KUVEMPU UNIVERSITY

Department of P.G. Studies and Research in Computer Science.

Kuvempu University, Jnana Sahyadri, Shankaraghatta-577451

CBCS SYLLABUS

FOR

M.Sc. in COMPUTER SCIENCE

(w.e.f. Academic year 2019-20)

KUVEMPU UNIVERSITY

SYLLABUS AND SCHEMNE OF EXAMINATION FOR M.Sc. COMPUTER SCIENCE

FIRST SEMESTER

	PAPER CODE	TITLE OF THE PAPER	HRS/ WEEK	TH/PR	IA	TOTAL	CREDITS
HARD CORE	MCS 1.1	COMPUTER ARCHITECTURE	04	75	25	100	04
	MCS 1.2	DATA STRUCTURES	04	75	25	100	04
	MCS 1.3	JAVA PROGRAMMING	04	75	25	100	04
SOFT CORE	MCS 1.4	DATA COMMUNICATIONS	04	75	25	100	03
	MCS 1.5	APPLIED MATHEMATICS	04	75	25	100	03
LAB	MCS 1.6	DATA STRUCTURES USING C LAB	03/Batch	50	-	50	02
	MCS 1.7	JAVA PROGRAMMING LAB	03/Batch	50	-	50	02
		TOTAL				**600**	**22**

SECOND SEMESTER

	PAPER CODE	TITLE OF THE PAPER	HRS/ WEEK	TH/PR	IA	TOTAL	CREDITS
HARD CORE	MCS 2.1	COMPUTER NETWORKS	04	75	25	100	04
	MCS 2.2	ANALYSIS AND DESIGN OF ALGORITHMS	04	75	25	100	04
	MCS 2.3	COMPUTER GRAPHICS	04	75	25	100	04
SOFT CORE	MCS 2.4	THEORY OF COMPUTATION	04	75	25	100	03
	MCS 2.5	DIGITAL IMAGE PROCESSING	04	75	25	100	03
LAB	MCS 2.6	ALGORITHMS LAB	03/Batch	40	-	50	02
	MCS 2.7	IMAGE PROCESSING LAB	03/Batch	50	-	50	02
	MCS 2.8	PROBLEM SOLVING USING C	04	40	10	50	02
		TOTAL				650	24

THIRD SEMESTER

	PAPER CODE	TITLE OF THE PAPER	HRS/ WEEK	TH/PR	IA	TOTAL	CREDITS
HARD CORE	MCS 3.1	WIRELESS COMMUNIATIONS	04	75	25	100	04
	MCS 3.2	MACHINE LEARNING	04	75	25	100	04
	MCS 3.3	LINUX INTERNALS	04	75	25	100	04
SOFT CORE	MCS 3.4	SOFTWARE ENGINEERING	04	75	25	100	03
	MCS 3.5	CLOUD COMPUTING	04	75	25	100	03
LAB	MCS 3.6	LINUX INTERNALS LAB	03/Batch	50	-	50	02
	MCS 3.7	MACHINE LEARNING LAB(PYTHON)	03/Batch	50	-	50	02
	MCS 3.8	WEB PROGRAMMING	04	40	10	50	02
		TOTAL				**650**	**24**

FOURTH SEMESTER

	PAPER CODE	TITLE OF THE PAPER	HRS/ WEEK	TH/PR	IA	TOTAL	CREDITS
HARD CORE	MCS 4.1	ARTIFICIAL INTELLIGENCE	04	75	25	100	04
	MCS 4.2	DATA SCIENCE	04	75	25	100	04
SOFT CORE	MCS 4.3	INTERNET OF THINGS (IOT)	04	75	25	100	03
	MCS4.4	PROJECT WORK	04	150	50	200	10
		TOTAL				**500**	**21**

TOTAL MARKS AND CREDITS

SL. NO.	SEMESTER	MARKS	CREDITS
1.	**FIRST SEMESTER**	**600**	**22**
2.	**SECOND SEMESTER**	**650**	**24**
3.	**THIRD SEMESTER**	**650**	**24**
4.	**FOURTH SEMESTER**	**500**	**21**
	GRAND TOTAL	**2400**	**91**

MCS 1.1: COMPUTER ARCHITECTURE
(Max Marks: 75 + 25, Credits: 4)

Unit 1

Fundamentals of Computer Design: Introduction, Classes of Computers, Defining Computer Architecture, Trends in Technology, Power in Integrated Circuits and Cost, Dependability, Measuring Reporting and Summarizing Performance, Quantitative Principles of Computer Design.

Unit 2

Memory Hierarchy Design: Introduction, Ten Advanced Optimization of cache Performance, Memory Technology and Optimizations, Protection: Virtual Memory and Virtual Machines.

Unit 3

Instruction - Level Parallelism and Its Exploitation: Concepts and challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Advanced Prediction, Overcoming Data Hazards with Dynamic Scheduling, Hardware Based Speculation, Exploiting ILP using Multiple Issue and Static Scheduling, Exploiting ILP using Dynamic Scheduling, Multiple Issue and Speculation; Advanced Techniques for Instruction Delivery and Speculation, Studies of the Limitations of ILP.

Unit 4

Data Level Parallelism in Vector, SIMD, and GPU Architectures: Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, Detecting and Enhancing Loop Level Parallelism.

Unit 5

Thread-Level Parallelism: Introduction, Centralized Shared Memory Architectures, Performance of Symmetric Shared-Memory Multiprocessors, Distributed Shared-Memory and Directory –Based Coherence, Synchronization: The Basics, Model of Memory consistency: An Introduction, Warehouse-Scale Computers to Exploit Request-Level and Data-Level Parallelism: Introduction.

References:

1. John L. Hennessey and David A. Patterson: Computer Architecture, A Quantitative Approach, 4th Edition, Elsevier, 2007.
2. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programability**,** 2nd Edition**,** Tata Mc Graw Hill, 2010.
3. David E. Culler, Jaswinder Pal Singh, Anoop Gupta: Parallel Computer Architecture, A Hardware / Software Approach, Morgan Kaufman, 1999.

MCS 1.2 : DATA STRUCTURES
(Max Marks : 75 + 25, Credits : 4)

Unit 1

Introduction to Stack, operations on stack, Applications- a desk calculator and bracket matching, abstract data types and their implementation, Introduction to Queues, implementation of Queues, applications of queues- simulation of an airport, random numbers, Linear Data Structures**:** Concepts and Terminology, Storage Structures for arrays, Polish Expressions.

Unit 2

Linked Stacks and Queues**:** Pointers and linked structures, Linked Stacks, Linked Queues, Application: Polynomial arithmetic, abstract data types and their implementation.

Unit 3
Binary Trees, Binary Search trees, building a binary search tree, Height Balance: AVL Trees, Splay Trees-A Self adjusting data structure.

Unit 4: Multi-way Tree**s,** Orchards, Trees, and Binary Trees, Lexicographic search trees-Tries, External Searching-B-Trees, Red-Black Trees.

Unit 5: Graphs and their representation**:** Definition and examples, Directed and undirected graphs Computer Representation, Graph Traversal, Topological Sorting, greedy algorithm- shortest paths, minimal spanning trees.

References:

1. Data Structures and Program Design in C++ : Robert L Kruse, Alexander J. Ryba
2. An Introduction to Data Structures with Applications : Trembley and Paul G.Sorenson
3. Data Structures Using C and C++ : Y Langsam, M.J Augenstein and A.M. Tenenbaum

MCS 1.3: JAVA PROGRAMMING
(Max Marks : 75 + 25, Credits : 4)

Unit 1
Object Orientation: History of Java, Java features, Difference between C/C++ and Java, Java program structure, Java tokens, JVM, Operators & Expressions, Data types, Constants and Variables, Type Conversions, Control Statements, Strings and String Buffer, Class, Objects, Inheritance, Access Protection, Overloading and Overriding.

Unit 2
Interfaces and Packages: Interfaces: Defining, and Implementing an Interface, variables in interface. Packages: Creating, Accessing, and Importing packages, Multithreaded programming: Introduction, Life cycle of Thread, creating threads by extending classes and implementing runnable interface.

Unit 3
Exception Handling: Errors, Types of errors, Exceptions, Use of keywords try, catch, throw, throws and finally. Networking: Introduction, Socket overview, TCP/IP Client/Server Sockets and Programming. JDBC: Architecture, Driver types, Connectivity, Statements.

Unit 4
Applets and Graphics: Applets basics, Life cycle, Life cycle of Applet programming, Graphics class, Line, Rectangle, Circle, Ellipse, Arcs and Polygon. AWT components: Components, Container, Panel, Windows, Frame, Dialogue box. AWT Controls: Button, Checkbox, Text field, Text area, Layouts, Menus and Menu bars.

Unit 5
J2EE: J2EE Architecture, Introduction to J2EE Components, J2EE Modules (Web App, EJB JAR, App Client), Structure of J2EE Application (Enterprise Archive), DO GET(), DO POST(), Java Servlets, JSP, JSP Directive, Tags, JSP Scriptlet Tags, JSP Action Tags, EJB, Introduction to XML.

References:

1. The Complete Reference JAVA – 2 : Herbert Schildt.
2. Sun Certified Programmer for Java 5 : Kathy Sierra, Bert Bates.
3. Programming with JAVA : E.Balaguruswamy, BPB Publications.
4. JAVA Programming : Steven Holzner, BPB Publications

MCS 1.4: DATA COMMUNICATIONS
(Max Marks: 75 + 25, Credits: 3)

Unit 1

Introduction: Data Communications, Data Representation, Direction of data flow, Networks, Physical Structures, Physical topology, Categories of networks, Protocol and Standards; Signals : Analog and Digital : Analog Signals, Period and Frequency, Phase, Time and Frequency domain, Composite Signals, Frequency Spectrum, Band width, Digital Signals, Analog verses Digital, Data Rate limits, Transmission impairments.

Unit 2

Digital Transmission: Line coding, Uni-polar Polar, Bipolar, Block Coding Steps in transmission, Sampling, Pulse Amplitude Modulation (PAM).Transmission mode: Parallel, Serial; Analog Transmission: Modulation of digital data, ASK, FSK, PSK, QAM, Modulation of analog Signals, AM, FM, PM.

Unit 3

Multiplexing: FDM, WDM, and TDM; Transmission Media: Guided Media, Unguided Media. Circuit Switching and Telephone Network: Circuit Switching, Space Division Switch, Time-Division Switch, Telephone networks.

Unit 4

Error detection and Correction: Types of errors, Error Detection: Parity check, CRC, Error correction. Data Link Control and Protocols: Flow and error control, Stop and wait ARQ, GO-BACK-N ARQ, HDLC, and PPP.

Unit 5

Multiple Accesses: Random Access, Multiple Access, CSMA, CSMA/CD, CSMA/CA, Channelization. Cellular Telephone and Satellite Networks : Cellular Telephony, First Generation, Second Generation, GSM, Satellite Networks, Orbits, Foot print, GEO, MEO, LEO

References:

1. Data Communications & Networking : Forouzan
2. Understanding Local area Network : Neil Jenkins
3. Computer Networks : Tanenbaum, Andrew S, Prentice Hall of India

MCS 1.5: APPLIED MATHEMATICS
(Max Marks : 75 + 25, Credits: 3)

Unit 1

Matrices and Gaussian Elimination: Introduction, Gaussian Elimination, Matrix Notation and Matrix Multiplication, Triangular Factors and Row Exchanges, Inverses and Transposes, Special Matrices and Applications, Determinants, Properties of the Determinant.

Unit 2

Vector Space: Vector Spaces and Subspaces, Solving $Ax = 0$ and $Ax = b$. Linear Independence, Basis and Dimension, Rank Nullity, Row space and Column Space of a Matrix. Linear Transformation: Definitions and Examples, Properties of Linear Transformation, Range and Kernel, Matrix Representation of a Linear Transformation, Isomorphism.

Unit 3

Orthogonality: Orthogonal Vectors and Subspaces, Projections and Least Squares, Orthogonal Bases and Gram-Schmidt Ortho normalization. Eigen values and Eigen vectors: Introduction, Diagonalization of a Matrix, Difference Equations and Powers A^k, Differential Equations and e^{At}, Complex Matrices, Similarity Transformations.

Unit 4

Probability Distributions: Introduction, Sample Space, Events, Algebra of Events, Types of Events, Probability Axioms, Conditional Probability, Discrete and Continuous variables, Probability Distribution, Discrete Probability Distributions: Binomial Distributions, Examples on Binomial Distributions, Poisson Distribution, Normal Distribution.

Unit 5

Statistics: Introduction, Measures of Dispersion, Central Tendency, Calculation of Mean, Median, Mode and Standard Deviation of grouped and ungrouped data. Computation of Correlation Coefficients, Rank Correlation, Variance, Covariance.

References:

1. Linear Algebra And Its Applicatins : Gilbert Strang
2. Elemtary Linear Algebra : Stanley I. Grossman
3. Murray R.Spiegel, "Probability And Statistics", Mcgrawhill, Schaum's Outline Series
4. A.Papoulis and S.Unnikrishnan Pillai, "Probability, Random Variables And Stochastic Processes", Mcgrawhill 4th Edition.
5. Probability and Statistics, Murray R. Spiegel, John Schiller & R. Alu Srinivasan, Second Edition

MCS 1.6: DATA STRUCTURES USING C LAB

MCS 1.7: JAVA PROGRAMMING LAB

MCS 2.1: COMPUTER NETWORKS
(Max Marks: 75 + 25, Credits: 4)

Unit 1

Review of Network Models: Layered tasks; The OSI model and layers in the OSI model; TCP / IP protocol suite; Addressing. Layered tasks; The OSI model and layers in the OSI model; TCP / IP protocol suite; Addressing. SONET / SDH: Architecture; SONET layers; SONET frames; STS multiplexing; SONET networks; Virtual tributaries.

Unit 2

Frame Relay and ATM: Frame relay; ATM and ATM LANs. IPv6, Address Mapping and Error Reporting: IPv6: Advantages, Packet format, and Extension headers; Transition from IPv4 to IPv6: Dual stack, Tunneling, and Header translation; Address mapping: ARP, RARP, and DHCP; Error reporting: ICMP.

Unit 3

Multicast Routing Protocols: Unicast, multicast and broadcast; Applications; Multicasting routing; Routing protocols RIP, OSPF, BGP, Simulation for Routing protocols. SCTP : SCTP services; SCTP features; Packet format; An SCTP association; Flow control; Error control; Congestion control.

Unit 4

Congestion Control and Quality of Service: Data traffic; Congestion and congestion control; Congestion control in TCP, Frame relay; Quality of Service; Techniques to improve QoS; Integrated services; Differentiated services. Application layer: Client-Server model, Socket interface, DNS, SMTP, FTP, HTTP, and WWW.

Unit 5

Multimedia: Digitizing audio and video; Audio and video compression; Streaming stored audio / video; Streaming live audio / video; Real-time interactive audio / video; RTP; RTCP.

References:

1. Behrouz A. Forouzan, Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
2. Nader F. Mir: Computer and Communication Networks, Pearson, 2007.
3. William Stallings: Data and Computer Communication, 8th Edition, Prentice Hall India, 2007.

MCS 2.2: ANALYSIS AND DESIGN OF ALGORITHMS
(Max Marks : 75 + 25, Credits : 4)

Unit 1

Notion of algorithm, Fundamentals of algorithmic problem solving, linear data structures, graphs, trees, sets and dictionaries. Analysis of algorithm efficiency: Analysis frame-work, asymptotic notations and basic efficiency classes, mathematical analysis of non recursive and recursive algorithms, empirical analysis of algorithms.

Unit 2

Brute Force and Divide and Conquer- General method, Binary Search, Finding the maximum and minimum, merge sort, quick sort, Strassen's matrix multiplication, Decrease-and-Conquer and

Transform-and-Conquer: Insertion sort, depth first search, topological sorting, presorting, Gaussian elimination, balanced search trees, heap sort, Horner's rule.

Unit 3

Greedy Method: General method, optimal storage on tapes, knapsack problem, job sequencing, Minimum Cost Spanning Trees- Prims's algorithm and Kruskal's algorithm, optimal storage on tapes, optimal merge patterns, single source shortest paths, Huffman trees.

Unit 4

Dynamic Programming: General method, principle of optimality, multistage graphs, all pairs shortest paths, 0/1 knapsack, traveling salesman problem, Warshall's and Floyd's algorithms.

Unit 5

Backtracking : General method, 8-queen problem, sum of subsets, Hamiltonian cycles, traveling salesman problem. Branch and Bound : Introduction FIFO solution , LC branch and bound, Rat in maze, TSP, Np completeness and approximation algorithm : Introduction, polynomial time, NP completeness and reducibility, approximation of algorithms.

References:

1. Computer Algorithms/C++ : Ellis Horowitz, Sartaj Sahani, Sanguthevar Rajashekaran
2. Fundamentals of Computer Algorithms : Horowitz, E. and Sahani, S
3. The Design and Analysis of Computer Algorithms : Aho A.V., Hopcroft, J.E. and Ullaman
4. Computer Algorithms – An Introduction to Design and Analysis : Sara Baase.
5. Design and Analysis of Algorithms : Goodman, S.E. and Hedetnieml. S.T
6. Data Structures and Algorithms : Aho, A.V., Hopcroft, J.E. & Ullman
7. The Art of Computer Programming : Knuth D.E

MCS 2.3 : COMPUTER GRAPHICS
(Max Marks : 75 + 25, Credits: 4)

Unit 1

Graphics Output Primitives and Attributes : Introduction to open GL, Coordinate reference frames, Specifying two dimensional world coordinate reference frame in Open GL, Open GL point functions, Open GL line functions, Video Display Devices(CRT), Raster Scan Display, Random Scan Display, Color CRT Monitors, Flat Panel Displays, Line drawing algorithms, Circle generation algorithms, Ellipse generation, Algorithms, Fill area primitives, Polygon fill areas, OpenGL polygon fill area functions, General scan line polygon fill algorithm, Fill methods for areas with irregular boundaries, Open GL fill area attribute functions.

Unit 2

Two – Dimensional and Three - Dimensional Geometric Transformations : Basic two dimensional geometric transformations, Matrix representations and homogeneous coordinates, Inverse transformations, Two dimensional composite transformations, Other two dimensional transformations, Three dimensional Translation, Rotation, Scaling, Other three dimensional transformations, Affine transformations, Open GL geometric transformation functions.

Unit 3

Two Dimensional Viewing : The two dimensional viewing, Clipping window, Normalization and viewport transformations, Clipping algorithms, Two dimensional point clipping, Two dimensional line clipping algorithms, Polygon fill area clipping, Curve clipping, Text clipping.

Unit 4

Three Dimensional Viewing : The three dimensional viewing concepts, Three dimensional viewing pipeline, Three dimensional viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformations, Orthogonal projections, Oblique parallel projections, Perspective projections, The viewport transformation and three dimensional screen coordinates.

Unit 5

Visible- Surface Detection Method: Back face detection, Depth Buffer Method, A-Buffer Method, Scan-Line Method, Depth-Sorting Method, BSP-Tree Method, Area-Subdivision Method, Octree Methods, Ray-Casting Method.

References:

1. Donald Hearn, M.Pauline Baker, Computer Graphics with Open GL, Pearson (Indian Edition), 3rd Edition.
2. Edward Angel, 'Interactive Computer Graphics' – A top down approach using Open GL, Pearson, 5th Edition
3. Peter Shirley, Steve Marschner, Computer Graphics, Cengage Learning (Indian edition), 2009.

MCS 2.4: THEORY OF COMPUTATION
(Max Marks : 75 + 25, Credits : 3)

Unit 1

Alphabets Strings and Languages, Automata and Grammars Finite Automata (FA) - Its Behavior DFA-Formal Definition Simplifies Notations Language of DFANFA-Formal Definition Language of NFA Equivalence of DFAs and NFAs.

Unit 2

Regular expressions (RE) Definition, FA and RE, RE to FA, FA to RE, Algebraic laws for RE, applications of REs. Regular grammars and FA, FA for regular grammar, Regular grammar for FA Proving languages to be non-regular -Pumping Lemma, applications. Some closure properties of Regular languages -Closure under Boolean operations.

Unit 3

Pushdown Automata Acceptance by final state and empty store, Equivalence to CFG Deterministic and Non-deterministic PDA Problems and Solutions.

Unit 4

Turing Machines: Turing Machines TM -Formal definition and behaviour Transition diagrams, Language of a TM, TM as accepters and deciders TM as a computer of integer functions Programming techniques for TMs -Storage in state, multiple tracks, subroutines, etc. Variants of TMs–Multi tape TMs, Nondeterministic TMs, TMs with semi-infinite tapes, multi stack machines, Equivalence of the various variants with the basic model.

Unit 5

The Chmosky Hierarchy :Languages, Grammars and Machines, Recursively Enumerable Languages, Counting Alphabets, Languages and Computing Machines, The idea of Enumeration, The idea of Diagnoalization, The ideas of Acceptance and Membership, Recursive Languages, Context Sensitive Languages and Grammars, The ideas of context, Other Grammars and Automata, Linear and Deterministic Context-Free Languages.

References :

1. Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation",Pearson Education
2. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI
3. Martin J. C., "Introduction to Languages and Theory of Computations", TMH 4. Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI

MCS 2.5: DIGITAL IMAGE PROCESSING
(Max Marks: 75 + 25, Credits: 3)

Unit 1

Introduction: Origins of digital image processing, Electromagnetic spectrum, Applications, Components of image processing system, Image sensing and acquisition, Digitization, Sampling and Quantization.

Unit 2

Image Enhancement: Basic gray level transformations, histogram processing, enhancement using arithmetic/ logic operations, basics of spatial filtering, smoothing and sharpening spatial filters, Frequency domain: introduction to the Fourier transform and the Frequency domain, smoothing and sharpening frequency domain filters, Discrete Fourier transforms, Properties of DFT, FFT.

Unit 3

Image Restoration and Color image processing. A model of the image degradation/restoration process, noise models, Spatial Filtering- mean filters, order static filters, adaptive filters, Color models, pseudo color image processing, smoothing and sharpening.

Unit 4

Morphological image processing: introduction, structuring elements, dilation and erosion, opening and closing, Hit-or-Miss transformation, basic morphological algorithms.

Unit 5

Image segmentation : detection of discontinuities ,edge linking and boundary detection, thresholding, Region based approach, segmentation by morphological watersheds.

References:

1. Digital Image Processing : Rafael C.Gonzaleze & Richard E. Woods
2. Digital Image Processing and Analysis : B. Chanda, D. Mutta Majumder
3. Digital Image Processing : Anil K Jain

MCS 2.6 : ADA LAB

MCS 2.7 : DIP LAB

MCS 2.8: PROBLEM SOLVING USING C
(Max Marks: 40+10, Credits: 2)

Unit 1

Introduction: Algorithms, Flow Charts, C structure, Variables, Data types, Constants, Declarations, Type conversion, Storage classes.

Unit 2

Operators and Input and output statements: Operators, types of operators: arithmetic, logical, relational, unary and conditional operators. Precedence, Associativity, Order of evaluation scanf, getchar, gets, printf, putchar, puts.

Unit 3

Control Statements – if, else-if, switch, Control Structures – while, for, do-while, break and continue, goto statements.

Unit 4

Arrays and Strings– Single dimension, two dimensional, Multi dimensional Arrays, Strings, String handling functions.

Unit 5

Functions- Categories of functions, Pointers, Pointer arithmetic, Call by value, Pointer Expression, Pointer as function arguments, recursion, Passing arrays to functions, passing strings to functions.

References

1. Let us C, Yashwant Kanetkar, BPB Publications
2. Programming with C, Balaguruswamy
3. The C Programming Language, Brian W Kernighan, Dennis M Ritchie, PHI, 2nd Edition

MCS 3.1: WIRELESS COMMUNICATION
(Max Marks: 75 + 25, Credits: 4)

Unit 1

Mobile Computing Architecture: Types of Networks, Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing, Wireless Networks – 1: GSM and SMS : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications.

Unit 2

Wireless Networks – 2: GPRS : GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRSWireless Networks – 3: CDMA, 3G and WiMAX : Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX.

Unit 3
Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6.

Unit 4:
Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators.

Unit 5
Building, Mobile Internet Applications: Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML.

References:

1. Dr. Ashok Talukder, Ms Roopa Yavagal, Mr. Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2d Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley, 2003.
3. Raj kamal: Mobile Computing, Oxford University Press, 2007.
4. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

MCS 3.2: MACHINE LEARNING
(Max Marks : 75 + 25, Credits: 4)

MCS 3.3 : LINUX INTERNALS
(Max Marks: 75 + 25, Credits: 4)

Unit 1
Introduction: The unix operating system, The Unix Architecture, Features of UNIX, POSIX and Single UNIX specification, Locating commands, Internal and External commands, Command Structure, Flexibility of command Usage, man command, cal command, date command, echo, printf, bc, script, passwd, who, uname, tty, stty. The File System : The file, The Parent-Child Relationship, The HOME Variable, pwd, cd, mkdir, rmdir, Absolute Pathname, Relative Pathname, ls.

Unit 2
The Unix File system, cat, cp, rm, mv, more, The lp subsystem: Printing a File, wc, od, cmp, comm, diff, compressing and archiving files, gzip, and gunzip, tar, zip and unzip. Basic File Attributes**:** Listing file attributes, listing directory attributes, File Ownership, File Permissions, changing file permissions, Directory Permissions, Changing File Ownership. Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.

Unit 3
The Shell: The shell's Interpretive Cycle, Pattern Matching, Escaping and Quoting, Redirection, /dev/null and /dev/tty, Pipes, tee, Command Substitution, Shell variables, Shell scripts, read, using

command line arguments, exit and exit status of command, the logical operators && and ||-conditional execution, the if conditional, using test and [] to evaluate expressions, the case conditional, expr, $0: calling a script by different names, for, while statement. Advanced Shell Programming: The sh command, export, cd, the Command, expr, Conditional Parameter Substitution, Merging Streams, Shell Functions, eval, exec Statement.

Unit 4:
The process: Process basics, process status, system process, Mechanism of process creations, Internal and external commands, process states and zombies, running jobs in background, nice, killing process with signals, job control, at and batch, cron, timing process, wait, waitpid, waited, wait3, wait4**,** Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter**,** Files, system function.

Unit 5
Filters using regular expressions: grep, basic regular expressions, extended regular expressions and egrep, sed, line addressing, using multiple instructions, context addressing, writing selected lines to a file, text editing, substitution, basic regular expressions revisited. Awk-Advanced Filters: Simple awk Filtering, Splitting a Line into Fields, printf, the Logical and Relational Operators, Number Processing, Variables, The –f option, BEGIN and END positional Parameters, get line, Built-in variables, Arrays, Functions, Interface with the Shell, Control Flow

References:

1. Sumitabha Das, UNIX System V.4, Concepts and Applications, TMH.
2. Terrence Chan: Unix System Programming Using C++, Prentice-Hall of India /Pearson Education, 1999.
3. W.Richard Stevens, Stephen A. Rago: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education / Prentice-Hall of India, 2005.

MCS 3.4: SOFTWARE ENGINEERING
(Max Marks : 75 + 25, Credits: 4)

Unit 1
Introduction: Professional Software Development Attributes of good software, software engineering diversity, IEEE/ ACM code of software engineering ethics, case studies. Software Process & Agile Software Development .Software Process models: waterfall, incremental development, reuses oriented, Process activities; Coping with change, the rational Unified process, Agile methods.

Unit 2
Requirements Engineering: Functional and non-functional requirements, The software requirements document, Requirements specification, Requirements engineering processes, Requirement elicitation and analysis, Requirements validation, Requirements management.

Unit 3
System Modeling, Architectural Design & Design and implementation: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering, Software architecture: the role of software architecture, architectural views, component and connector view, Architectural styles for C&C view, Documenting architectural design. Design: Design concepts, Function oriented design, detailed design, verification, matrix (Complexity matrix for function oriented design).

Unit 4
Component-based software engineering: Components and component model, CBSE process, Component composition. Distributed Software engineering, Distributed system issues, Client-server computing, Architectural patterns for distributed systems, Software as a service.

Unit 5
Planning a software Project: Process planning, Effort estimation, Project scheduling and staffing, Software configuration, management plan, Quality plan, Risk Management, Project monitoring plan. Software Testing : Testing fundamentals, Black-box testing, White-box testing, Testing process.

References:

1. Ian Sommerville : Software Engineering, 9th edition, Person Education Ltd, 2011.
2. Pankaj Jalote: Software Engineering, Wiley India Pvt
3. Roger S Pressman: Software Engineering-A Practitioners approach, 6th edition, McGraw-Hill, 2010
4. Hans Van Vliet: Software Engineering Principles and Practices, 3rd Edition, Wiley India, 2010

MCS 3.5 : CLOUD COMPUTING
(Max Marks : 75 + 25, Credits: 4)

Unit 1
Introduction to Cloud Computing, The Evolution of Cloud Computing, Hardware Evolution, Internet Software Evolution, Server Virtualization, Web Services Deliver from the Cloud, Communication-as-a-Service, Infrastructure-as-a-Service, Monitoring-as-a-Service, Platform-as-a-Service, Software-as-a-Service, Building Cloud Network.

Unit 2
Federation in the Cloud, Presence in the Cloud, Privacy and its Relation to Cloud-Based Information Systems, Security in the Cloud, Common Standards in the Cloud, End-User Access to the Cloud Computing.

Unit 3
Introduction, advancing towards a Utility Model, Evolving IT infrastructure, Continuum of Utilities, Standards and Working Groups, Standards Bodies and Working Groups, Service Oriented Architecture, Business Process Execution Language, Utility Computing Technology, Virtualization, Hyper Threading, Blade Servers, Automated Provisioning, Policy Based Automation, Application Management, Data Center Challenges, Automating the Data Center.

Unit 4
Software Utility Application Architecture, Characteristics of an SaaS, Software Utility Applications, Cost Versus Value, Software Application Services Framework, Common Enablers, Conceptual view to Reality, Business Profits, - Implementing Database Systems for Multitenant Architecture.

Unit 5
Other Design Considerations - Design of a Web Services Metering Interface – Application Monitoring Implementation - A Design for an Update and Notification Policy - Transforming to Software as a Service - Application Transformation Program-ATP with their major steps.

References:

4. Donald Hearn, M.Pauline Baker, Computer Graphics with Open GL, Pearson (Indian Edition), 3rd Edition.
5. Edward Angel, 'Interactive Computer Graphics' – A top down approach using Open GL, Pearson, 5th Edition
6. Peter Shirley, Steve Marschner, Computer Graphics, Cengage Learning (Indian edition), 2009.

MCS 3.6: LINUX INTERNALS LAB

MCS 3.7: COMPUTER GRAPHIS LAB WITH OPEN GL

MCS 3.8: WEB PROGRAMMING
(Max Marks: 40+10, Credits: 2)

MCS 3.8: CYBER SECURITY
(Max Marks: 40+10, Credits: 2)

MCS 3.8: INTERNET OF THINGS
(Max Marks: 40+10, Credits: 2)

MCS 4.1: ARTIFICIAL INTELLIGENCE
(Max Marks : 75+25, Credits : 4)

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MCS 4.2: DATA SCIENCE
(Max Marks: 75 + 25, Credits: 4)

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MCS 4.3: INERNET OF THINGS (IOT)
(Max Marks: 75+25, Credits: 3)

Unit 1

Introduction: Definition, phases, Foundations, Policy, Challenges and Issues, identification, security, privacy. Components in internet of things**:** Control Units, Sensors, Communication modules, Power Sources, Communication Technologies: RFID, Bluetooth, Zigbee , Wifi , Rflinks , Mobile Internet, Wired Communication.

Unit 2

Programming The Microcontroller For IOT: Basics of Sensors and actuators – examples and working principles of sensors and actuators , Cloud computing and IOT , Arduino/Equivalent Microcontroller platform – Setting up the board - Programming for IOT – Reading from Sensors, Communication**:**

Connecting microcontroller with mobile devices – communication through Bluetooth and USB – connection with the internet using Wi-Fi / Ethernet.

Unit 3

Resource Management In The Internet Of Things : Clustering - Software Agents - Data Synchronization - Clustering Principles in an IOT Architecture - The Role of Context – Design Guidelines -Software Agents for Object – Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.

Unit 4

Business Models For The Internet Of Things : The Meaning of DiY in the Network Society- Sensor-actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY Internet of Things Semantic Interoperability as a Requirement for DiY Creation, Ontology, Value Creation in the Internet of Things, Application of Ontology Engineering in the IOT-Semantic Web-Ontology - The Internet of Things in Context of EURIDICE - Business Impact.

Unit 5

From The Internet Of Things To The Web Of Things: Resource-oriented Architecture and Best Practices- Designing REST ful Smart Things – Web enabling Constrained Devices - The Future Web of Things - Set up cloud environment – send data from microcontroller to cloud – Case studies – Open Source e-Health sensor platform – Be Close Elderly monitoring – Other recent projects

References:

1. Charalampos Doukas , Building Internet of Things with the Arduino, Create space, April 2002
2. Dieter Uckelmann et.al, “Architecting the Internet of Things”, Springer, 2011
3. Luigi Atzor et.al, “The Internet of Things: A survey, “, Journal on Networks, Elsevier Publications, October, 2010

MCS 4.5: PROJECT WORK