley, 2013	
2.	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence by P. J. Sadalage and M. Fowler. Addison-Wesley Professional, 2012.	
3.	Hadoop: The Definitive Guide by Tom White. Third Edition, O'Reilley, 2012.	
4.	Hadoop Operations by Eric Sammer. O'Reilley, 2012.	
5.	Programming Hive by E. Capriolo, D. Wampler, and J. Rutherglen. O'Reilley, 2012.	
6.	HBase: The Definitive Guide by Lars George. O'Reilley, 2011.	
7.	Cassandra: The Definitive Guide byEben Hewitt. O'Reilley, 2010.	

Central University of Kashmir				
Course Title	Advanced RISC Machine (ARM)	**Course Code**	MTCS E040	
Degree	Master of Technology	**Branch**	Computer Science &Engg.	
Course Type	Theory / Laboratory	**Department**	Information Technology	
Credits	04	**L**	**T**	**P**
Semester		4	0	0

Course Objectives

- Collect knowledge of architecture of ARM processor and assembly programming of ARM.
- Learn to design, construct, program, verify, analyze and troubleshoot ARM assembly and C language programs and supporting hardware.
- Cover the details of cache architectures,AMBA bus, virtual memory management concepts with the detailed explanation on the Memory Management Unit (MMU) and Memory Protection Unit (MPU).

Learning Outcomes

- Describe the ARM processor architecture and its family.
- Develop an understanding of the instruction set and addressing modes
- Develop assembly language programs to perform specific tasks
- using ARM instructions.
- Develop ARM microcontroller applications using Embedded C
- language.

Course Synopsis

This course introduces the concept of architecture and programming of advanced embedded microcontrollers i.e ARM family of microcontrollers that are widely used in design of real time sophisticated embedded systems like tablets, hand held devices, automation and industrial control systems. The course has been divided into five units for understanding the stepwise programming and architecture of ARM .

Course Outline / Content

Unit	Topics	Week
1.	The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM Processor Fundamentals: ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics. Exceptions, Interrupts, and Vector Table, Core Extensions, Architecture Revisions, ARM Processor Families, LPC2148 Microcontroller Architecture	04
2.	Introduction to the ARM Instructions Set: Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software Interrupt Instructions, Program Status Register Instruction, Example Programs**.**	04
3.	Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and	04

	Multi Register Load-Store Instructions, Stack, Interrupts, Software Interrupt Instructions, Exception handling	
4.	Efficient C Programming: Overview of C Compilers and Optimization, Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Structure Arrangement, Bit-fields, Unaligned Data and Endianness, Division, Floating Point, Inline Functions and Inline Assembly.	04
5.	Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation, Access Permissions, Content Switch. Communication Protocols: UART, I2C (onboard) Programming using C.	04
Text Books		
1.	Andrew N. Sloss, Dominic Symes, Chris Wright, ARM Systems Developer's Guide Designing and Optimizing System Software, Morgan Kaufmann Publishers, Elsevier Inc, 2004.	
2.	Steve Furber, ARM System On Chip Architecture, Second Edition, Pearson Education Limited, 2000.	
References		
1.	William Hohl, Christopher Hinds, ARM ASSEMBLY LANGUAGE Fundamentals and Techniques, 2nd Edition, CRC Press, 2015.	
2.	Gibson, ARM Assembly Language An Introduction, Second Edition, 2007.	