

## MCA-201

### Database Management Systems

Max. Marks: 100 (80+20)

Time: 3Hrs

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

#### UNIT-I

**Database System Concepts and Architecture:** Traditional File Processing System vs DBMS, Characteristics & Advantages of DBMS, Three-Schema Architecture and Data Independence; Data Models, Schemas, and Instances; Database Languages and Interfaces; Classification of DBMS.

**Data Modelling:** Overview of Entity-Relationship Diagram, Relational Model - Constraints, Relational Database Schemas, Relational Algebra and Relational Calculus; Codd Rules.

#### UNIT-II

**Normalization for Relational Databases:** Functional Dependencies and Normalization;

**SQL:** SQL as 4GL, SQL Components: DDL, DML, DQL, DCL, TCL; Data Definition and Data Types; Constraints, Queries, Insert, Delete, and Update Statements; Views, Stored Procedures and Functions; Database Triggers, SQL Injection.

#### UNIT-III

**Query Processing and Optimization:** Translating SQL queries into Relational Algebra, Basic Algorithm for Executing Query Operations, Using Heuristic in Query Optimization, Using Selectivity and Cost Estimation in Query Optimization, Semantic Query Optimization.

**Transaction Processing:** Introduction, Desirable properties of Transactions, Schedules & Recoverability, Serialization of Schedulers, Transaction Support in SQL.

**Basics of Database Security and Authorization.**

#### UNIT-IV

**Concurrency Control Techniques:** Locking techniques for Concurrency Control, Concurrency Control based on Timestamp ordering, Multiversion Concurrency Control Techniques, Validation Currency Control Techniques, Granularity of data items and multiple granularity locking, Using locks for Concurrency Control in Indexes.

**Database Recovery Techniques:** Basic Concepts, Recovery Technique based on Deferred Update, Recovery Technique based on Immediate Update, Shadow Paging, The ARIES recovery algorithm, Database backup and recovery from catastrophic failure.

**Textbooks & References:**

1. Elmasri & Navathe: Fundamentals of Database Systems, 5th edition, Pearson Education.
2. C. J. Date: An Introduction to Database Systems, 8th edition, Addison Wesley N. Delhi.
3. Thomas Connolly, Carolyn Begg: Database Systems, Pearson Education.
4. Any other book(s) covering the contents of the paper in more depth.

**Note:** Latest and additional good books may be suggested and added from time to time

## MCA-202

### Theory of Computation and Compilers

Max. Marks: 100 (80+20)

Time: 3Hrs

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

#### UNIT-I

**Theory of Computation:** Formal Language, Language Vs Grammar, Non-Computational Problems, Chomsky Hierarchy of Languages

**System Programming & Compiler:** Introduction to System programs; Assembler Vs Compiler Vs Interpreter; **Structure of a Compiler:** Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Symbol Table Management, Grouping of phases into passes, compiler construction tools. Applications of Compiler Technology.

## Unit-II

**Lexical Analysis:** The role of lexical analyser, Lexical Analysis vs Parsing, Specification of Tokens, Recognition of Tokens, Basic introduction to *lex*.

**Regular Language Models:** Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA.

## Unit-III

**Syntax Analysis:** Basic Concepts: Syntax definition, Parse Tree and Derivations, Ambiguity, Associativity & Precedence of Operations; Context Free Grammars Vs Regular Expressions; Lexical Analysis Vs Syntactical Analysis, Eliminating Ambiguity, Eliminating Left Recursion.

**Parsing:** Top Down Parsing: Recursive Descent, Predictive Parsing, LL(1) Grammars, Bottom up Parsing: Reductions, Handle Pruning, SR parsing, LR Parser, LALR Parser; Basic introduction to *Yacc*.

## Unit-IV

**Code Generation and Code Optimization:** Control-flow, Data-flow Analysis, Local Optimization, Global Optimization, Loop Optimization, Peep-Hole Optimization.

**Context Free Language:** Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity, Equivalence of PDA's and Context Free Grammars; Properties of Context Free Language.

*\*An introduction to the Turing Machine and issue of unsolvable problem and computational complexity.*

*NOTE: \* Not for examination purpose.*

### **Textbooks & References:**

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman: Compilers: Principles, Techniques & Tools, 2nd edition, Pearson Addison Wesley, 2007.
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory Languages and Computation, 3<sup>rd</sup> edition, Pearson Education, India, 2007.
3. K. L. P Mishra, N. Chandrashekar, Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India, (2003).
4. Any other book(s) covering the contents of the paper in more depth.
5. **Note: Latest and additional good books may be suggested and added from time to time**

## MCA-203

### The JAVA Programming Language

*Max. Marks: 100 (80+20)*

*Time: 3Hrs*

**Note:** *Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.*

## UNIT-I

**Introduction:** The History and Evolution of JAVA, features of JAVA:- Platform independent, Robust etc, JAVA Environment. Hardware and Software Requirements, Byte Code, Installing JDK, Difference between C++ and JAVA, Command-Line Arguments, Environment Variables, System Utilities. Command-Line I/O Objects. PATH and CLASSPATH.

**JAVA as Programming Language:** Java as Object Oriented Language, JAVA Program Structure, JAVA literals, Data Type, Variable & Arrays in JAVA.

## UNIT-II

**JAVA Programming Constructs:** Operators and Expressions, Precedence Rules and Associativity, Type conversion and casting, Control Structures in JAVA.

**JAVA Object Oriented Basics:** Classes and Objects in JAVA, Variables & Methods in Classes: declaration and invocation, constructors and garbage collection, *static and this* keywords.

## UNIT-III

**Inheritance in JAVA:** Types, Access Specifiers, Class vs Interface, Extending vs Implementation of Interface, overloading vs overriding, Abstract Class, super & final keywords.

**JAVA as Internet Programming Language:** Applets: difference from normal application, life cycle, Applet tag, Passing parameters and display output. AWT: Basics, Component and Container Layouts, AWT vs Swings

## UNIT-IV

**Exception Handling:** The concept of Exceptions. Types of Exceptions. Dealing with Exceptions, Exception Objects, Defining Your Own Exceptions.

**Multithreading Programming:** The Java Thread Model. Understanding Threads, The Main Thread, Creating a Thread, Creating Multiple Threads, Thread Priorities. Synchronization.

**Input/Output in Java:** I/O Basic, Byte and Character Structures, I/O Classes, Reading Console Input Writing Console Output, Reading and Writing on Files. Random Access Files, Storing and Retrieving Objects from File, Stream Benefits.

### **Textbooks & References:**

1. The Complete Reference JAVA, TMH Publication.
2. E-Balagurusamy, "Programming with JAVA- A Primer" Tata McGraw-Hill Publishers.
3. Dietel and Dietel, "CORE JAVA"
4. Herbert Shield, "The complete reference-JAVA2", TMH
5. Beginning JAVA, Ivor Horton, WROX Public.
6. JAVA 2 UNLEASHED, Tech Media Publications.
7. Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**

## MCA-204A

### Software Engineering

*Max. Marks: 100 (80+20)*

*Time: 3Hrs*

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

## UNIT-I

**Introduction:** Software and its Characteristics, Evolving Role of Software, Software Product. Software Processes. Software Crisis. Software Engineering Evolution. Principles of Software Engineering. Programming-in-the-small vs. Programming-in-the-large. Software Components. Software Engineering Processes.

**Software Life Cycle (SLC) Models:** Water-Fall Model. Prototype Model. Spiral Model. Evolutionary Development Models. Iterative Enhancement Models. Object Oriented Models and other latest Models.

**Software Requirements:** Functional and Non-Functional. User requirements. System requirements. Software Requirements Document - Requirement Engineering Process: Feasibility Studies. Requirement's elicitation and analysis, requirements validation, requirements management.

## UNIT-II

**Software Design:** Basic Concept of Software Design. Architectural Design. Low Level Design: Modularization. Design Structure Charts. Flow Charts. Coupling and Cohesion Measures; Design Strategies: Function Oriented Design. Object Oriented Design. Top-Down and Bottom-Up Design. User Interface Design. Programming practices and Coding standards.

**Software Testing:** Introduction. Verification vs. Validation. Software Reliability. Levels of Testing. Structural Testing (White Box Testing). Functional Testing (Black Box Testing).

## UNIT-III

**Software Quality:** Attributes, Software Quality Assurance - plans & activities: Software Documentation.

**Software Project Management:** Project Management activities. Project Estimation. Project planning. Project scheduling.

**Software Risk Management:** Reactive versus Proactive Risk Strategies. Risk management activities: Software Risks (Risk Identification. Risk Projection. Risk Refinement. Risk Mitigation). Risks Monitoring and Management.

**Software Measurement and Metrics:** Process Metrics. Project metrics. Estimation - LOC, Halstead's Software Science. Function Point (FP). Cyclomatic Complexity Measures: Software Project Estimation Models- Empirical. Putnam. COCOMO I & II.

## UNIT-IV

**Software Maintenance:** Need for Maintenance. Categories of Maintenance: Preventive. Corrective and Perfective Maintenance. Cost of Maintenance: Software Re- Engineering. Reverse Engineering, Software Documentation.

**Software Configuration Management:** SCM Activities. Change Control Process. Software Version Control: Software Reuse. Software Evolution.

**CASE Computer Aided Software Engineering (CASE). CASE Tools.**

### ***Textbooks & References:***

1. Rogers Pressman: Software Engineering. TMH.
2. Jalote. Pankaj: An Integrated Approach to Software Engineering. Narosa Publications.
3. Chhillar Rajender Singh: Software Engineering: Testing. Faults. Metrics. Excel Books. New Delhi.
4. Gill, Nasib Singh: Software Engineering, Khanna Book Publishing Co.(P) Ltd. New Delhi
5. Ghezzi Carlo: Fundamentals of Software Engineering. PHI.
6. Fairley. R.E.: Software Engineering Concepts. McGraw-Hill.
7. Lewis. T.G.: Software Engineering. McGraw-Hill.
8. Shere: Software Engineering & Management. Prentice Hall.
9. Deutsch. Willis: Software Quality Engineering: A Total Technical and Management Approach. Prentice Hall.
10. Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**

## MCA-204B

### Soft Computing

*Max. Marks: 100 (80+20)*

*Time: 3Hrs*

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

## UNIT-I

**Introduction:** Introduction to soft computing, Soft Vs Hard Computing, Different Components of Soft Computing: Artificial Intelligence Systems, Neural Networks, Fuzzy Logic, Genetic Algorithms.

**Genetic algorithms:** Basic concepts; Encoding; Fitness Function; Reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections; Convergence of GA, Problem Solving using GA.

## UNIT-II

**Artificial Neural Networks:** Introduction to biological and artificial neural network; Different artificial neural network models; Supervised, Unsupervised and Reinforcement Learning; Hebbian Learning, Generalized Hebbian learning algorithm.

**Artificial Neural Networks Architecture:** Basic building block of an artificial neuron, Activation functions, Introduction to Early ANN architectures: McCulloch & Pitts model; Single Perceptron, Backpropagation networks; Multi-Layer Perceptron; Hopfield Network; **Applications of Neural Network.**

## UNIT-III

**Fuzzy systems and applications:** Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification; Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems.

## UNIT-IV

**Applications:** Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Share Market Analysis, Natural Language Processing.

**Suggested Books:**

1. M. Mitchell: An Introduction to Genetic Algorithms, Prentice-Hall.
2. J.S.R.Jang, C.T.Sun and E.Mizulani; Neuro-Fuzzy and Soft Computing, PHI, Pearson Education.
3. Timothy J.Ross: Fuzzy Logic with Engineering Applications, McGraw-Hill.
4. Davis E. Goldberg: Genetic Algorithms: Search, Optimization and Machine Learning. Addison Wesley.
5. S. Rajasekaran and G.A.V.Pai: Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI.
6. D. E. Goldberg: Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley.
7. Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**

## MCA-204C

### Discrete Structures and Optimization

*Max. Marks: 100 (80+20)*

*Time: 3Hrs*

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

## UNIT-I

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

**Sets and Relations:** Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering.

## UNIT-II

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

**Boolean Algebra:** Boolean Functions and its Representation, Simplifications of Boolean Functions.

### UNIT-III

**Group Theory:** Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory.

**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 Colouring, Bipartite Graphs, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and Cut-Sets.

### UNIT-IV

**Optimization:** Linear Programming - Mathematical Model, Graphical Solution, Simplex and Dual Simplex Method, Sensitive Analysis; Integer Programming, Transportation and Assignment Models, PERT-CPM: Diagram Representation, Critical Path Calculations, Resource Levelling, Cost Consideration in Project Scheduling.

#### **Suggested Books:**

1. C L Liu, Elements of Discrete Mathematics, Second Edition, Tata McGraw-Hill.
2. J P Tremblay and R Manohar, Discrete mathematical structures with applications to Computer Science, Tata McGraw-Hill.
3. Bernard Kolman, Robert C Busby, and Sharon Cutler Ross, Discrete Mathematical Structures, fifth edition, Prentice-Hall of India.
4. Lipschutz, Seymour: Discrete Mathematics, Schaunvs Series
5. Babu Ram: Discrete Mathematics. Vinayek Publishers, New Delhi.
6. Kenneth H. Rosen: Discrete Mathematics and its applicatioas, TMH.
7. Doerr Alan & Lvasseur Kenneth: Applied Discrete Structures for Computer Science, Galgolia Pub. Pvt. Ltd.
8. Gersting: Mathematical Structure for Computer Science, WH Freeman & Macmillan.
9. Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**

## MCA-204D

### Wireless Networks & Mobile Computing

*Max. Marks: 100 (80+20)*

*Time: 3Hrs*

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

### UNIT-I

**Introduction:** History and challenges of wireless communications; Wireless Channel Characterization: Multipath propagation environment, LTI channel model, Channel correlation function, Large scale path loss, Small scale multipath fading.

**WLAN technologies:** Infrared, UHF narrowband, spread spectrum, IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART.

### Unit-II

**Mobile Technology:** Evolution of Mobile Radio Communication, Generations upto 5G; Cellular concept: Spectrum reuse and re-farming; Cell cluster concept; Co-channel and adjacent channel interference; Cell site call blocking and delay; Channel allocation strategies, Hand off strategies.

**Mobile Radio Propagation:** Large Scale Fading: Free space propagation model. Three basic propagation mechanisms. Reflection, Ground Reflection (Two-Ray) Model, Diffraction,

Scattering, Small Scale Fading: Multipath Propagation, Types of small scale fading, Fading effects due to multipath time delay Spread and Doppler spread.

### Unit-III

**Mobile Network Layer:** Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol; Mobile ad-hoc networks: Introduction, Routing: Source vs Destination Initiated, IoT: CoAP  
**Mobile Transport Layer:** Implications of mobility on Classical TCP, TCP enhancements for wireless networks, Indirect TCP, Snooping TCP, Mobile TCP, TCP over 3G.

### Unit-IV

**3G Overview:** Overview of UTM, Terrestrial Radio access network-UMTS Core network Architecture: 3GPP Architecture, User equipment.

**4G Overview:** 4G vision, 4G features and challenges, Applications of 4G, 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

**5G Overview:** 5G architecture and design objective, 5G spectrum requirements, Millimeter wave propagation, 5G Protocol Stack, 5G RAN & Dynamic CRAN, Distributed massive MIMO principle.

#### Suggested Books:

1. Theodore S. Rappaport - Wireless Communications Principles and Practice. 2nd Edition. Pearson Education, 2003.
  2. Andreas F. Molisch - Wireless Communications, John Wiley, 2nd Edition, 2006.
  3. Kamilo Feher - Wireless Digital Communications. PHI, 2003
  4. W.C.Y. Lee - Mobile Cellular Communications. 2nd Edition, MC Graw Hill. 1995.
  5. Yi-Bing Lin - Wireless and Mobile Network Architectures, 2nd Edition, Wiley, 2008.
- Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**

## MCA-205A

### Computer System Architecture

Max. Marks: 100 (80+20)

Time: 3Hrs

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

#### UNIT-I

**Number System:** Binary. Octal Hexadecimal and Decimal 1's and 2's Complements, Inter conversion of numbers. Codes: Weighted and Non-weighted codes, BCD Codes, Gray codes, Self-complementing codes, Error-Detecting/Correcting codes, Alphanumeric Codes Hamming Codes. Floating Point Numbers. Binary Arithmetic: Binary Addition and Subtraction, 2's Complement Arithmetic, Booth Coding. Binary Multiplication.

**Logic Design:** Logic Gates, Truth Tables. Boolean Algebra, Boolean Expressions-Variables and Literals. Boolean Expressions-Equivalent and Complement, Theorems of Boolean Algebra. Simplification Techniques. SOPs & POSs Boolean Expressions.

#### UNIT-II

**Combinational Circuits:** Combinational Logic. Arithmetic Circuits- Adder and Subtractor BCD Adder. Code Converters, Magnitude Comparator, Parity Generators/Checkers, Multiplexers, Demultiplexers, Decoders. Encoders.

**Sequential Circuits:** Latches. R S Flip Flop, Level Triggered and Edge Triggered Flip Flops JK Flip-Flop, Master-Slave Flip Flops. T Flip-Flop. D Flip-Flops.

**Registers and Counters:** Controlled Buffer Registers, Shift Registers, Applications of Shift-registers; Ripple Counter, Synchronous Counter, Modulus Counter. Binary Ripple Counters, Up/Down Counters. Decade and BCD Counters.

#### UNIT-III

**Basic Computer Design:** Computer Instructions and types. Instruction Set. Instruction Cycle, Instruction Formats, Addressing Modes. Computer Registers. Bus System. Register Transfer Language terminology.

**Programming in 8086/8088 Assembly Language:** A/L program structure, segments, registers, instructions, macros, A/L directives.

**CPU Design:** CPU Registers, Micro-operations and its types, Design of ALU. Control Unit Design- Microprograms. Control Unit of a basic computer-Timing and Control: Hardwired and Micro-programmed controlled unit. Architectures -RISC. CISC, Scalar. Superscalar and pipelined architectures.

## UNIT-IV

**Input/Output Organization:** Peripheral Devices, Input-output Interface. Asynchronous Data Transfer. Mode of Transfer, Priority Interrupt, Direct Memory Access, Input-output Processor. Serial Communication.

**Advance Architecture:** Introduction to parallel processing- Pipelining. Parallel Computer structures. Architectural classification. Pipelining & Vector processing; Instruction and Arithmetic pipelines. Principles of designing pipelined processors. Structures for array processors: SIMD Array processor, SIMD Interconnection networks. Parallel Processing Applications.

### Suggested Books:

1. Mano, M.M.: Digital Logic and Computer Design. Prentice-Hall of India.
2. Gill Nasib Singh and Dixit J.B: Digital Design and Computer Organisation, University Science Press (Laxmi Publications). New Delhi.
3. Stallings, William: Computer Organisation & Architecture.
4. Anand Kuman: Fundamentals of Digital Circuits. PHI.
5. Kai Hwang: Advanced Computer Architecture, McGraw Hill International
6. Mano, M.M.: Computer System Architecture, Prentice-Hall of India.
7. Tokheim: Digital Electronics, TMH.
8. Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**

## MCA-205B

### Internet of Things

*Max. Marks: 100 (80+20)*

*Time: 3Hrs*

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

### UNIT-I

**Introduction:** Definitions, Motivation, Impact & Challenges, IoT vs WoT, Functional Requirements; Web 3.0 view of IoT, DNA of IoT: Device, Connect & Manage; IoT Security & Vulnerability.

**Four Pillars of IoT:** M2M, RFID, WSN, SCADA, Communication Middleware for IoT.

### UNIT-II

**Communicating smart objects:** *Standard Wireless Access Technologies:* IEEE Technologies - IEEE 802.15.4, IEEE 802.15.4e, IEEE 802.11ah, IEEE 1901.2a, Mobile - 2G, 3G, Standard LTE, 4G; *Private Long Range Access Technologies:* LoRAWAN, ZigBee, SigFox, DASH7; *Portable Short Range Access Technologies:* NB-IoT, Z-Wave, Bluetooth Low Energy;

**IoT Network Layer:** IP as IoT Network layer, 6LoWPAN, 6Lo, 6T1SCH, RPL, CORPL, CARP.

### UNIT -III

**IoT Application Layer:** MQTT, SMQTT, CoAP, AMQP, XMPP, DDS.

**Protocol Standardization for IoT:** IoT Protocol Standardization Efforts, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Introduction of Unified Data Standards.

### UNIT-IV



**Implementing IoT:** Examples and working principles of sensors and actuators, Setting up the board, Reading from Sensors Communication: Arduino microcontroller and programming.

**Ubiquitous IoT:** IoT in Big Data, Cloud Computing, Applications of IoT: Smart Building, Smart Home, Smart City, Smart Grid, Smart Transportation, Smart Manufacturing, Smart Healthcare.

#### **Suggested Reading:**

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou — CRC Press.
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison: Fbrian Michahelles- (Eds.) - Springer.
3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press.
4. The Internet of Things: Applications to the Smart Grid and Building Automation by- Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, 'The Internet of Things — Key applications and Protocols', Wiley.
6. Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**

## **MCA-205C**

### **Computer Graphics**

*Max. Marks: 100 (80+20)*

*Time: 3Hrs*

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#### **UNIT-I**

Basics of Computer Graphics: Computer Graphics. Classification. Applications of computer graphics, Display devices. Random and Raster scan systems, Graphics input devices. Graphics software and standards.

Graphics Primitives: Points, lines, circles and ellipses as primitives, scan conversion algorithms for primitives, Fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill character generation, line attributes, area-fill attributes, character attributers.

#### **UNIT-II**

2D Transformation and Viewing: Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping (Cohen-Sutherland. Liang-Barsky, NLN), polygon clipping.

3D Concepts and Object Representation: 3D display methods, polygon surfaces, tables, equations, meshes, curved lies and surfaces, quadric surfaces, spline representation, cubic spline interpolation methods. Bazier curves and surfaces, B-spline curves and surfaces.

#### **UNIT-III**

3D Transformation and Viewing: 3D scaling, rotation and translation, composite transformation, viewing pipeline and coordinates, parallel and perspective transformation, view volume and general (parallel and perspective) projection transformations. Modelling: Wireframe and Solid.

Hidden Surfaces: Visible surface detection concepts, Back-face detection. Depth Buffer method. Illumination. Light sources. Illumination methods (ambient, diffuse reflection, specular reflection). Color models: properties of light, XYZ, RGB. YIQ and CMY color models. Shading: Flat, Gouraud and Phong.

#### **UNIT-IV**

Multimedia Basics: Concepts of Multimedia. Multimedia applications. Multimedia system architecture, Evolving technologies for multimedia. Defining objects for multimedia systems, Multimedia data interface standards. Multimedia databases. Compression and decompression: Data and file format standards. Multimedia I/O technologies. Digital voice and audio. Video image and animation. Full motion video. Storage and retrieval technologies.

Multimedia Authoring: Concept of Multimedia Authoring, Hypermedia messaging, Mobile messaging. Hypermedia message component. Creating hypermedia message. Integrated multimedia message standards. Integrated document management. Distributed multimedia systems.

Case Study (FLASH/ BLENDER): Drawing Basic Shapes. Modeling. Shading & Textures, Creating a multimedia project.

**Suggested Books:**

1. Donald Hearn and M.Pauline Baker: Computer Graphics, PHI Publications
2. Plastock : Theory & Problem of Computer Graphics. Schaum Series.
3. Foley & Van Dam: Fundamentals of Interactive Computer Graphics. Addison-Wesley.
4. Newman : Principles of Interactive Computer Graphics. McGraw Hill.
5. Tosijas. L.K. : Computer Graphics. Springer-Verlag.
6. S Gokul: Multimedia Magic, BPB Publication.
7. Bufford: Multimedia Systems. Addison Wesley.
8. Jeffcoate : Multimedia in Practice. Prentice-Hall.
9. Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**

## **MCA-205D**

### **Advanced Algorithms**

*Max. Marks: 100 (80+20)*

*Time: 3Hrs*

**Note:** Examiner will be required to set NINE questions with all questions carrying equal marks. Question Number 1, covering the entire syllabus, will be compulsory. Examiner will set two questions from each Unit with internal choice. Student will be required to attempt FIVE questions in all, selection one question from every unit apart from the Question Number 1.

#### **UNIT-I**

The Role of Algorithms in computing: Analyzing Algorithms, Time and Space Analysis of Algorithms, Big-Oh and Theta Notations, Average. Best and Worst case analysis. Designing Algorithms, Growth of functions. Asymptotic Notations. Divide and Conquer. Recurrences, Maximum sub-array problem, Stressan's Method, Substitution method. Recurrence tree method. The Master method, Floors and Ceilings.

#### **UNIT-II**

Trees : Binary tree traversal methods: Pre-order, In-order, Post-ordered traversal. Recursive Algorithms. Traversal methods. Representation of trees and its applications: Binary tree representation of a general tree. Conversion of forest into tree. Threaded binary trees. Binary search tree: Height balanced (AVL) tree, B-trees, Splay tree. Heap: Heap operations, Binomial heaps. Fibonacci heaps, Skew heaps, heap set.

#### **UNIT-III**

Graphs & Algorithms: Representation. Type of Graphs. Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs. Isomorphism, Graph Coloring. Covering and Partitioning, Depth-and breadth-first traversals, Minimum Spanning Tree: Prim's and Kruskal's algorithms. Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Maxflow: Ford-Fulkerson algorithm, max flow -min cut.

#### **UNIT-IV**

Dynamic Programming: Backtracking Algorithms. Design Methodologies, Travelling salesperson problem, 0/1 Knapsack problem, multistage graphs. All Pair Shortest Path, 8-

Queens problem Advanced String Matching Algorithms: Naive string matching algorithm, Robin-Karp algorithm, string matching with finite automata, Knuth-Morris-Pratt algorithm. P, NP and Approximation Algorithms: Basic Concepts, Non-Deterministic algorithms, NP Complete and NP-hard classes. NP complete Problems. Implementation of above-mentioned data structures & algorithms through C++/Java programming.

**Suggested Books:**

1. Thomas H. Cormen. Charles E. Leiserson. Ronald L. Rivest: Introduction to Algorithms, PHI Learning Pvt. Ltd.
2. Gilles Brassard. Paul Bratley: Fundamentals of Algorithms. PHI Learning Pvt. Ltd, 2011.
3. Hubbard JR: Schaum's Outline of Data Structures with C++, Tata McGraw Hills, New Delhi.
4. R. Sedgewick: Algorithms in C++, Pearson Education Asia.
5. Y.Langsam, M.J.Augenstein and A.M.Tanenbaum: Data Structures Using C and C++, Prentice Hall of India.
6. R.Kruse, C.L.Tonodo and B.Leung: Data Structures and Program Design in C, Pearson Education. New Delhi
7. G.L. Heileman: Data Structures: Algorithms and Object Oriented Programming, Tata McGraw Hill, New Delhi
8. E. Horowitz, Salmi and D. Mehta: Fundamentals of Data Structures in C++, Galgotia Publication, New Delhi.
9. Any other book(s) covering the contents of the paper in more depth.

**Note: Latest and additional good books may be suggested and added from time to time**