DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

Evaluation Scheme & Syllabus

for

M. Tech. Integrated 4th Year

Computer Science and Engineering

(Effective from the Session: 2022-23)

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

STUDY & EVALUATION SCHEME

M. TECH INTEGRATED (COMPUTER SCIENCE AND ENGINEERING) 4TH YEAR

COURSE CURRICULUM

SEMESTER- VII

Sl. No.	Subject Codes	Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	MKOE07X	Open Elective -II	3	0	0	30	20	50		100		150	3
2	MKCS701	Artificial Intelligence	3	0	0	30	20	50		100		150	3
3	MKCS702	Cryptography & network security	3	0	0	30	20	50		100		150	3
4	MKCS07X	Departmental Elective IV	3	0	0	30	20	50		100		150	3
5	MKCS751	Artificial Intelligence Lab	0	0	2				25		25	50	1
6	MKCS752	Cryptography & Network Security Lab	0	0	2	---	---	---	25		25	50	1
7	MKCS753	Internship Assessment	0	0	2				50			50	1
8	MKCS754	Project Based Learning - I	0	0	10				50		100	150	5
		Total										**900**	**20**

M. TECH INTEGRATED (COMPUTER SCIENCE AND ENGINEERING) 4th Year

COURSE CURRICULUM

SEMESTER- VIII

Sl. No.	Subject Codes	Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	MTCC 101	Research Process and Methodology	3	0	0	30	20	50		100		150	3
2	MKCS801	Cloud Computing	3	0	0	30	20	50		100		150	3
3	MKCS08X	Departmental Elective –V	3	0	0	30	20	50		100		150	3
4	MKCS851	Cloud Computing Lab	0	0	2				25		25	50	1
5	MKCS852	Project Based Learning - II			18				50		300	350	9
6	MKCS853	Seminar -I	0	0	2				50			50	1
		Total										**900**	**20**

Departmental Elective-IV

1. MKCS071 Design & Development of Applications
2. MKCS072 Software Testing
3. MKCS073 High Performance Computing
4. MKCS074 Mobile Computing

Departmental Elective-V

1. MKCS081 Deep Learning
2. MKCS082 Quantum Computing
3. MKCS083 Internet of Things
4. MKCS084 Blockchain Architecture Design

M.TECH. INTEGRATED (Computer Science and Engineering) 4th Year

SEMESTER VII (DETAILED SYLLABUS)

MKCS 701 ARTIFICIAL INTELLIGENCE		
Course Outcome (CO)		**Bloom's Knowledge Level(KL)**
At the end of course, the student will be able to understand		
CO1	Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.	K_2
CO2	Understand search techniques and gaming theory.	K_2,K_3
CO3	The student will learn to apply knowledge representation techniques and problem-solving strategies to common AI applications.	K_3,K_4
CO4	Student should be aware of techniques used for classification and clustering.	K_2,K_3
CO5	Student should be aware of basics of pattern recognition and steps required for it.	K_2,K_4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Overview of History and Goals of AI**: Artificial Intelligence -- Definition, components, scope, and application areas; Turing's test; Review of AI success and failure.	08
II	**State Spaces, Production Systems, and Search:** State space representation of problems; Problem solving using search; Definition and examples of production systems; Heuristic search techniques i.e. generate-and-test, hill climbing, best-first search, constraint satisfaction and mean-ends analysis.	08
III	**Knowledge Representation:** Definition of knowledge; Issues in knowledge representation; Procedural vs declarative knowledge and their representation; Predicate logic, production rules, semantic nets, and frames; Meta-knowledge.	08
IV	**Reasoning and Inference Strategies**: Forward vs backward reasoning; Depth first, breadth first, min-max etc.; Non-monotonic reasoning; Symbolic reasoning under uncertainty; Probability and Baye's theorem; Certainty factors, Dempster-Shafer theory; Fuzzy logic etc.	08
V	**Expert Systems and their Applications:** Justification, structure, knowledge sources; Expert knowledge acquisition; Expert system languages; ES building tools/shells; Applications of AI in CAD, CAPP, process selection, GT, MRP II, adaptive control, robotics, process control, fault diagnosis, failure analysis, etc	08

Textbooks:

1. S.Russell and P.Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition ,2009.
2. I.Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. M. Tim Jones,—Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers,Inc.FirstEdition,2008
4. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009.
5. WilliamF.ClocksinandChristopherS.Mellish,‖ProgramminginProlog:UsingtheISOStandard‖,FifthEd ition,Springer,2003.
6. Gerhard Weiss, Multi Agent Systems, Second Edition,MIT Press, 2013.
7. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.

MKCS 702 CRYPTOGRAPHY & NETWORK SECURITY

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO1	Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.	K2,K3
CO2	Ability to identify information system requirements for both of them such as client and server	K1,K2
CO3	Ability to understand the current legal issues towards information security	K4
CO4	Be able to understand the Transport Layer security Socket Layer and wireless security.	K3
CO5	Summarize the IP Security and its solutions to overcome the attacks.	K2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Security Concepts**: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.	**08**
II	**Symmetric key Ciphers:** Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.	**08**
III	**Cryptographic Hash Functions**: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure	**08**
IV	**Transport-level Security**: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security	**08**
V	**E-Mail Security:** Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, combining security associations, Internet Key Exchange Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.	**08**

Textbooks:

1. WilliamStallings,“CryptographyandNetworkSecurity:PrincipalsandPractice”,PearsonEducation.
2. Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill.
3. C K Shyamala,N Harini, Dr. T. R. Padmnabhan Cryptography and Security, Wiley
4. Bruce Schiener,“Applied Cryptography”.John Wiley & Sons
5. Bernard Menezes,”Network Security and Cryptography”,Cengage Learning.
6. Atul Kahate,“Cryptography and Network Security”, McGraw Hill

MKCS 071 DESIGN & DEVELOPMENT OF APPLICATIONS

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	Be exposed to technology and business trends impacting mobile applications	K1, K2
CO2	Be competent with the characterization and architecture of mobile applications.	K3
CO3	Be competent with understanding enterprises requirements of mobile applications.	K1, K2
CO4	Be competent with designing and developing mobile applications using one application development framework.	K3
CO5	Be exposed to Android and iOS platforms to develop the mobile applications	K1, K2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**INTRODUCTION:** Introduction to mobile applications–Embedded systems–Market and Business drivers for mobile applications–Publishing and delivery of mobile applications–Requirements gathering and validation for mobile applications	08
II	**BASIC DESIGN:** Introduction – Basics of embedded systems design – Embedded OS – Design constraints for mobile applications, both hardware and software related–Architecting mobile applications–User interfaces for mobile applications–touch events and gestures–Achieving quality constraints–performance, usability, security, availability and modifiability	08
III	**ADVANCED DESIGN:** Designing applications with multimedia and web access capabilities –Integration with GPS and social media networking applications – Accessing applications hosted in a cloud-computing environment –Design patterns for mobile applications.	08
IV	TECHNOLOGY –ANDROID: Introduction–Establishing the development environment–Android architecture–Activities and views–Interacting with UI–Persisting data using SQLite–Packaging and deployment–Interaction with server side applications–Using Google Maps, GPS and Wi-Fi – Integration with social media applications.	08
V	TECHNOLOGYII–iOS: Introduction to Objective C–iOS features–implementation–Touch frameworks–Data persistence using Core Data and SQLite–Location aware applications using Core Location and Map Kit–Integrating calendar and address book with social media application–Using Wi-Fi – iPhone market place. Swift: Introduction to Swift, features of swift	08

Textbooks:

1. CharlieCollins,MichaelGalpinandMatthiasKappler,"AndroidinPractice", Dream Tech, 2012
2. Anubhav Pradhan, Anil V Despande, Composing Mobile Apps, Learn, explore, apply
3. James Dovey and AshFurrow,"BeginningObjectiveC",Apress,2012
4. JeffMc Wherter and ScottGowell,"ProfessionalMobileApplicationDevelopment",Wrox,2012
5. David Mark, Jack Nutting, Jeff La Marche and Frederic Olsson, "Beginning iOS
6. Development: Exploring the iOS SDK", Apress, 2013.

MKCS 072 SOFTWARE TESTING

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	Have an ability to apply software testing knowledge and engineering methods.	K2, K3
CO2	Have an ability to design and conduct a software test process for a software-testing project.	K3,K4
CO3	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	K1, K2
CO4	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	K1, K2
CO5	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems.	K2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**TESTING BASICS** : Testing as an engineering activity – Role of process in software quality – Testing as a process – Basic definitions – Software testing principles – The tester's role in a software development organization – Origins of defects – Defect classes – The defect repository and test design – Defect examples – Developer / Tester support for developing a defect repository.	**08**
II	**TEST CASE DESIGN** : Introduction to testing design strategies – The smarter tester – Test case design strategies – Using black box approach to test case design – Random testing – Equivalence class partitioning – Boundary value analysis – Other black box test design approaches – Black box testing and COTS – Using white box approach to test design – Test adequacy criteria – Coverage and control flow graphs – Covering code logic – Paths – Their role in white box based test design – Additional white box test design approaches – Evaluating test adequacy criteria.	**08**
III	**LEVELS OF TESTING**: The need for levels of testing – Unit test – Unit test planning – Designing the unit tests – The class as a testable unit – The test harness – Running the unit tests and recording results – Integration tests – Designing integration tests – Integration test planning – System test – The different types – Regression testing – Alpha, beta and acceptance tests	**08**
IV	**Software Testing Activities**: Levels of Testing, Debugging, Testing techniques and their applicability, Exploratory Testing Automated Test Data Generation: Test Data, Approaches to Test data generation, test data generation using genetic algorithm, Test Data Generation Tools, Software Testing Tools, and Software test Plan.	**08**
V	**Object Oriented Testing**: Definition, Issues, Class Testing, Object Oriented Integration and System Testing, Testing Web Applications: Web Testing, User	**08**

	Interface Testing, Usability Testing, Security Testing, Performance Testing, Database testing, Post Deployment Testing	

Textbooks:

1. Yogesh Singh,"Software Testing", Cambridge University Press, NewYork, 2012
2. K. K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.
3. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
4. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.
5. M.C. Trivedi, Software Testing & Audit, Khanna Publishing House
6. Boris Beizer,"Software System Testing and Quality Assurance", Van Nostr and Reinhold, New York, 1984

MKCS 073 HIGH PERFORMANCE COMPUTING

Course Outcome (CO)		Bloom's Knowledge Level(KL)
	At the end of course, the student will be able to understand	
CO1	Able to understand the basic concept of Computer architecture and Modern Processor	K2
CO2	Able to understand the basic concepts of access optimization and parallel computers	K2,K3
CO3	Able to describe different parallel processing platforms involved in achieving high Performance computing	K3,K4
CO4	Develop efficient and high-performance parallel programming.	K2,K3
CO5	Able to learn parallel programming using message-passing paradigm.	K2,K4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Overview of Grid Computing Technology**, History of Grid Computing, High Performance Computing, Cluster Computing. Peer-to-Peer Computing, Internet Computing, Grid Computing Model and Protocols, Types of Grids: Desktop Grids, Cluster Grids, Data Grids, High-Performance Grids, Applications and Architectures of High-Performance Grids, High Performance Application Development Environment.	**08**
II	**Open Grid Services Architecture**: Introduction, Requirements, Capabilities, Security Considerations, GLOBUS Toolkit	**08**
III	**Overview of Cluster Computing:** Cluster Computer and its Architecture, Clusters Classifications, Components for Clusters, Cluster Middleware and SSI, Resource Management and Scheduling, Programming, Environments and Tools, Cluster Applications, Cluster Systems,	**08**
IV	**Beowulf Cluster:** The Beowulf Model, Application Domains, Beowulf System Architecture, Software Practices, Parallel Programming with MPL, Parallel Virtual Machine (PVM).	**08**
V	**Overview of Cloud Computing**: Types of Cloud, Cyber infrastructure, Service Oriented Architecture, Cloud Computing Components: Infrastructure, Storage, Platform, Application Services, Clients, Cloud Computing Architecture.	**08**

Textbooks:

1. Laurence T.Yang, Minyi Guo–High Performance Computing Paradigm and Infrastructure, John Wiley
2. Ahmar Abbas, "Grid Computing: Practical Guide to Technology & Applications", Firewall Media, 2004.
3. Joshy Joseph and Craig Fellenstein, "Grid Computing", Pearson Education, 2004.
4. Lan Foster, et al., "The Open Grid Services Architecture", Version 1.5(GFD.80).Open Grid Forum, 2006.
5. Rajkumar Buyya. High Performance Cluster Computing: Architectures and Systems. Prentice Hall India

MKCS 074 MOBILE COMPUTING

Course Outcome(CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO1	Explain and discuss issues in mobile computing and illustrate overview of wireless telephony and channel allocation in cellular systems.	K1,K4
CO2	Explore the concept of Wireless Networking and Wireless LAN.	K1
CO3	Analyze and comprehend Data management issues like data replication for mobile computers, adaptive clustering for mobile wireless networks and Disconnected operations.	K4
CO4	Identify Mobile computing Agents and state the issues pertaining to security and fault to Mobile computing environment.	K1,K2
CO5	Compare and contrast various routing protocols and will identify and interpret the performance of networks systems using Adhoc networks.	K2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM:air- interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.	08
II	Wireless Networking, Wireless LAN Overview: MAC issues ,IEEE802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broad casting, Mobile IP,WAP: Architecture, protocol stack , application environment, applications.	08
III	Data management issues, data replication for mobile computers, adaptive clustering for mobile Wireless networks, Files system, Disconnected operations.	08
IV	Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing Environment.	08
V	Adhoc networks, localization, MAC issues, Routing protocols, global state routing(GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand and distance vector routing(AODV),Temporary ordered routing algorithm(TORA),QoS in Adhoc Networks, applications.	08

Textbooks:

1. J. Schiller, Mobile Communications, Addison Wesley.
2. A. Mehrotra, GSM System Engineering.
3. M.V.D. Heijden, M. Taylor, Understanding WAP, Artech House.
4. Charles Perkins, Mobile IP, Addison Wesley.
5. Charles Perkins, Adhoc Networks, Addison Wesley.

MKCS 751 ARTIFICIAL INTELLIGENCE LAB

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	Explain unification, Recursion and listing using Prolog.	K2
CO2	Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.	K4
CO3	Design and carry out an empirical evaluation of different algorithms on a problem formalization and state the conclusions that the evaluation supports.	K5
CO4	Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).	K5

DETAILED SYLLABUS

The following programs may be developed–

1. Study of Prolog.
2. Write simple fact for the statements using PROLOG.
3. Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
4. Write a program to solve the Monkey Banana problem.
5. WAP in turboprolog for medical diagnosis and show the advantage and disadvantage of green and redcuts.
6. 6WAP to implement factorial ,Fibonacci of a given number.
7. Write a program to solve4-Queenproblem.
8. Write a program to solve traveling salesman problem.
9. Write a program to solve waterjug problem using LISP

MKCS 752 CRYPTOGRAPHY & NETWORK SECURITY LAB

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	Use C language to develop simple XOR operation for encryption of data	K3
CO2	Make use of C/Java to implement Symmetric cryptography	K3, K5
CO3	Choose C/Java to develop Asymmetric cryptography	K5
CO4	Implement Diffie-Hellman Key exchange using HTML and JavaScript	K3, K5
CO5	Develop java programs on MD-5 and SHA-1 algorithms	K5

DETAILED SYLLABUS

The following programs may be developed -

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
    i. Ceaser Cipher
    ii. Substitution Cipher
    iii. Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Hello world" using Blow Fish. Create your own key using Java keytool.
8. Write a Java program to implement RSA Algoithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

MKCS 753 INTERNSHIP ASSESSMENT		
Course Outcome(CO)		**Bloom's Knowledge Level(KL)**
At the end of course, the student will be able to understand		
CO1	Developing a technical artifact requiring new technical skills and effectively utilizing a new software tool to complete a task	K_4,K_5
CO2	Writing requirements documentation, selecting appropriate technologies, identifying and Creating appropriate test cases for systems.	K_5,K_6
CO3	Demonstrating professional customs & practices and working with understanding professional standards.	K_4,K_5
CO4	Improving problem-solving, critical thinking skills and report writing.	K_4,K_5
CO5	Learning professional skills like exercising leadership, behaving professionally, behaving ethically, listening effectively, participating as a member of a team, developing appropriate work place attitudes.	K_2,K_4

M.TECH. INTEGRATED (Computer Science and Engineering)

SEMESTER VIII (DETAILED SYLLABUS)

MKCS 801 CLOUD COMPUTING		
Course Outcome (CO)		**Bloom's Knowledge Level(KL)**
At the end of course, the student will be able to understand		
CO1	Describe architecture and underlying principles of cloud computing.	K_3
CO2	Explain need, types and tools of Virtualization for cloud.	K_3,K_4
CO3	Describe Services Oriented Architecture and various types of cloud services.	K_2,K_3
CO4	Explain Inter cloud resources management cloud storage services and their providers Assess security services and standards for cloud computing.	K_2,K_4
CO5	Analyze advanced cloud technologies.	K_3,K_6
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Overview of Computing Paradigm**: Recent trends in Computing Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing Business driver for adopting cloud computing. **Introduction to Cloud Computing:** Cloud Computing (NIST Model) Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers Properties,	**08**

	Characteristics & Disadvantages Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing Role of Open Standards	
II	**Cloud Computing Architecture**: Cloud computing, stack Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services Service Models (XaaS), Infrastructure as a Service (IaaS) , Platform as a Service (PaaS), Software as a Service(SaaS) Deployment Models Public cloud, Private cloud, Hybrid cloud, Community cloud.	**08**
III	**Infrastructure as a Service(IaaS)** :Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) Resource Virtualization Server, Storage, Network Virtual Machine (resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service) Examples Amazon EC2 Renting, EC2 Compute Unit, Platform and Storage, pricing, customers Eucalyptus **Platform as a Service(PaaS):** Introduction to PaaS What is PaaS, Service Oriented Architecture (SOA) Cloud Platform and Management Computation Storage Examples Google App Engine Microsoft Azure **Software as a Service (PaaS):** Introduction to SaaS, Web services, Web 2.0, Web OS, Case Study on SaaS	**08**
IV	**Service Management in Cloud Computing**: Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously Managing Data Looking at Data, Scalability & Cloud Services Database & Data Stores in Cloud Large Scale Data Processing.	**08**
V	**Cloud Security:** Infrastructure Security Network level security, Host level security, Application level security Data security and Storage Data privacy and security Issues, Jurisdictional issues raised by Data location Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.	**08**

Textbooks:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. Rajkumar Buyya ,Christian Vecchiola, S. Thamarai Selvi,―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing–A Practical Approach, Tata Mcgraw Hill, 2009.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice),O'Reilly, 2009.

MKCS 081 DEEP LEARNING

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	To present the mathematical, statistical and computational challenges of building neural networks	K_1, K_2
CO2	To study the concepts of deep learning	K_1,K_2
CO3	To introduce dimensionality reduction techniques	K_2
CO4	To enable the students to know deep learning techniques to support real-time applications	K_2,K_3
CO5	To examine the case studies of deep learning techniques	K_3,K_6

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	INTRODUCTION: Introduction to machine learning-Linear models (SVMs and Perceptrons, logistic regression)-Introduction to Neural Nets: What a shallow network computes-Training a network: Loss functions, back propagation and stochastic gradient descent-Neural networks as universal function approximates	08
II	DEEPNETWORKS: History of Deep Learning- A Probabilistic Theory of Deep Learning-Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks-Generative Adversarial Networks(GAN),Semi-Supervised Learning	08
III	DIMENTIONALITY REDUCTION Linear (PCA, LDA) and manifolds, metric learning – Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures –AlexNet, VGG, Inception, ResNet-Training a Convnet: weights initialization, batch normalization, hyper parameter optimization	08
IV	OPTIMIZATION AND GENERALIZATION: Optimization in deep learning –Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM-Recurrent Neural Network Language Models-Word-Level RNNs & Deep Reinforcement Learning-Computational & Artificial Neuroscience	08
V	CASE STUDY AND APPLICATIONS: Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition-Scene Understanding-Gathering Image Captions	08

Textbooks:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng &Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

MKCS 082 QUANTUM COMPUTING

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.	K_1, K_2
CO2	Demonstrate an understanding of a quantum computing algorithm by simulating it on a Classical computer, and state some of the practical challenges in building a quantum computer.	K_2, K_3
CO3	Contribute to a medium-scale application program as part of a co-operative team, making use of appropriate collaborative development tools (such as version control systems).	K_2, K_3
CO4	Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.	K_3, K_4
CO5	Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and identifying and implementing relevant outcomes.	K_3,K_6

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Fundamental Concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	**08**
II	**Quantum Computation**: Quantum Circuits–Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems ,Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms–Quantum counting – Speeding up the solution of NP– complete problems – Quantum Search for an Unstructured database.	**08**
III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer–Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	**08**
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations–Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	**08**
V	**Quantum Error Correction:** Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information–Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.	**08**

Textbooks:

1. Micheal A. Nielsen. & IssacL.Chiang,"Quantum Computation and Quantum Information",Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G.Rieffel, Wolfgang H Polak,"Quantum Computing-A Gentle Introduction" , Scientific and Engineering Computation, Oct 2014
3. Computing since Democritus by Scott Aaronson, Computer Science:An Introduction by N. David Mermin. Yanofsky and Mannucci, Quantum Computing for Computer Scientists.

MKCS 083 INTERNET OF THINGS

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	Demonstrate basic concepts, principles and challenges in IoT.	K1, K2
CO2	Illustrate functioning of hardware devices and sensors used for IoT.	K2
CO3	Analyze network communication aspects and protocols used in IoT.	K4
CO4	Apply IoT for developing real life applications using Ardunio programming.	K3
CP5	To develop IoT infrastructure for popular applications	K_2,K_3

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT,Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT / M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	**08**
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Net Arduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	**08**
III	**Network &Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & Dissemination	**08**
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	**08**
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications ,home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	**08**

Textbooks:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things key applications and protocols", Wiley
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill,1ST Edition, 2016
5. Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A hands on approach)"1ST edition, VPI publications, 2014
6. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things", Wiley India

MKCS 084 BLOCKCHAIN ARCHITECTURE DESIGN

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	Describe the basic understanding of Block chain architecture along with its primitive.	K_1,K_2
CO2	Explain the requirements for basic protocol along with scalability aspects.	K_2,K_3
CO3	Design and deploy the consensus process using frontend and backend.	K_3,K_4
CO4	Apply Block chain techniques for different use cases like Finance, Trade / Supply and Government activities.	K_4,K_5

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Blockchain**: Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature, Hash chain to Blockchain, Basic consensus mechanisms	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains	**08**
III	**Hyperledger Fabric(A):** Decomposing the consensus process, Hyperledger fabric components, Chain code Design and Implementation **Hyperledger Fabric(B):** Beyond Chain code: fabric SDK and Front End(b) Hyper ledger composer tool	**08**
IV	**Usecase1:** Blockchain in Financial Software and Systems(FSS):(i) Settlements,(ii) KYC,(iii) Capital markets, (iv) Insurance **Usecase2:** Blockchain in trade/ supply chain, Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.	**08**
V	**Usecase3**: Blockchain for Government:(i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and security on Blockchain	**08**

Textbooks:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reilly
3. Hyperledger Fabric-https://www.hyperledger.org/projects/fabric
4. ZerotoBlockchain-An IBM Redbooks course, by BobDill,DavidSmits-https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

MKCS 851 CLOUD COMPUTING LAB

Course Outcome(CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	To know about the use AWS management console, create and manipulate Amazon instances.	K1, K5
CO2	Access the encrypting and controlling of S3	K3
CO3	Describe how to create private and virtual private cloud.	K1
CO4	How to create IAM group in cloud.	K5
CO5	To understand the steps of Installation of Open Stack	K2

DETAILED SYLLABUS

1. Navigate the AWS Management Console. CO1
2. Create and manipulate Elastic Compute Cloud instances. CO1
3. Create AWS EC2 Virtual Machine Using AWS Console. CO1
4. Monitoring Virtual Resources in AWS. CO2
5. Getting Started with S3 in Cloud. CO3
6. Working with EBS in AWS .CO3
7. Build a relational database server. CO3
8. Create private cloud - Designing a Custom VPC (Virtual Private Cloud). CO4
9. Create an IAM Group in Cloud. CO4
10. Built a RESTful serverless API on AWS

MKCS 754/ MKCS 852 PROJECT BASED LEARNING I / PROJECT BASED LEARNING II

Course Outcome (CO)		Bloom's Knowledge Level(KL)
At the end of course, the student will be able to understand		
CO1	Analyze and understand the real-life problem and apply their knowledge to get programming solution.	K_4,K_5
CO2	Engage in the creative design process through the integration and application of diverse Technical knowledge and expertise to meet customer needs and address social issues.	K_4,K_5
CO3	Use the various tools and techniques, coding practices for developing real life solution to the Problem.	K_5,K_6
CO4	Find out the errors in software solutions and establishing the process to design maintainable Software applications	K_4,K_5
CO5	Write the report about what they are doing in project and learning the team working skills	K_5,K_6