DEPARTMENT OF COMPUTER SCIENCE

CENTRAL UNIVERSITY OF TAMIL NADU

School of Mathematics and Computer Sciences

M.Sc. Computer Science - Syllabus

Semester	S.No.	Subject Code	Subject Title	Credit Score	Hours	Semester Cumulative Credits
I	1	MSCT11	Discrete mathematics	3	3	21
	2	MSCT12	Data Structures and Algorithms	3	3	
	3	MSCT13	Computer Organization	3	3	
	4	MSCT14	Database management systems	3	3	
	5	MSCT15	Introduction to Programming	3	3	
	6	MSCP11	Data Structures and Algorithms lab	2	3	
	7	MSCP12	Database management systems	2	3	
	8	MSCP13	Programming Lab	2	3	
II	1	MSCT21	Operating Systems	3	3	20
	2	MSCT22	Networks	3	3	
	3	MSCT23	Software Engineering	2	2	
	4	MSCT24	Web Technology	3	3	
	5	MSCT25	Theory of Computation	3	3	
	6	MSCP21	Networks Lab	2	3	
	7	MSCP22	Software Engineering Lab	2	2	
	8	MSCP23	Web Technology Lab	2	3	
III	1	MSCT31	Network and System Security	3	3	26
	2	MSCT32	Data Science and Analytics	3	3	
	3	MSCT33	Advanced Programming Java	2	2	
	4		Elective I	2	2	
	5		Elective II	2	2	
	6	MSCP31	Network and System Security Lab	2	3	
	7	MSCP32	Data Science and Analytics Lab	2	3	
	8	MSCP33	Advanced Programming Lab	2	3	
	9	MSCP34	Mini Project	8	6	

IV	1	MSCT41	Web services	3	3	20
	2	MSCT42	Distributed computing	3	3	
	3		Elective III	2	2	
	4	MSCP41	Main Project	12	12	

List of Electives:

MSCE1 Mobile App Development
MSCE2 Cryptography
MSCE3 Formal methods and verification
MSCE4 Cloud Computing
MSCE5 Secure systems engg.
MSCE6 Software testing
MSCE7 Internet of Things
MSCE8 Basics of C Programming
MSCE9 Artificial Intelligence
MSCE10 Block Chain Technology
MSCE11 Machine Learning
MSCE12 Statistics for Data Analytics
MSCAEC1 Cyber Security

Course No: **MSCT11**
Course Name: **DISCRETE MATHEMATICS**
Credits: **3**
Course Position: **Semester I**

UNIT I

Mathematical Logic: Propositional and Predicate Logic, Propositional Equivalences, Normal Forms, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.

UNIT II

Sets and Relations: Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering**. Boolean Algebra:** Boolean Functions and its Representation, Simplifications of Boolean Functions.

UNIT III

Counting, Mathematical Induction and Discrete Probability: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion- Exclusion Principle, Mathematical Induction, Probability, Bayes' Theorem.

UNIT IV

Group Theory: Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory, Polya's theory of counting, Introduction to Error Correcting Codes. Discrete Geometry: Some basic definitions, Ham-Sandwich theorem

UNIT V

Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs

TEXTBOOKS:

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.

2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES :

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.

2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

Course No: **MSCT12**
Course Name: **DATA STRUCTURES AND ALGORITHMS**
Credits: **3**
Course Position: **Semester I**

Course Content

Unit - I
Introduction – linear and non linear data structures – Arrays – Structures – Stack – Queue - Representing Stacks and Queue - Linked lists and its different types – Application of stacks, queues and lists.
Unit - II
Trees – binary tree - binary search trees - querying a binary search tree – insertion – deletion - union-find operations – AVL trees - Graphs - Undirected and Directed Graphs - Elementary graph algorithms – minimum spanning trees – single source shortest paths – All-pairs shortest paths
Unit - III
The role of algorithms in computing; algorithm analysis – computational tractability- asymptotic order of growth - survey of common running times - Big O notation; sorting and searching - algorithm analysis techniques –quick sort – heaps - Maintaining the heap property- building a heap – the heap sort algorithm -sorting in linear time - recurrences
Unit - IV
Divide and conquer- The maximum-subarray problem - Strassen's algorithm for matrix multiplication; greedy algorithms - An activity-selection problem - Elements of the greedy strategy; dynamic programming - Rod cutting - Matrix-chain multiplication
Unit - V
Linear Programming - Standard and slack forms - simplex algorithm. NP-Hard And NP-Complete Problems – Basic concepts; NP-HARD GRAPH PROBLEMS – Clique Decision Problem(CDP); NP-HARD SCHEDULING PROBLEMS - Scheduling Identical Processors

References

1. T.H. Cormen, C.E. Leiserson, and R.L. Rivest: Introduction to algorithms, Prentice-Hall (1998).
2. J. Kleinberg and E. Tardos: Algorithm design, Pearson/Addison-Welsey (2006).
3. Jean Paul Tremblay and Paul G. Sorenson, An Introduction to data structures, with applications 2nd edition,Tata McGraw-Hill, 2001
4. Mark Allen Weiss,Data Structures and Algorithm Analysis in C++ (English) 3rd Edition, Addition-wesley, Third Indian Reprint, 2007
5. V. Aho, J. E. Hopcroft, and J. D. Ullman, Data Structures and Algorithms, Addison-Wesley, Reading, Massachusetts, 1983.
6. R. L. Kruse, Data Structures and Program Design in C.,Prentice Hall of India, New Delhi, 1994.
7. Ellis Horowitz , Sartaj Sahni and Susan Anderson,Fundamentals of Data Structures using C, Computer Science Press, 1993

Course No: **MSCT13**
Course Name: **COMPUTER ORGANIZATION**
Credits: **3**
Course Position: **Semester I**

Course Content

UNIT I BASIC STRUCTURE OF COMPUTERS

Function and structure of a computer, Interconnection of components, Performance of a computer. Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

UNIT II PROCESSING UNIT AND PIPELINING

Organization of a processor - Registers, ALU and Control unit, Arithmetic Units - addition, subtraction, multiplication, division, floating point units - Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Micro programmed control unit. Pipelining, Hazards, Overcoming hazards

UNIT III MEMORY SUBSYSTEM

Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Memory management unit - Concept of virtual memory, Address translation, Hardware support for memory management.

UNIT IV INPUT/OUTPUT SUBSYSTEM

Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O, Interrupt controlled I/O and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, I/O peripherals - Input devices, Output devices, Secondary storage devices.

UNIT V PARALLELISM

ILP, Dynamic scheduling, Introduction to Multi-core processors, GPUs.

TEXT BOOKS

1. Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, by David Patterson & John Hennessy, 2013, Morgan-Kaufmann.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", TenthEdition, Pearson Education, 2016.
2. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.

Course No: **MSCT14**
Course Name: **Database Management System**
Credits: **3**
Course Position: **Semester I**

Course Content

UNIT-1
File System versus DBMS – Advantages -Views – Data models – Database languages – Architecture – E-R Model – Conceptual design with E-R – Extended E-R - Relational Model - Codd's rule - Keys – Constraints – Relational database design – Anomalies - Functional dependencies – 1NF to 5NF – Decomposition – Denormalization.

UNIT-2
Relational Query Languages – Relational Algebra – Tuple and domain Relational Calculus – SQL – Query processing and optimization – Transformation of relational expressions – Evaluation plans

UNIT-3
Transaction – Properties – Concurrent execution – Serializability – Concurrency control – Protocols – Recovery System – Database Security

UNIT-4
File organization – Organization of records in files – Indexing – B tree and B+ tree index files – Static hashing – Dynamic hashing

UNIT-5
Parallel and distributed databases – Object-based databases - Mobile databases - XML and Web databases – Intelligent databases – Mongo DB – NOSQL – PostgreSQL

Text Book
A. Silberchatz, F. Korth, and S. Sudarshan, "Database System Concepts", Fourth Edition, McGraw Hill, 2002.

Reference Book

R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", Third Edition, Pearson Education, 2000.

Lab exercises related to Install, configure, and interact with a relational database management system and master the basics of SQL and construct queries using SQL, build a database management system that satisfies relational theory and provides access to users.

Course No: **MSCT15**
Course Name: **INTRODUCTION TO PROGRAMMING**
Credits: **3**
Course Position: **Semester I**

Course Content:

- Introduction to an interpreter programming language, with its basic constructions (variables, assignment, control primitives) and its main components (text editor and interpreter, or one EDI)
- Programming concepts
- Algorithms – Basics
- Data Structures and Memory Management in Python
- Exception – Object Orientated Concepts (Basics), File Handling
- Graph Plotting

Text Book:

- Python in easy steps, McGraw Hill, 2nd Reprint , 2014
- Python 3 Documentation, https://docs.python.org/3/.

References:

- Philips Dusty, Python 3, Object Oriented Programming , 2010

Course No: **MSCT21**
Course Name: **OPERATING SYSTEMS**
Credits: **3**
Course Position: **Semester II**

Course Content

UNIT – I OPERATING SYSTEMS OVERVIEW

Introduction to operating systems – Computer system organization, architecture – Operating system structure, operations – Process, memory, storage management – Protection and security – Distributed systems – Computing Environments – Open-source operating systems – OS services – User operating-system interface – System calls – Types – System programs – OS structure – OS generation – System Boot – Process concept, scheduling – Operations on processes – Cooperating processes – Inter-process communication – Examples – Multithreading models – Thread Libraries – Threading issues – OS examples

UNIT – II PROCESS MANAGEMENT

Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple processor scheduling – Operating system examples – Algorithm Evaluation – The critical section problem – Peterson's solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock detection – Recovery from deadlock

UNIT – III STORAGE MANAGEMENT

Memory Management – Swapping – Contiguous memory allocation – Paging – Segmentation – Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing.

UNIT – IV I/O SYSTEMS

File concept – Access methods – Directory structure – File-system mounting –Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling – Disk management – Swap-space management – Protection

UNIT – V CASE STUDY

The Linux System – History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-process Communication – Network Structure – Security – Windows 7 – History – Design Principles – System Components – Terminal Services and Fast User – File system – Networking.

References:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Concepts”, 9th edition John Wiley & Sons Inc., 2012.

2. Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Addison Wesley, 2014.

3. Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Education”, 1996.

4. D M Dhamdhere, “Operating Systems: A Concept-based Approach”, Second Edition, Tata McGraw-Hill Education, 2007.

5. William Stallings, “Operating Systems: Internals and Design Principles”, Seventh Edition, Prentice Hall, 2011

Course No: **MSCT22**
Course Name: **NETWORKS**
Credits: **3**
Course Position: **Semester II**

Course Content

UNIT – I APPLICATION LAYER

Network Architecture – Layers - HTTP – DNS – E-Mail (SMTP, MIME, POP3, IMAP, Web Mail), FTP, Telnet - SNMP.

UNUT – II TRANSPORT LAYER

User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Details - Flow Control – Congestion Control – Queuing Discipline - Introduction to Quality of services (QOS).

UNIT – III NETWORK LAYER

Circuit Switching - Packet Switching - Virtual Circuit Switching – IP – ARP – DHCP – ICMP – Routing – RIP – OSPF – Subnetting – CIDR – Interdomain Routing – BGP – IPV6 Basic Features – Multicast – Congestion Avoidance in Network Layer.

UNIT – IV DATA LINK LAYER

Channel access on links – TDMA – FDMA – CDMA – Hybrid Multiple Access Techniques – Issues in the Data Link Layer – Framing - Error correction and detection – Link Level Flow Control – Medium Access – Ethernet – Token Ring – FDDI – Wireless LAN – Bridges and Switches.

UNIT – V PHYSICAL LAYER

Data Transmission – Transmission Media – Signal Encoding Techniques – Multiplexing – Spread Spectrum.

REFERENCES:

1. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, Sixth Edition, Pearson Education, 2012.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, “Data and Computer Communications”, Eighth Edition, Pearson Education, 2011
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach “, McGraw Hill Publisher, 2011.
5. Behrouz A. Forouzan, “Computer Netwroks - A top-down approach”, Tata McGraw-Hill, 2012.

Lab Component to cover:

1. Simple Programs using TCP Sockets & UDP Sockets
2. Simulation of HTTP Protocol using TCP Sockets
3. Simulation of DNS using UDP Sockets
4. Learn to use commands like TCP Dump, Netstat, Trace Route
5. Simulation of Ping using Raw Sockets
6. Simulation of Distance Vector/ Link State Routing algorithm
7. Study and configure functionalities of a router and switches (or by simulation)
8. Study of TCP/UDP performance using Simulation tool
9. Performance comparison of Routing protocols using Simulation tool
10. Simulation of error correction code (like CRC)

Course No: **MSCT23**
Course Name: **SOFTWARE ENGINEERING**
Credits: **2**
Course Position: **Semester II**

Course Content

UNIT – I Software Process Models
The Evolving role of Software – Software – The changing Nature of Software – Legacy software — A generic view of process– A layered Technology – A Process Framework – The Capability Maturity Model Integration (CMMI) – Process Assessment – Personal and Team Process Models – Product and Process – Process Models – The Waterfall Model – Incremental Process Models – Incremental Model – The RAD Model – Evolutionary Process Models – Prototyping – The Spiral Model – The Concurrent Development Model – Specialized Process Models – the Unified Process - Agile development.

UNIT – II Requirement Engineering
Software Engineering Practice – communication Practice – Planning practice Modeling practice– Construction Practice –Deployment. Requirements Engineering - Requirements Engineering tasks – Initiating the requirements Engineering Process- Eliciting Requirements – Developing Use cases – Building the Analysis Models – Elements of the Analysis Model – Analysis pattern – Negotiating Requirements – Validating Requirements.

UNIT – III Analysis Modelling
Requirements Analysis – Analysis Modeling approaches – data modeling concepts – Object oriented Analysis – Scenario based modeling – Flow oriented Modeling – Class based modeling – creating a behaviour model.

UNIT – IV Design & Testing
Design Engineering – Design process -Design Quality-Design model-User interface Design – Testing strategies- Testing Tactics - strategies Issues for conventional and object oriented software-validation testing –system testing –Art of debugging – Project management

UNIT – V Quality & Maintenance
Software evolution - Verification and Validation -Critical Systems Validation – Metrics for Process, Project and Product-Quality Management -Process Improvement –Risk Management Configuration Management – Software Cost Estimation
Lab component:

To cover case tools such as Rational rose or equivalent

Use the tool to cover the full SDLC

References:

1. Roger S.Pressman, Bruce R. Maxim, Software Engineering: A Practitioner's Approach, McGraw Hill International edition, Eighth edition, 2015.

2. Ian Sommerville, Software Engineering, 10th Edition, Pearson Education, 2015.

3. Stephan Schach, Object Oriented and classical Software Engineering, 8th edition, Tata McGraw Hill, 2016

Course No: **MSCT24**
Course Name: **WEB TECHNOLOGY**
Credits: **3**
Course Position: **Semester II**

Course Content

Unit – I
Internet Principles – basic web concepts – Client/ server model – Retrieving data from Internet – Internet Protocols and applications
Unit – II
HTML forms – HTML tags emulation – Links and addressing- HTML and Images
Unit – III
Streaming – Networking Principles – Sockets for Clients – Sockets for Servers – Protocol Handlers – Content Handlers – Multicast sockets – Remote method Invocation.
Unit – IV
Scripts - Java Script, VB Script, DHTML, XML, CGI, Servlets.
Unit – V
Server Scripts - Java Sever Pages (JSP), Active Server pages (ASP), Simple applications – On-line databases – Monitoring user events – Plug-ins – Database connectivity.

Text Books:
1. Eillotte Rusty Harold, "Java Network Programming", O"Reilly Publications, 1997.
2. Harvey M. Deitel and Paul J. Deitel, "Internet & World Wide Web How to Program", 4th edition, 2008.
3. N. P. Gopalan and J. Akilandeswari, "Web Technology – A Developer"s Perspective", PHIO Pvt Ltd., New Delhi-, 2007.

Reference Books:
1. Jason Hunter and William Crawford, "Java Servlets Programming", O"Reilly Publications, 1998.
2. Jeff Frantzen and Sobotka, "Java Script" Tata McGraw Hill, 1999.
3. Eric Ladd and Jim O"donnell, "Using HTML 4, XML and Java", Prentice Hall of India – QUE, 1999.

Course No: **MSCT25**
Course Name: **THEORY OF COMPUTATION**
Credits: **3**
Course Position: **Semester II**

Course Content

UNIT I FINITE AUTOMATA

Introduction- Basic Mathematical Notation and techniques- Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) - Finite Automaton with €-moves- Regular Languages - Regular Expression - Proving languages not to be regular – Closure properties of regular languages - Equivalence of NFA and DFA - Equivalence of NDFA's with and without €-moves - Minimization of DFA - Pumping Lemma for Regular Language- Its use as an adversarial game.

UNIT II CONTEXT FREE GRAMMARS (CFG) AND LANGUAGES

Notion of Grammars and languages generated by grammars - Parse Trees - Derivations and Languages – Ambiguity - Relationship between derivation and derivation trees - Simplification of CFG - Elimination of Useless symbols - Unit productions - Null productions - Greiback Normal form (GNF) – Chomsky normal form (CNF) - Problems related to CNF and GNF- applications to compliers.

UNIT III PUSHDOWN AUTOMATA (PDA)

Definition of the Pushdown automata – Languages of a Pushdown Automata – Moves - Instantaneous descriptions - Deterministic and Nondeterministic pushdown automata - Equivalence of Pushdown automata and CFL - pumping lemma for CFL - Closure Properties of CFL - problems based on pumping Lemma.

UNIT IV TURING MACHINES

Definitions of Turing machines - Models – Universal Turing machine - Deterministic and Nondeterministic Turing machines Computable languages and functions - Techniques for Turing machine construction - Multi head and Multi tape Turing Machines - The Halting problem -Partial Solvability - Problems about Turing machines.

UNIT V UNDECIDABALITY AND INTRACTABILITY

A language that is not Recursively Enumerable (RE) - An undecidable problem that is RE - Undecidable problems about Turing Machine - Post's Correspondence Problem - Measuring and Classifying complexity: Tractable and Intractable problems- Tractable and possibly intractable problems – P and NP.

TEXT BOOKS:

1. Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2008. (UNIT 1,2,3)
2. John C Martin, "Introduction to Languages and the Theory of Computation", Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007. (UNIT 4,5)

REFERENCES:

1. Dexter C. Kozen , "Automata and Computability" ,Springer-Verlag Berlin Heidelberg, 1977.

2. Mishra K L P and Chandrasekaran N, “Theory of Computer Science – Automata, Languages and Computation”, Third Edition, Prentice Hall of India, 2004.
3. Harry R Lewis and Christos H Papadimitriou, “Elements of the Theory of Computation”, Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003.
4. Peter Linz, “An Introduction to Formal Language and Automata”, Third Edition, Narosa Publishers, New Delhi, 2002.
5.Micheal Sipser, “Introduction of the Theory and Computation”, Thomson Brokecole, 1997.
6. J. Martin, “Introduction to Languages and the Theory of computation” Third Edition, Tata Mc Graw Hill, 2007.

Course No: **MSCT31**
Course Name: **NETWORK AND SYSTEM SECURITY**
Credits: **3**
Course Position: **Semester III**

Course Content

UNIT – I Overview of information security: confidentiality, integrity, and availability
Understanding the Threats: Malicious software (Viruses, trojans, rootkits, worms, botnets),
Memory exploits (buffer overflow, heap overflow, integer overflow, format string)
Formalisms: Access control theory, access control matrix, Information flow
Policy: Security policies, Confidentiality policies (BLP model), Integrity policies
(Biba, and Clark-Wilson model), Hybrid policies (Chinese Wall model, role-based access control)

UNIT – II Implementation: Cryptography --- Block and stream ciphers, Cryptographic hash functions, Message Authentication Codes (MAC), Public and private key systems, Authentication, Password system

UNIT – III Implementation: Systems --- TCB and security kernel construction, UNIX security and Security-Enhanced Linux (SELinux)

UNIT – IV Network Security: TCP/IP security issues , DNS security issues and defenses, TLS/SSL, Intrusion detection and prevention systems, Firewalls

UNIT – V Software Security: Sandboxing, Control flow integrity - Web Security: User authentication, authentication-via-secret and session management Legal and Ethical Issues: Hacking and intrusion, Privacy, identity theft.

Recommended Texts

1. Computer Security Arts and Science by Matt Bishop, (2nd Ed), Addison wesley.
2. William Stallings. Network Security Essentials (2nd edition). Prentice Hall. 2003.
3. Saadat Malik. Network Security Principles and Practices Pearson Education.2002.

Course No: **MSCT32**
Course Name: **DATA SCIENCE AND ANALYTICS**
Credits: **3**
Course Position: **Semester III**

Course Content

UNIT I – INTRODUCTION TO DATA SCIENCE

Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL.

UNIT II – INTRODUCTION TO R

Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution.

UNIT III – MAP REDUCE

Introduction – distributed file system – algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce – Hadoop - Understanding the Map Reduce architecture - Writing Hadoop MapReduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.

UNIT IV – INTRODUCTION TO BIG DATA

Introduction to Big Data Platform – Challenges of Conventional Systems - Five Vs - Intelligent data analysis – Nature of Data – Big data analytic processes - Ingesting data into the system - Persisting the data in storage - Computing and Analyzing data - Visualizing the results – Big data tools

UNIT V – INTRODUCTION TO SPARK

Introduction to data analysis with spark - Programming with RDDs – working with key value pairs – loading and saving your data – Spark SQL – Spark Streaming – Apache spark MLIB - Machine Learning with MLib – Development of real time applications using SPARK

REFERENCES

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.

2. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, “Mining of Massive Datasets”,

Cambridge University Press, 2014.

3. Mark Gardener, “Beginning R - The Statistical Pr ogramming Language”, John Wiley & Sons, Inc., 2012

4. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.

5. Chris Eaton, Dirk deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.

6. Tom White, “HADOOP: The definitive Guide” , O Reilly 2012.

7. Spark - The Definitive Guide, Bill Chambers and Matei Zaharia, 2018, O'Reilly Media, Inc, USA, ISBN10 1491912219, ISBN13 9781491912218

8. Holden Karau, Andy Konwinski, Patrick Wendell & Matei Zaharia, Learning Spark Lightning-Fast Data Analysis, ISBN-13: 978-1449358624, ISBN-10: 1449358624, O’Reilly, 2015

9. Josh Wills, Sandy Ryza, Sean Owen, and Uri Laserson, Advanced Analytics with Spark: Patterns for Learning from Data at Scale 2nd Edition, O'Reilly, 2016

Course Code: **MSCT33**
Course Name: **Advanced Programming - Java**
Credits: **2**
Course Position: **Semester III**

Course Content:

Concepts of Object Oriented Programming- Encapsulation, inheritance, polymorphism

Introduction to Java – Data types, variables, operators, control statements

Introduction to classes, declaring objects, data fields, methods, Inheritance, packages and interfaces

Exception handling, multithreading, generics

GUI development- Introduction to AWT and Swing Classes, Input/Output, file handling, Applet class

Introduction to Java Collections

Reference

Schildt : Java Fundamentals : A comprehensive Introduction

Course No: **MSCT41**
Course Name: **WEB SERVICES**
Credits: **3**
Course Position: **Semester IV**

Course Content

UNIT – I

Web Technology - Web 2.0 technologies, Introduction to Ajax, Ajax Design Basics, Introduction to WWW, TCP/IP, HTTP, ARP, ICMP FTP, UDP, routing protocols (RIP, OSPF, BGP), Network Management Protocols (SNMP), and Application-level protocols (FTP, TELNET, SMTP), URL, Web Browsers, Web Servers.

UNIT – II

Web services, Evolution and differences with Distributed computing, XML - Name Spaces - Structuring With Schemas and DTD - Transformation - XML Infrastructure WSDL, SOAP, UDDI, ebXML - SOAP And Web Services in E-Com - Overview Of .NET And J2EE.

UNIT - III

Platform for Web Services Development, MVC Design Pattern, Web services - EJB, .NET, J2EE Architecture, J2EE Components & Containers, Specification, Application servers, Struts,Introduction to JSON.

UNIT - IV

Web Transactions, Coordination, Orchestration, and Choreography – tools BPEL, WS- CDL Overview of Web service standards -BPEL4WS. WS-Security and the Web services security specifications, WSReliable Messaging, WS-Policy, WS-Attachments.

UNIT - V

Web Service Case Study - Web Service Search Engine, Web Service Discovery, Web Service Composition. Web Service – SOAP vs Web Service – REST.

REFERENCES

1. Deitel, and Nieto, “Internet and World Wide Web – How to program”, Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, “Java Network Programming”, O’Reilly Publishers, 2002.
3. Ramesh Nagappan , Robert Skoczylas and Rima Patel Sriganesh, " Developing Java Web Services", Wiley Publishing Inc., 2004.
4. R. Krishnamoorthy & S. Prabhu, “Internet and Java Programming”, New Age International Publishers, 2004.
5. Frank. P. Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.
6. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services", Pearson Education, 2004.
7. McGovern, et al., "Java Web Services Architecture", Morgan Kaufmann Publishers, 2005.

Course No: **MSCT42**
Course Name: **DISTRIBUTED COMPUTING**
Credits: **3**
Course Position: **Semester IV**

Course Content

Unit – I
Distributed Systems - Goal - Advantages over centralized systems - Organization of multiprocessor systems - Hardware/software concepts - Review of layered protocols.
Unit – II
Client/Server Model - Microkernel - RMI - Distributed algorithms - Time stamping - Circulating tokens - Diffusing computations.
Unit – III
Mutual Exclusion Algorithm - Election algorithm - Detecting loss of tokens and regeneration - Distributed deadlock detection algorithms - Distributed termination algorithms.
Unit – IV
File Replication - Semantics of file sharing - Remote access methods - Fault tolerant issues - Introduction to distributed operating systems.
Unit – V
Introduction to Distributed Operating Systems - Motivations - Management systems - Levels of distribution transparency - Architecture - Introduction to concurrency control.

Text Books
1. George Coulouris and Jean Dollimore, and Tim Kindberg, "Distributed System Concepts and Design", 4th Edition, Addison Wesley, 2005

2. A. S. Tanenbaum, "Distributed Operating Systems", Prentice Hall, 1995.

Reference Book
S. Ceri and G.Pelagatti, "Distributed Databases - Principles and Systems",
McGraw Hill, 1985.

Course No: **MSCE1**
Course Name: **MOBILE APPLICATION DEVELOPMENT**
Credits: **2**
Course Position: **Optional**

Course Content

UNIT – I
Mobile Network Architecture - Mobile Device Architecture - Mobile Application Development - Mobile Web Applications - Business Communication

UNIT II
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.

UNIT III
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.

Unit – IV
Overview of Android- What does Android run On – Android Internals-Android for mobile apps development - Environment setup for Android apps Development - Framework - Android- SDK, Eclipse - Emulators – What is an Emulator / Android AVD? - Android Emulation – Creation and set up - First Android Application - Design criteria for Android Application : Hardware Design Consideration, Design Demands For Android application, Intent, Activity, Activity Lifecycle and Manifest

Unit – V
Simple UI -Layouts and Layout properties: Introduction to Android UI Design, Introducing Layouts - Event driven Programming in Android (Text Edit, Button clicked etc.) - Activity Lifecycle of Android - Menu :Basics, Custom v/s System Menus, Create and Use Handset menu Button (Hardware) - Basic operation of SQLite Database

References

Architecting Mobile Solutions for the Enterprise, Dino Esposito, Microsoft press, 2015
Professional Mobile Application Development, Author: JEFF MCWHERTER, SCOTT GOWELL, Publisher: Wiley India Pvt Lt, 2014
Mobile Application Penetration Testing Paperback – Import, 11 Mar 2016, Vijay Kumar Velu

Course Code: **MSCE2**
Course Name: **CRYPTOGRAPHY**
Credits: **2**
Course Position: **Optional**

Course Content:

UNIT – I Foundations of Cryptography and Security :-

Ciphers and Secret Message, Security Attacks and Services. Mathematical Tools for Cryptography : Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic. Design Principle of Block ciphers: Theory of Block Cipher Design. Cipher Network Structures, DES and Triple DES, Modes of Operation (ECB, CBC, OFB, CFB) , Strength of DES

UNIT – II Block Cipher Algorithms:-

IDEA, CAST, Blowfish ,Rijndael (AES). Pseudo Random Numbers and stream ciphers: Pseudo random sequences, Linear Congruential Generators, Cryptographic Generators, Design of Stream Cipher , RC4, RC5 .

UNIT – III Public Key Cryptography:-

Prime Numbers and Testing for Primality, Factoring Large Numbers, Discrete Logarithms RSA, Diffie- Hellman, ElGamal , Introduction of Elliptic acre Cryptosystems Key Management , Key Exchange Algorithms, Public – Key Cryptography Standards. Hashes and Message Digests: Message Authentication, MD5, SHA-1, RIPEMD , HMAC

UNIT – IV Digital Signatures, Certificates, and Standards:-

Digital Signature Standard (DSS and DSA), Public key Infrastructure, Digital Certivicates and Basics of PKCS Standards. Authentication: Kerberos V 4 and V 5, X.509 Authentication Service. Electronic Mail Security : Pretty Good Privacy (PGP) , S /MIME, X.400 . IP and Web Security Protocols: IPSec and Virtual Private Networks, Secure Sockets and Transport Layer (SSL and TLS).

UNIT – V System Security: -

Computer Virus, Firewall and Design Principles, Electronic Commerce Security: Electronic Payment Systems, Secure Electronic Transaction (SET), Protocols (CyberCash, iKey) Ecash (DigiCash), Smart Card Based Systems.

Reference Book:
Cryptography and Network Security, William Stalling , PHI.
Applied Cryptography: Protocols & Algorithms, Schneier& Bruce, MGH

Course No: **MSCE3**
Course Name: **FORMAL METHODS AND VERIFICATION**
Credits: **3**
Course Position: **Optional**

Course Content

UNIT 1Logic - ACL2 (Applied/Mechanized Logic)

Syntax - Models, semantics - Proof theory, soundness - Completeness theorem - Compactness &Lowenheim-Skolem theorems - Foundations of mathematics - Godel's incompleteness theorems -The ACL2 programming language - Primitive data types,Functions/macros ,Modeling systems ,List processing ,Modeling examples from hardware, software, and security - The ACL2 logic - Definitional principle , The ACL2 ordinals and termination proofs , Induction , Hand Proofs ,Quantification & encapsulation - Mechanization of ACL2 ,Computation as proof, Overview of the waterfall , Overview of simplification ,Induction

UNIT II Theory of rewrite systems and Decision procedures

Confluence ,Termination,Completion, including Knuth-Bendixcompletion,Conditional rewriting - Decision procedures -Propositional logic - Soundness & completeness ,If-normatization ,Davis/Putnam ,BDDs,Linearithmetic,Combining decision procedures,Nelson-Oppen and/orShostak

UNIT III Reactive systems

Transformational vs. reactive systems - Safety and liveness ,Topological characterization ,Lattice theoretic - Temporal logic,Lineartime,Branchingtime,Tarski-Knasterfixpoint theorem ,Mu-calculus ,Notions of correctness:Trace containment, equivalence - Simulation, bisimulation ,Complexity/ Algorithms

UNIT IV Verification ByModel Checking

Model checking the mu-calculus, Symbolic model checking ,Tablaux method for CTL

UNIT V Abstraction

Boolean and predicate abstractions, counter-example guided refinement Homomorphisms ,Conservative abstractions ,Abstract interpretation

REFERENCES

1. M Kaufmann, P Manolios, and J Strother Moore. Computer-Aided Reasoning: An Approach. Kluwer Academic Publishers, 2000.
2. Edmund M. Clarke, Jr., Orna Grumberg, and Doron A. Peled. Model Checking. MIT Press,1999.
3. Mathematical Logic, Second Edition. H.-D. Ebbinghaus and J. Flum and W. Thomas. Springer-Verlag, 1994..

4. Term Rewriting and All That. Franz Baader and Tobias Nipkow. Cambridge University Press, 1998. (ISBN: 0-521-77920-0)
5. Formal Modelling and Analysis of Security Protocols. Peter Ryan and Steve Schneider. AAddison Wesley, 2001
6. Computer-Aided Reasoning: ACL2 Case Studies. Matt Kaufmann, PanagiotisManolios, and J Strother Moore (eds.). Kluwer Academic Publishers, June, 2000. (ISBN: 0-7923-7849-0).

Course No: **MSCE4**
Course Name: **CLOUD COMPUTING**
Credits: **2**
Course Position: **Optional**

Course Content

UNIT 1: **Foundation of cloud computing**-Introduction-History-Fundamentals-Cloud computing characteristics-Advantages and disadvantages-comparison of traditional and cloud computing paradigms-Evaluating-Business drivers-Future of cloud (FoC)-**Cloud services and deployment models**-Cloud deployment models-Cloud service model-Cloud infrastructure mechanism-Cloud service management

UNIT 2: **Cloud computing architecture**-Design principle-Life cycle (CCLC)-Reference architecture-Load balancing approach-Mobile cloud computing (MCC)-Case study of oracle cloud management-**Virtualization technology**-Techniques-How virtualisation work - Kernel-based virtual machine (KVM)-VMware-Virtual Box-Citrix-Types of virtualization-Virtualisation in cloud

UNIT 3: Service oriented Architecture-Objectives-SOA foundation-Web services and SOA-SOA communication-SOA components-SOA Infrastructure-Need of SOA-Business Process Management (BPM)-Services-BPM PaaS- BPaaS-**Cloud Computing Applications**-Introduction-Google App Engine-Google Apps-Google Cloud Data store-Dropbox Cloud-Apple iCloud-Microsoft Windows Azure Cloud-Amazon Web Services(AWS)

UNIT 4: Cloud Security and Privacy-Cloud security-Cloud CIA security model-Cloud computing security architecture-Service provider security issues-Security issues in Virtualization- Data security in cloud-Data privacy risks-Business continuity and disaster recovery-Threats in cloud-Security techniques for threats-Cloud service level agreements(SLA)-Components-Types-Cloud vendors-Quality of Cloud Services-Techniques-Migration-Trust management

UNIT 5:Cloud Computing Technologies - High performance Computing-Message Passing Interface(MPI)-MapReduce programming model-Dryad and Dryad LINQ - Eucalyptus cloud platform-Components -OpenNebula-Layers-Features-OpenStack - components-Benefits Apache Hadoop ecosystem-**Adoption of Cloud Computing**-Factors affecting the adoption-Existing area of application-Case studies-Certifications

References

1. Kant Hiran, Kamal, Ruchi Doshi, Temitayo Fagbola, Mehul Mahrishi, Cloud Computing: Master the Concepts, Architecture and Applications with Real-world examples and Case studies, Kant Hiran, Kamal, Ruchi Doshi, Temitayo Fagbola, Mehul Mahrishi, BPB Publications; 1 edition, 2019
2. Ben Piper and David Clinton, AWS Certified Solutions Architect Study Guide: Associate SAA-C01 Exam, Googel Book, 2019
3. Legorie Rajan Ps, Steven Porter, and Ted Hunter, Building Google Cloud Platform Solutions: Develop Scalable Applications from Scratch and Make Them Globally Available in Almost Any Language, Packt, 2019
4. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, Tata McGraw Hill Education Private Limited, 2013

5. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Morgan Kaufmann Publishers, 2012.
6. Gautam Shroff "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University press, 2010.

Course No: **MSCE5**
Course Name: **SECURE SYSTEMS ENGINEERING**
Credits: **2**
Course Position: **Optional**

Course Content

Unit - I

Overview of the Security Environment: Cloud computing, Mobile computing systems, Social media - Information Security Overview - Risk Analysis - Compliance with Standards, Regulations, and Laws - Secure Design Principles - Security Policies, Standards, Procedures,

and Guidelines - Security Organization - Authentication and Authorization

Unit - II

Risk Analysis: Understanding system-wide tradeoffs, strategies - Systems Engineering and Security: enterprise architecture, security metrics

Unit - III

Identification and authentication - Introduction - Identification - Authentication - More advanced - Additional resources - Alert! - Identification and authentication in the real world: Authorization and access control, physical, network, OS security

Unit - IV

Systems and Programs: Roles, responsibilities, and requirements

Unit - V

Analysis Toolkit: Scenario planning, security technologies

References

1. Jason Andress, The Basics of Information Security, Syngress, 2011.
2. Mark Rhodes-Ousley, Information Security, The Complete Reference, Second Edition, 2013.

Course No: **MSCE6**
Course Name: **SOFTWARE TESTING**
Credits: **2**
Course Position: **Optional**

Course Content

UNIT I INTRODUCTION
What is software testing and why it is so hard? Testing Process, Basic Definitions - Software Testing Principles - The Tester's Role in a Software Development Organization - Origins of Defects - Defect Classes - Error, Fault, Failure, and Incident - The Defect Repository and Test Design – Defect Examples – Developer/Tester Support for Developing a Defect Repository.

UNIT II TEST CASE
Test Case Design Strategies - The Smarter Tester - Functional Testing (Black Box) - Boundary Value Analysis - Equivalence Class Testing – Decision Table Based Testing, Cause Effect - Graphing Technique – error guessing - compatibility testing - Requirements based testing – positive and negative testing – Structural Testing (White Box) – Path testing, code functional testing - DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing Test Adequacy Criteria – static testing vs. structural testing.

UNIT III TYPES OF TESTING
Levels of Testing – Unit testing - Planning - Designing - Running and Recording results - Integration testing – Designing –Planning – scenario testing -System testing - Types - Acceptance testing - Performance testing - Regression Testing - Slice based testing - Debugging, Domain Testing - Alpha - Beta Tests - Object Oriented Testing.

UNIT IV TESTING TOOLS AND TEST MANAGAEMENT
Static Testing Tools - Dynamic Testing Tools - Characteristics of Modern Tools - Test Planning - Test Plan Components - Test Plan Attachments - Test Items - Test management - Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group.

UNIT V CONTROLLING AND MONITORING
Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation - Test metrics and measurements –project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results. – Evaluating software quality – defect prevention – testing maturity model.

TEXT BOOKS
1. Srinivasan Desikan and Gopalaswamy Ramesh, " Software Testing – Principles and Practices", Pearson education, 2006.
2. Aditya P.Mathur, "Foundations of Software Testing", Pearson Education,2008.

REFERENCES:
1. Boris Beizer, "Software Testing Techniques", Second Edition,Dreamtech, 2003
2. Elfriede Dustin, "Effective Software Testing", First Edition, Pearson Education, 2003.
3. Renu Rajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill, 2004.

Course No: **MSCE7**
Course Name: **INTERNET OF THINGS**
Credits: **2**
Course Position: **Optional**

Course Content

UNIT I FUNDAMENTALS OF IOT

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M. IoT Example: The Refrigerator - IoT Devices - IoT Devices vs. Computers - Trends in the Adoption of IoT - IoT Is Powerful and Pervasive - Societal Benefits of IoT

UNIT II IOT DESIGN METHODOLOGY

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development. Embedded Systems - Generic Embedded Systems Structure - Components of Embedded Systems - Analog/Digital Conversion

UNIT III BUILDING IOT WITH RASPBERRY PI

Basic Equipment - Design Methods for Networked Devices - Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services

UNIT IV BUILDING IOT WITH GALILEO/ARDUINO

Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks

UNIT V CASE STUDIES and ADVANCED TOPICS

Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT – Software & Management Tools for IoT – IOT - Risks, Privacy, and Security

REFERENCES

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
2. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, **"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",** 1st Edition, Academic Press, 2014.
4. Vijay Madisetti and Arshdeep Bahga, **"Internet of Things (A Hands-on-Approach)",** 1stEdition, VPT, 2014.
5. Francis daCosta, **"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",** 1st Edition, Apress Publications, 2013

Course code : MSCE9
Course title : ARTIFICIAL INTELLIGENCE
Credits : 2
Course Type : ELECTIVE

UNIT-1

Introduction: Overview of AI problems, examples of successful recent AI applications. Production Systems.

Search Strategies: Problem spaces (states, goals and operators), problem solving by search. Uninformed search (breadth-first, depth-first, depth-first with iterative deepening). Heuristics and informed search (hill-climbing, generic best-first, A*). Minimax Search, Alpha-beta pruning. Space and time efficiency of search. Two-player games (introduction to minimax search). Constraint satisfaction (backtracking and local search methods).

UNIT -2

Knowledge Representation and Reasoning: ontologies, foundations of knowledge representation and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, reasoning about knowledge, sample applications.

UNIT- 3

Planning-The blocks world, Components of Planning Systems, Goal stack planning, Nonlinear planning, Hierarchical planning. Multi agent planning, Case based planning. Definition and examples of broad variety of machine learning tasks, Classification, Inductive learning, Simple statistical-based learning such as Naive Bayesian Classifier, Decision trees.

UNIT-4

Natural Language Processing: Language models, n-grams, Vector space models, Bag of words, Text classification, Information retrieval, Pagerank, Information extraction, Question-answering

UNIT-5

Agents: Definition of agents, Agent architectures (e.g., reactive, layered, cognitive), Multi-agent systems- Collaborating agents, Competitive agents, Swarm systems and biologically inspired models.

Text Book

1. Artificial Intelligence: A Modern Approach- S. Russell and P. Norvig, Prentice Hall, 3rd Edition 2009
2. Artificial Intelligence -Elaine Rich, Kevin Knight and Shivashankar B Nai, 3rd Edition TMH 2009

Reference Book

1. Introduction to Artificial Intelligence and Expert Systems- Dan W. Patterson, Pearson Education 1st Edition 2015.

Course No : MSCE10
Course Name : Block chain Technology
Credits : 2
Course Type : Elective
Prerequisite : Basics of Cryptography

Unit 1

Introduction - Basics of Block chain - Evolution - Properties (Functional) -Immutability - Non-repudiation -Data Integrity - Transparency - Distributed Ledger - Peer Network; Cryptography Basics - Encryption schemes - Public Key Cryptography -Overview of Hashing

Unit 2

Block chain Architecture - Components - Block chain Transaction - Types of Block chain - Public - Bitcoin - Ethereum - Private (Permissioned) -Enterprise Block chain - Hyperledger -Architecture - Exploring Hyperledger frameworks - Fabric

Unit 3

Consensus - Basics - Proof of Work (Pow) - Byzantine General's Problem (Permissioned Block chain) - RAFT Consensus - Byzantine Fault Tolerance - Distributed Databases vs. Blockchain

Unit 4

Cryptocurrency - Double-spending - Traditional Banking - Single Entry Ledger - Double Entry System-Bitcoin - Use - Peer Network - Trading - Distributed Consensus - Bitcoin Transaction - Mining - Proof-of-Work - Hashing - Nakamoto Consensus - Blocks - Merkle Tree - Wallets

Unit 5

Ethereum - Ethereum Virtual Machine (EVM) - Wallets -Smart Contracts - DApp service - Metamask - Solidity Programming Language - Remix Browser - Issues with Smart Contracts – vulnerabilities

Text books / References

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

2. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310.

3. Hands- On Block chain with Hyperledger , Nitin Gaur Luc Desrosiers Venkatraman Ramakrishna Petr Novotny Dr. Salman A. Baset Anthony O'Dowd, Packt Publishing

4. https://nptel.ac.in/courses/106105184/

Course code : MSCE11
Course title : MACHINE LEARNING
Credits : 2
Course Type : ELECTIVE

MACHINE LEARNING

Course Content

UNIT I: Introduction to Machine Learning- Human learning and its types-Machine learning and its types-Applications-Issues in Machine Learning-Tools in Machine Learning.

UNIT II: Machine Learning activities- Exploring categorical and numerical data-Exploring relationship between variables-Data issues and remediation-Data Pre-processing- Modelling and Evaluation: Selecting a Model –Training a Model-Model Representation and Interpretability-Model performance Evaluation-Basics of Feature Engineering.

UNIT III: Probability-Random variables-discrete distributions-binomial, Poisson, Bernoulli, etc; Continuous distribution-uniform, normal, Laplace; central theorem; Monte Carlo approximation. Bayesian Concept learning-Bayes theorem-prior and posterior probability, likelihood; Concept learning; Bayesian Belief Network

UNIT IV: Supervised learning-Classification: Basics-k-Nearest neighbor; decision tree; support vector machine; Regression - Unsupervised learning: Clustering techniques, association rules.

UNIT V: Introduction to Neural Network-Biological Neuron and Artificial Neuron-Activation function-Early implementations of ANN-Architecture- Learning process in ANN; back propagation-Introduction to Deep Learning.

Text / Reference Books:

1. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson Publications 2019
2. Machine Learning The Arts and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge University Press 2018
3. *Machine Learning*, Tom Mitchell, McGraw , 1997, 0-07-042807-7

Course code : MSCE8

Course title : Basics of C Programming

Credits : 4

Course Type : ELECTIVE

Syllabus:

Unit I Basics of Computer Programming

Introduction to Computers- Characteristics-Hardware and Software- Types of Programming Languages-Developing a Program- Algorithms-Characteristics-Flowcharts-Exercises-Principles of Structured Programming.

Unit II Introduction to C Programming and Control Structures

Introduction to writing a program in C - C character set – Identifiers and Keywords– Datatypes – Constants – Variables – Declarations- Expressions – Statements – Symbolic constants – Operators- Sequential Structures - Library functions – Data input and output: Single character input and output – Entering input data – Writing output data – gets and puts functions- Control Statements-Branching: if-else-Nested Control Structures.

Unit III Iterative Structures and Functions

Looping: while- do while-for- Programs using Iterative construct – switch – break - continue statement - comma operator - goto statement – Modular Programming-Functions and Procedures-Defining a Function- Accessing a Function- Function Prototypes.

Unit IV Arrays

Defining an Array- Processing an Array – One Dimensional Array- Two-Dimensional Array- Multidimensional Arrays- Arrays and Functions- Passing arrays to a function-Pass by value-Pass by Reference.

Unit V Pointers

Pointer operator- Pointer expressions and arithmetic- Recursion- Pointers and Functions-Pointers and Arrays-Passing pointers to a function.

Text/ Reference Books:

a. Byron Gottfried, "Programming with C", Third Edition, Tata McGraw Hill Education, 2010

b. R. G. Dromey, "How to Solve it By Computers?", Prentice Hall, 2009.

Learning materials:

b. J. R. Hanly and E. B. Koffman, "Problem Solving and Program Design in C", 6th Edition, Pearson Education, 2009.

c. Paul Deital and Harvey Deital, “C How to Program”, Seventh Edition, Prentice Hall, 2012.
d. Yashavant Kanetkar, “Let Us C”, 12th Edition, BPB Publications, 2012.

E-materials:

https://nptel.ac.in/courses/106105085/ lecture **by Dr. P.P. Chakraborty IIT Kharagpur.**

Course code : MSCAEC1

Course title : CYBER SECURITY

Credits : 2

Course Type : ELECTIVE

CYBER SECURITY

1. **Syllabus:**

Unit I - Computing Security Concepts

What is Computer Security?-Threats-Harm-Vulnerabilities-Unintentional(Non Malicious) Programming-Malicious code-Malware-Countermeasures.

Unit II Cryptography

Authentication-Access Control- Cryptography-Block and Stream Cipher- RSA-Diffie Hellman Algorithm

Unit III – Networks

Network concepts- Threats to Network communications- Wireless Network Security-Denial of Service- Firewalls-Intrusion Detection and Prevention Systems-Network Management-Forensics

Unit IV – Privacy

Privacy Concepts- Privacy Principles and Policies- Authentication and Privacy- Privacy on the Web- Email Security- Privacy in financial transactions and social media -Privacy Impacts of Emerging Technologies.

Unit V- Legal Issues and Ethics

Protecting Programs and Data-Information and the Law-Rights of Employees and Employers-Redress for Software Failures-Computer Crime-Ethical Issues in Computer Security

Text/ Reference Books:

a. Pfleeger, C.P., Security in Computing 5th Edition, Prentice Hall, Copyright 2010ISBN 0-13-239077-9

b. Schneier, Bruce. *Applied Cryptography*, Second Edition, John Wiley & Sons, 1996..

Learning materials:

A. "Network Security, Firewalls And Vpns" by J Michael Stewart
B. "Network Security: Private Communication in a Public World" by Charlie Kaufman and Radia Perlman
C. "Understanding Cryptography: A Textbook for Students and Practitioners" by Christof Paar and Jan Pelzl

Course code : MSCE12
Course title : STATISTICS FOR DATA ANALYTICS
Credits : 2
Course Type : ELECTIVE

STATISTICS FOR DATA ANALYTICS

UNIT I Statistical Learning
The Trade-Off Between Prediction Accuracy and Model Interpretability - Supervised Versus Unsupervised Learning -Regression Versus Classification Problems – Assessing Model Accuracy - Introduction to R.

UNIT II Linear Regression
Simple Linear Regression - Multiple Linear Regression - Other Considerations in the Regression Model – The Marketing Plan - Comparison of Linear Regression with *K*-Nearest Neighbors - Lab. For Linear Regression.

UNIT III Classification
An Overview of Classification - Logistic Regression - Linear Discriminant Analysis - A Comparison of Classification Methods - Lab: Logistic Regression, LDA, QDA, and KNN.

UNIT IV Resampling Methods
Cross-Validation: The Validation Set Approach -Leave-One-Out Cross-Validation - k-Fold Cross-Validation -Bias-Variance Trade-Off for k-Fold- Cross-Validation - Cross-Validation on Classification Problems - The Bootstrap

UNIT V Linear Model Selection and Regularization
Subset Selection – Shrinkage Methods - Dimension Reduction Methods - Considerations in High Dimensions - Moving Beyond Linearity

Text Book
1. James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in R. Springer, 2013.

Reference Books
1. Hastie, T., Tibshirani, R., Friedman, J. The Elements of Statistical Learning, 2nd edition. Springer, 2009.
2. Murphy, K. Machine Learning: A Probabilistic Perspective. - MIT Press, 2012.
3. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010