

Program:

1. Graduate Course: BSc, BCA
2. Post Graduate Course: M.Sc. (Mathematics), M.Sc. (Computer Science)
3. P.G. Diploma Course: PGDCA

Graduate Program Outcome

Post Graduate Program Outcome

- **Disciplinary Knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.
- **Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
- **Critical Thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
- **Problem Solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
- **Analytical Reasoning:** Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
- **Research-related Skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problematizing, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.
- **Cooperation/Team Work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
- **Reflective Thinking:** Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

- **Scientific Reasoning:** Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences LOCF 4 from an open-minded and reasoned perspective.
- **Information/Digital Literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
- **Self-Directed Learning:** Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
- **Multicultural Competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
- **Moral and Ethical Awareness/Reasoning:** Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
- **Leadership Readiness/Qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.
- **Lifelong Learning:** Ability to acquire knowledge and skills, including learning how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

PROGRAMME OUTCOMES (PO)

Graduate / Postgraduate

At the completion of the Graduate Programme/ Post Graduate Programme, the student will be able to accomplish the following outcomes:

PO.1 Critical Thinking: Take an informed and analytical approach to learning and demonstrate in-depth knowledge of the subject and give opinion(s) supported by logical reasoning that one has judged to be appropriate and understanding different approaches and using them

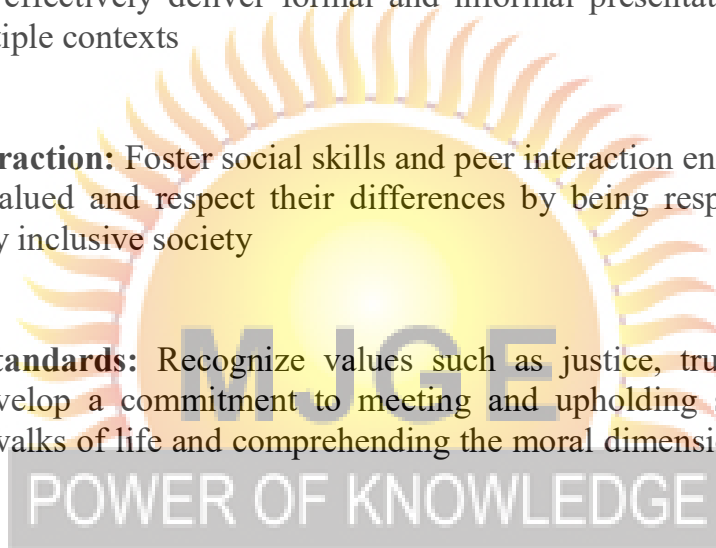
PO.2 Effective Communication: Demonstrate proficiency in communicating competently in groups and organizations, competence in interpersonal communication; possess skills to effectively deliver formal and informal presentations to a variety of audiences in multiple contexts

PO.3 Social Interaction: Foster social skills and peer interaction enabling them to make all people feel valued and respect their differences by being responsible citizens for creating a socially inclusive society

PO.4 Ethical Standards: Recognize values such as justice, trust, equity, fairness, kindness and develop a commitment to meeting and upholding standards of ethical behaviour in all walks of life and comprehending the moral dimensions of decisions and actions

PO.5 Environmental Consciousness: Discern the issues of environmental contexts and engages in promoting values and attitudes that claim coexistence and sustainable living with reduced, minimal, or no harm upon ecosystems

PO.6 Lifelong Learning: Acquire the skill to be an independent lifelong learner embracing real-time changes in the socio-technological context, promoting continuous development and improvement of the knowledge and skills needed for employment and personal fulfilment



Programme Specific Outcomes (PSOs)

PROGRAMME: B. Sc., BCA

By the end of this course, the students will be able to:

PROGRAMME: M. Sc. (Computer Science), M.Sc. (Mathematics)

By the end of this course, the students will be able to:

Course Outcome

B.C.A.: Bachelor of Computer Application

Students will be able to recognize & appreciate the role of computing in a wide variety of activities & application of Modern society, including commerce, education, communication. Analyse a given problem and develop an algorithm to solve the problem. Demonstrate the basic technicalities of creating word document, creating power point presentation, design spreadsheet for office use.

I Year

Paper I: BCA101: Discrete Mathematics

CO1: Recall of statements and logical connectives, tautologies and contradictions, logical equivalence, algebra of propositions quantifiers.

CO2: Boolean algebra and its properties, algebra of propositions as an example, De Morgan's Laws, partial order relations g.l.b., l.u.b.

CO3: Boolean functions - disjunctive and conjunctive normal forms. Boolean's expansion theorem, fundamental forms. Many terminal Networks.

CO4: Arbitrary Cartesian product of sets. Equivalence relations, partition of sets, injective, surjective, bijective maps, binary operations, countable.

CO5: Basic Concept of Graph Theory, Sub graphs, Trees and their properties, Binary Trees, Spanning Trees.

Paper II: BCA102: Computer Fundamental

CO1: Computer System Characteristics and Capabilities, Computer Hardware and Software: Block Diagram of a Computer, Data Processing, Types of Computers, Computer Generations

CO2: Input Devices: Categorizing Input Hardware, Scanning Devices, Output Fundamentals, Hardcopy Output Devices, Printers, Non-Impact Printers, Plotters, Cathode Ray Tube, Flat Screen Technologies

CO3: Central Processing Unit: The Microprocessor, control unit, A.L.U., Registers, Storage Devices: Storage Fundamentals, Primary and Secondary Storage, – Sequential, Direct & Indexed Sequential, Tape Storage and Retrieval Methods Tape Storage Devices

CO4: Computer Software, System software Vs. Application Software, Operating Systems programs, Booting Loader, Assembler, Compiler & Interpreter. Types of Application Software, Program and Packages.

CO5: Introduction, History and Versions of DOS. Fundamentals of DOS, Disks & DOS versions, Preparing Disks for use, Operating System function and definition, Overview of Linux / Unix.

Paper III: BCA103: Programming in 'C' Language

CO1: Overview of C: History of 'C', Structure of 'C' program. Keywords, Tokens, Data types, Console I/O formatting, Unformatted I/O functions: getch(), getchar, getche(), getc(), putc(), putchar()

CO2: If-else, conditional operators, switch and break, nested conditional branching statements, loops: For, do. while, while, Nested loops, function components: Function arguments, return value, function call statement

CO3: Array: -Array declaration, One and Two dimensional numeric, String declaration, initialization, string manipulation, declaring structure and structure variable, Union: basics, declaring union and union variable

CO4: Definition of pointers, pointer declaration, using & and * operators. Void pointer, dynamic memory allocation functions – malloc, calloc, realloc and free, pointers vs. Arrays, pointer to structure, dynamic array.

CO5: File handling: file pointer, file accessing functions, fopen, fclose, fputc, fgetc, fprintf, fflush, rewind, fseek, ferror. File handling through command line argument. Introduction to C preprocessor #include, #define, conditional.

Paper IV: BCA104: PC Software and Multimedia

CO1: MS Word: Word Processing, Page Formatting, Mail Merge, Word Art, Images, Header, Footer, Tables, Hyperlink, Opening and Printing Document, Heading1, Heading2, Spelling & Grammar Check

CO2: MS Excel: Formulas, Goal Seek, Macro, Page Break, Protect Sheet, working with Functions & Formulas, using absolute reference, referencing cell by name, using cell label, giving name to cell and ranges

CO3: Creating presentation, working with slides, different types of slides, setting page layout, selecting background and applying design, adding graphics to slide, adding sound and movie

CO4: MS Access: Introduction to DBMS, Relationships, Importing Data, Pivot Table, Reports, creating tables in Access, defining datatypes, creating relationships, manipulating records

CO5: Basic concept of 2D/3D animation, principle of animation, various file format, animate text, transformation, basic action scripts, importing sound through flash

Paper V: BCA105: Web Technology and E-Commerce

CO1: History, evolution, internet applications, WWW, OSI and TCP/IP model, Email concept, SMTP, TELNET, Chat services, Internet messaging.

CO2: Introduction to HTML, HTML versions, Headings on web pages, Hyperlinks, Creating Paragraph, Images, Links, Tables, Frame, Creating an HTML Form, HTML Controls

CO3: DHTML Introduction, CSS, Inline Style Sheet, Event Handling, Java Script, Embedding JavaScript into HTML Pages, Handling events

CO4: Features and Advantages of PHP, Installing, Creating and running PHP, working with variables, Array, User Defined Function.

CO5: Definition of Ecommerce, Scope, E Payment System, Security Threats, Types of Ecommerce, B2B, B2C, Business to Business to Consumer, C2C

Paper VI: BCA106: Communication Skills

CO1: Structure of Sentences: simplex, Complex, Compound, Clause, Tenses, Model, Participle: Non-finite and finite, infinitive

CO2: Transformation of sentences, Active to Passive, Affirmative to Negative, Explanative to Assertive, Interrogative to Assertive.

CO3: Report writing, Essay Writing, Application Writing, Description of events, Letter Writing.

CO4: Precis writing, reading comprehension, summarising, presentation skills, paraphrasing.

CO5: Official communication: notice, Circular, Minutes of the meeting, Agenda of meeting, Morden media of communication.

II Year

Paper I: BCA201: Part-I: Numerical Analysis

CO1: Bisection method, Regula falsi method & Newton's method, Solution of Cubic & Biquadratic Equation

CO2: Gauss-Jordan method, Cholesky's method, Reduction to lower or upper Triangular forms, Inversion of matrix, method of partitioning.

CO3: Newton's Interpolation formula, Newton's Forward and Backward Difference Interpolation Formula, Langranges Interpolation formula, Newton's Divided Difference

CO4: Newton - cotes integration formula, Trapezoidal Rule, Simpson's One-Third and Three-Eight Rule, Waddle's Rule.

CO5: Numerical Solution of first order Ordinary Differential Equations, one step method, Euler's, Picard's and Taylor's series Methods, Picard's Methods for successive approximations, Runga-Kutta Method

Paper I: BCA201: Part-II: Differentiation and Integration

CO1: Successive Differentiation, Leibnitz's Theorem, Rolle's Theorem, Lagrange's and Cauchy Mean Value Theorem, Taylor's Theorem, Expansion by Taylor's and Maclaurin's series

CO2: Asymptotes, Curvature, Test of Convexity and Concavity, Point of Inflexion, Tracing of Curves in Cartesian and Polar form.

CO3: Partial and Directional Derivatives of functions of two and three variables, Jacobian's Theorem

CO4: Integration of functions by parts, by substitution and by partial fraction; Definite Integral and its properties.

CO5: Integration of functions of two and three variables, Change of order of Integration, Determination of Area and Length

Paper I: BCA201: Part-III: Data Structure

CO1: Introduction, Basic terminology, Elementary data organization, Data structure, Data structure operation

CO2: Basic Terminology, Linear Array; Sorting: Bubble Sort; Searching: Linear Search, Binary Search, Pointers: Pointer Array; Records: Record Structures.

CO3: Link lists, traversing a linked list, searching a linked list; Insertion into a linked List, Deletion from a Linked List, Stacks, Array Representation of Stack; Queues.

CO4: Types of Trees, Binary Trees, Representing Binary, traversing binary tree, Searching and Inserting in Binary Tree, Deleting in Binary tree.

CO5: Sorting, Insertion Sort, Selection Sort, Merging, Merge.

Paper II: BCA202: DBMS (Oracle, SQL)

CO1: Database, Definition of DBMS, Purpose of Database System, Data abstraction, Instances, Schema, Data Independence, Data administration roles, DBMS users

CO2: Entity - Relationship model as a tool for conceptual design-entities attributes and relationships. ER diagrams; Concept of keys: candidate key.

CO3: Relational Algebra: select, project, cross product different types of joins (inner join, outer joins, self-join); set operations, Simple and complex queries using relational algebra.

CO4: Normalization concept in logical model; Pitfalls in database design, update anomalies: Functional dependencies, Join dependencies, Normal forms.

CO5: Introduction to Commercial database query language, SQL & its environment. SQL as a data definition language- creating tables, altering tables, drop tables. SQL as data manipulation language- Inserting, Deleting, Retrieving and updating data in a table.

Paper III: BCA203: Programming in C++ and VC++

CO1 Need for Object Oriented programming; Procedural Languages; The Object Oriented approach; advantages of Object Oriented Programming; characterization of Object Oriented Languages

CO2: Object and Class, Using the class, class construct, class destructors, object as function argument, struct and classes, array as class member, operator overloading.

CO3: Overview of C++ Programming; Loops and decisions; Structures and functions. Arrays and Pointers, Inheritance, Overloaded Function, Inline Function, Virtual Functions, pure virtual Functions Streams.

CO4: Object structure concepts; Object type; Attribute types; relationship type; Object behavioral concepts; Methodology for Object Oriented Design; Booch methodology Relational Vs Object Oriented Databases.

CO5: Introduction to VC++ - C under windows, Overview of VC++, VC++ workspace & projects, Introduction to MFC- The part of VC++ programs, the application object, the main window object.

Paper IV: BCA204: Computer Networking & Internet Technology

CO1: Data Communication, Networks - Distributed Processing, Network Criteria, Applications; Protocols, Standards, Standard Organization.

CO2: The model - Layered architecture, functions of the Layers-Physical layer, Data Link layer, Network layer, Transport layer, session layer, Presentation layer, Application layer.

CO3: Analog and Digital, digital data transmission - parallel transmission, serial transmission, data circuit terminating equipment, standards, modems- Transmission rate, Modem standards.

CO4: Architecture of Internet, Client server model, www, The concept of web publishing, The HTML Basics Review, Tables, frames, image maps, forms & Introduction to CGI Scripting.

CO5: What is java, Introduction to java applet, Adding applet to web page, JavaScript, Structure of Java Script. Defining styles within HTML tags. Features of Style sheet, Web server, Publishing website, Case Studies

Paper IV: BCA205: Linux

CO1: Introduction to Linux system, History and Emergence, Features of Linux system, Features of Linux file system, File types and permissions, getting started, Logging in /out with the concept of home directory.

CO2: Introduction to Text Processing, Vi editor, Vi Features, Vi Commands, Yanking, running shell commands, from within Vi, Command macros

CO3: Introduction to Shell & Shell Programming: Features of a Shell, Different types of a Shell, why use more shell, the environment, set, setenv.

CO4: x-windows: what is X-windows, Microsoft windows versus x-windows, Using the GNOME & KDE desktop environment: starting the GNOME desktop environment, the GNOME panel.

CO5: Installation & system Administration of Linux: responsibilities of a system administrator, startup and shutdown process, inittub and profile file importance, security file access permission, user and group related jobs

Paper VI: BCA206: A. Principles of Management

CO1: Concept, Nature and Scope of management. The evolution of Management thought, Approaches of management, New classical school, Behavioral Approach and Systems Approach.

CO2: Significance, Objectives Types of Plans, Strategies & Polices, Proceedings methods & rules Project Management, Planning Evaluation, Feasibility Report, Planning Process Planning under systems approach

CO3: Significance, objectives, Major approaches to organizational theory, Organizational Structure and Design, the organizational Process, span of control or Departmentation, Delegation of Authority

CO4: Significance and issue in managing human factors. Motivation, nature and significance theories and techniques, Leadership styles and influence process, Leadership challenges.

CO5: Definition and elements, Control Techniques, Coordination and determinants of an effective control System, Organizational, Context of Decisions, Decision Making Techniques and Processes

Paper VI: BCA206: B. English Language

CO1: Short answer questions.

CO2: Reading Comprehension of unseen passage, Vocabulary.

CO3: Report Writing

CO4: Expansion of an idea.

CO5: Grammar and Vocabulary.

III Year

Paper I: BCA301: Part-I: Calculus and Geometry

CO1: The Riemann Integral, Existence of the Riemann Integral, Properties of Riemann Integrals, Fundamental Theorem of Integral Calculus.

CO2: Maxima and minima of functions of two and three variables. LaGrange's method of undetermined multipliers.

CO3: Improper integrals, meaning of integrals of type $\int_a^\infty f(x) dx$, $\int_a^b f(x) dx$ where $f(x)$ is not defined at a and/or b . Tests of convergence for improper integrals

CO4: Equation to cone with given base, Generators of Cone, condition for three mutually perpendicular generators, Right Circular Cone, Equation of a cylinder.

CO5: Polar Coordinates, Polar equation to straight line, Circle. Polar equation of a Conic

Paper I: BCA301: Part-II: Differential Equation & Fourier Series

CO1: Concept of Differential equation. Recall of first order and first degree differential equations. Equation of first order but of higher degree. Homogeneous and exact differential equations

CO2: Geometric representation, Family of curves and orthogonal trajectories. Linear differential equation with constant coefficients. Operational rules of D. Homogeneous linear equations.

CO3: Partial differential equations of first order, Standard forms, Linear partial differential equations of higher order with constant coefficients

CO4: Periodic Function, Fourier Sine and Cosine Series, Even and Odd Functions, Full Range and Half Range Fourier Series.

CO5: Convergence of Fourier Series, Gibbs Phenomenon, Operations on Fourier Series, Applications of Fourier Series to Differential Equation

Paper I: BCA301: Part-III: Computer System Architecture

CO1: Data Representation – Data Types, Number System, Fixed Point Representation – 1's, 2's complements, Binary operation, Overflow & Underflow

CO2: Digital Logic Circuits –Gates & their truth tables, NOR, NAND& XOR Gates, Boolean algebra, Basic Boolean Law, Doorman's theorem, Map Simplification, Minimizing technique, K Map.

CO3: CPU organization, ALU & Control circuit, Idea about arithmetic circuits, Program control, Instruction sequencing, Microprocessor architecture, System buses.

CO4: Input output organization, I/O Interface, Properties of simple I/O devices and their Controller, isolated versus Memory mapped I/O, Modes of Data transfer.

CO5: Auxiliary memory - Magnetic drum, Disk & Tape, Semiconductor memories, Memory Hierarchy, Associative memory, Virtual memory, address space & memory space, Address mapping, Page table.

Paper II: BCA302: Programming in Java

CO1: Genesis of java, importance to the Internet, overview of features, OOP features, data types, control structures, arrays, methods and classes, nested & inner classes

CO2: Basics type, method Override, using abstract and final classes, using super, Defined CLASSPATH, importing packages, implementing interface.

CO3:exception types, using try and catch, throwing exceptions, defined exceptions, Java spread model, creating threads, and thread priorities, synchronization. Suspending resuming and stopping threads

CO4: Basic Streams, Byte and Character Stream, predefined streams, reading and writing from console and files, TCP/IP client & server sockets, URL connection., Setting the JDBC connectivity with backend database

CO5: Fundamentals, life cycle, overriding update, HTML APPLET tag, passing parameters Developing single applets, Window fundamentals, creating windowed, programs waking with graphics

Paper III: BCA303: Operating System

CO1What is operating system, basic concept, terminology, batch processing, spooling, multiprogramming, time sharing, real time systems, protection, multiprocessor system, operating system as resource manager

CO2: Reviewing of multiprogramming concept, scheduling concept, basic concept, CPU I/O burst cycle process state, PCB, scheduling queries, schedulers, scheduling algorithms.

CO3:Preliminaries of memory management, memory handling in M/C, relocation, swapping and swap time calculation, multiple partitions, partitioned allocation MFT, fragmentation, MVT, compaction, paging, job scheduling implementation of page tables.

CO4: File concept, file type, typed based system, disk based system, general model of file system, file directory maintenance, symbolic file system, basic file system, physical file system, file support device directory.

CO5: The Dead Lock problem - Dead Lock definition, Dead Lock detection, detection algorithm usage, Dead Lock characterization, resource allocation graph, Dead Lock prevention, mutual exclusion, hold and wait.

Paper IV: BCA304: Software Engineering

CO1: Introduction to Software Engineering, Definition, Need and Software problem, Software Crises, Software Engineering Problem, Software Engineering Approach.

CO2: Project Management, The Phase Management Process, Software Metrics, Size Oriented Metrics, Function Oriented Metrics.

CO3:Software Requirement and Specification, Introduction and Need of SRS, Structured Analysis, Data Flow Diagram, Context Diagram, Data Dictionary.

CO4: Software Design & Coding, Principle of Software Design, Partitioning, Abstraction, Top Down and Bottom up Strategies, Concept of Module, Coupling, Cohesion, Structured Chart, Coding

CO5: Software Testing and Maintenance, Definition, Testing Fundamentals, Error, Fault, Failure, Test Oracles, Types of Testing, Level of testing- Unit, Integration, System, Acceptance, Introduction of Maintenance

Paper IV: BCA305: Multimedia Tools and Application

CO1: Needs and areas of use, Development platforms for multimedia – DOS, Windows, Linux. Identifying Multimedia elements, Concepts of plain &

CO2: Sound and its Attributes, Mono V/s Stereo sound, Sound channels, Sound and its effect in multimedia, Analog V/s Digital sound, Basics of animation, Principle, Animation on the Web – features and limitations

CO3: Basics of Video – Analog and Digital Video, Introduction to graphics accelerator cards, Introduction to video capturing Media & instrument

CO4: Type of multimedia authoring tools, key factors of selecting CD based multimedia authoring tools.

CO5: Multimedia on the Web: Bandwidth relationship, broadband technologies, Text in the web – Dynamic and embedded font technology, Audio on the Web – Real Audio and MP3/MP4

Paper VI: BCA306: A. Financial Management & Accountancy

CO1: Financial Accounting: Meaning and Nature, Accounting Principles underlying the preparation of financial statements, A Synoptic View-Profit and Loss account, Balance Sheet

CO2: Financial statement Analysis, Ratio analysis, Conceptual Framework of Cost Accounting Meaning nature and need of cost accounting, Elements of cost, Preparation of cost

CO3: Cost – volume Profit (CVP) relationship Break-even analysis; (single and multiple products), Determination of sales volume to attain desired profits

CO4: Budgeting: Definition and objective. Preparation of various types of budgets including cash budget. Fixed and flexible budgets.

CO5: Cost Accumulation System, Job and Process, Variable and absorption costing systems Comparison for income determination

Paper VI: BCA306: B. Foundation Course

CO1: Essay type answer in about 200 words. Four essay. Type question to be asked and two to be attempted

CO2: Writing skills for composition- Essay writing

CO3: Precise Writing

CO4: Reading Comprehension of an unseen passage

CO5: Vocabulary based on text, Grammar- Advanced Exercises

B.Sc.: Bachelor of Science

Learn to solve improper integrals. Make use of linear equations for solving any differential equations Understand various problems related with planar graphs, demonstrate a rigorous understanding of the core theories & principles of physics, which includes mechanics, electromagnetism, thermodynamics, & quantum mechanics, serve as the Programmers or the Software Engineers with the sound knowledge of practical and theoretical concepts for developing software. Serve as the Computer Engineers with enhanced knowledge of computers and its building blocks. Work as the Hardware Designers/Engineers with the knowledge of Networking Concepts.

I Year

Mathematics: Paper I: Algebra and Trigonometry

CO1: Elementary operations on matrices, Inverse of a matrix. Linear independence of row and column matrices, Row rank, column rank and rank of a matrix. Equivalence of column and row ranks

CO2: Application of matrices to a system of linear (both homogeneous and nonhomogeneous) equations. Theorems on consistency of a system of linear equations

CO3: Mappings, Equivalence relations and partitions. Congruence modulo n . Definition of a group with examples and simple properties. Subgroups, generation of groups, cyclic groups

CO4: Homomorphism and Isomorphism of groups. The fundamental theorems of homomorphism. Introduction, properties and examples of rings

CO5: De-Moivre's theorem and its applications. Direct and inverse circular and hyperbolic functions. Logarithm of a complex quantity. Expansion of trigonometrical functions

Mathematics: Paper II: Calculus

CO1: $\varepsilon - \delta$ definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuities

CO2: Asymptotes. Curvature. Tests for concavity and convexity. Points of inflexion. Multiple points. Tracing of curves in Cartesian and polar coordinates

CO3: Integration of transcendental functions. Reduction formulae. Definite integrals. Quadrature. Rectification. Volumes and surfaces of solids of revolution

CO4: Degree and order of a differential equation. Equations reducible to the linear form. Exact differential equations. First order higher degree equations solvable for x , y , p . Clairaut's form and singular solutions

CO5: Linear differential equations of second order. Transformation of the equation by changing the dependent variable/the independent variable

Mathematics: Paper III: Vector Analysis & Geometry

CO1: Scalar and vector product of three vectors. Product of four vectors. Reciprocal Vectors. Vector differentiation. Gradient, divergence and curl

CO2: Vector integration. Theorems of Gauss, Green, Stokes and problems based on these

CO3: General equation of second degree. Tracing of conics. System of conics. Confocal conics. Polar equation of a conic

CO4: Sphere. Cone. Cylinder

CO5: Central Conchoids. Paraboloids. Plane sections of conchoids. Generating lines. Confocal Conchoids. Reduction of second degree equations

Computer Science: Paper I: Computer Fundamentals (Paper Code-0805)

CO1: History of computer, Generation of computer, calculator vs computer. Digital and Analogue computers and its evolution. Major components of digital computers, Memory addressing capability of CPU.

CO2: Parts of CPU-ALU control unit, Registers; Architecture of Intel 8085 microprocessor, Instruction for Intel 8085 microprocessor, Instruction Word size, Various addressing mode, Interrupts some special control signals

CO3: Memory hierarchy, Primary and Secondary Memory, Cache memory, Virtual Memory, Direct Access storage devices (DASD) Destructive and Non-destructive Readout

CO4: I/O Devices-KeyBoard, Mouse, Monitor, Impact and Non-Impact Printers, Plotters, Scanner, other Input/output devices: Scan method of Display, Raster Scan, Vector Scan, Bit Mapped Scan, CRT Controller

CO5: Application and System Software: Introduction, Example, Difference etc. Open Source Software such as Unix/Linux (Ubuntu), Libre office etc. Machine Language Assembly Language

Computer Science: Paper II: Programming in C Language (Paper Code-0806)

CO1: Overview of C: History of 'C', Structure of 'C' program. Keywords, Tokens, Datatypes, Constants, Literals and Variables, Operators and Expressions.

CO2: If-else, conditional operators, switch and break, nested conditional branching statements, loops, Definition, function components: Function arguments, return value, function call statement, function prototype

CO3: Array declaration, one and two dimensional numeric and character arrays. Multidimensional arrays, String declaration, initialization, declaring structure, Union

CO4: Definition of pointers, Pointer declaration, Using & and * operators. Void pointer, Pointer to pointer, Pointer in math expression, Pointer arithmetic, Pointer comparison, Dynamic memory allocation functions

CO5: File handling:file pointer,Fileaccessingfunctions:fopen, fclose,fputc,fgetc,fprintf,fscanf,fread,fwrite,feof,fflush,rewind,fseek,ferror.File handling through command line argument

Information Technology: Paper I: Fundamental of IT, Computer and PC Software (Paper Code-0824)

CO1: Concept of IT and information system, Application of IT (In Business, Education Medicine Science Governance and Agriculture) Impact of IT on society E and industry, Legal and Ethical aspect of IT, Security Threats in IT.

CO2: Basic Concept of Computer Network Internet Concept Lan, Man, Wan Topology, Wireless Communication Mobile Internet Gps,3g, 4g Wi-Fi Bluetooth, Social Network Evolutions of Social Network Site

CO3: Introduction word processing (MS-Word) Advantage of word processing, Introduction and Installation Editing a file using paragraph styles, Newspaper style columns using macros advanced word processing

CO4: Introduction to spreadsheets (MS-EXCEL), Definition and advantage of electronics worksheet, working on spread sheets range and related operations, setting saving and retrieving worksheets Inserting, Deleting

CO5: Presenting with Power point: Creating presentation working with slides, Different type of slides, Settings page layout, selecting background and applying designs

Information Technology: Paper II: Programming in C Language (Paper Code-0825)

CO1: Overview of C: History of 'C', Structure of 'C' program. Keywords,Tokens,Datatypes,Constants,LiteralsandVariables,OperatorsandExpressions.

CO2: If-else, conditional operators, switch and break, nested conditional branching statements, loops, Definition, function components: Function arguments, return value, function call statement, function prototype

CO3: Array declaration, one and two dimensional numeric and character arrays. Multidimensional arrays, String declaration, initialization, declaring structure,Union

CO4: Definition of pointers, Pointer declaration, Using &and* operators. Void pointer, Pointer to pointer, Pointer in math expression, Pointer arithmetic, Pointer comparison, Dynamic memory allocation functions

CO5: File handling:file pointer,Fileaccessing functions:fopen, fclose,fputc,fgetc,fprintf,fscanf,fread,fwrite,feof,fflush,rewind,fseek,ferror.File handling through command line argument

II Year

Mathematics: Paper I: Advance Calculus (Paper Code-0848)

CO1: Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion. Series of non-negative terms

CO2: Continuity, Sequential continuity, Properties of continuous functions, Uniform continuity, Chain rule of differentiability, Mean value theorems and their geometrical interpretations

CO3: Limit and continuity of functions of two variables, Partial differentiation Change of variables, Euler's theorem on homogeneous functions

CO4: Envelopes, Evolutes, Maxima, minima and saddle points of functions, two variables, Lagrange's multiplier method.

CO5: Beta and Gamma functions, Double and triple integrals, Dirichet's integrals, Change of order of intergration in double integrals

Mathematics: Paper II: Differential Equation (Paper Code-0849)

CO1: Series solutions of differential equations- Power series method, Bessel and Legendre, Functions and their properties-convergence, recurrence.

CO2: Laplace Transformation - Linearity of the Laplace transformation, Existence theorem for Laplace transforms, Laplace transforms of derivatives.

CO3: Partial differential equations of the first order, Lagrange's solution, Some special types of equations

CO4: Partial differential equations of second and higher orders, Classification of linear partial differential equations of second order.

CO5: Calculus of Variations - Variation problems with fixed boundaries- Euler's equation for functional containing first order derivative and one independent variable, Externals

Mathematics: Paper III: Mechanics (Paper Code-0850)

CO1: Analytical conditions of Equilibrium, Stable and unstable equilibrium, virtual work, Catenary

CO2: Forces in three dimensions, Poinsot's central axis, Null lines and planes, Dynamics

CO3: Simple harmonic motion, Elastic strings, velocities and accelerations along radial and transverse directions, Projectile, Central orbits

CO4: Kepler's laws of motion, velocities and acceleration in tangential and normal directions, motion on smooth and rough plane curves.

CO5: Motion in a resisting medium, motion of particles of varying mass, motion of a particle in three dimensions, acceleration in terms of different co-ordinate systems

Computer Science: Paper I: Computer Hardware (Paper Code-0855)

CO1: Digital and Analog computers and its evolution. Major components of digital computers; Memory addressing capability of CPU; word length and processing speed of computers

CO2: CPU organization, ALU control unit registers. Instructions for INTEL 8085, Instruction word size, Various addressing mode interrupts and exceptions, some special Control signals

CO3: Main memory secondary memory, backup memory, cache memory; real and virtual Memory Semiconductor memory. Memory controller and magnetic memory; RAM;

CO4: I/O devices of micro controller; processors. I/O devices, printer, plotter, other output devices, I/O port serial data transfer scheme

CO5: ML, AL, HLL, stack subroutine debugging of programs macro, micro programming, Program Design, software development, flow & chart multi programming

Computer Science: Paper II: Computer Software (Paper Code-0856)

CO1: Concept of a Web Site, Web Standards, Basic HTML Tags, Structure-Head Section, Structure-Body Section, Text Emphasis Elements, Netscape, Microsoft and Advanced Standard Elements List

CO2: List, FONT, BASEFONT and CENTER Insertion of images using the element IMG, Element and Attributes, Image as Hypertext Anchor, Practical IT Application Designing web pages' links with each other

CO3: Advantages of OOP, The Object Oriented Approach, Function Declaration, Calling Function, Function Defines, Passing Argument to function, Passing Constant

CO4: Object and Class, Using the class, class constructor, class destructors, object as function argument, copy constructor, Type of inheritance, Base class, Derive class. Access Specifier: protected.

CO5: pointers: & and * operator pointer variables, pointer to pointer, void pointer, pointer and array, Virtual Function, File and Stream

Information Technology: Paper I: Digital Circuit & Computer Hardware (Paper Code-0874)

CO1: Octal and hexadecimal number, decimal rep., complements, addition, subtraction, Laws, demorgan's theorem, Simplification boolean expression & logic diagram

CO2: Half adder, full adder, flip-flop: SR, JK, D, T, sequential circuits: encoder, decoder, multiplexer, shift register, binary counters, BCD adder

CO3: Monostable, astable, bistable, smitt trigger, clocked RS, master-slave flip-flop, edge triggered flip-flop, latch;

CO4: Introduction, register organisation, stack organisation, Instruction formats, Addressing modes

CO5: Memory hierarchy, main memory, Auxiliary memory, Associative memory, cache memory, virtual memory, memory management techniques

Information Technology: Paper II: Programming in C++ (Paper Code-0875)

CO1: Introduction to OPP: Advantages of OPP, the Object oriented approach, characteristics of object oriented languages

CO2: Function: function declaration, calling function, function definition, passing arguments to function, passing constant, passing value

CO3: Object and classes, using the classes, class constructor, class destructor, object as function argument, copy constructor, struct and classes, array as class member, static class data

CO4: Pointers: & and * operator pointer variables, pointer to pointer, void pointer, pointer and array, pointer and functions, pointer and string, memory management.

CO5: File and stream: C++ streams, C++ manipulators, Stream class, string I/O, char I/O; object I/O, I/O with multiple objects, disk I/O.

III Year

Mathematics: Paper I: Analysis (Paper Code-0898)

CO1: Series of arbitrary terms. Convergence, divergence and Oscillation. Abel's and Dirichlet's test. Multiplication of series. Double series

CO2: Riemann integral. Inerrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus

CO3: Complex numbers as ordered pairs. Geometric representation of Complex numbers. Stereographic projection. Continuity and differentiability of Complex functions

CO4: Definition and examples of metric spaces. Neighbourhoods, Limit points, Interior points, Open and closed sets, Closure and interior.

CO5: Dense subsets. Blaire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem

Mathematics: Paper II: Abstract Algebra (Paper Code-0899)

CO1: Group-Auto morphisms, inner auto morphism. Auto morphism groups and their computations, Conjugacy relation, Normaliser, Counting principle.

CO2: Ring Theory-Ring homomorphism. Ideals and Quotient Rings. Field of Quotients of an Integral Domain, Euclidean Rings, Polynomial Rings, Polynomials over the Rational Field.

CO3: Definition and examples of vector spaces. Subspaces. Sum and direct sum of subspaces, Linear span. Linear dependence, independence

CO4: Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis.

CO5: Inner Product Spaces-Cauchy-Schwarz inequality. Orthogonal vectors. Orthogonal Complements. Orthonormal sets and bases

Mathematics: Paper III: Programming in C & Numerical Analysis (Paper Code-0909)

CO1: Programmer's model of a computer. Algorithms. Flow Charts. Data Types. Arithmetic and input/output instructions. Decisions control structures

CO2: Solution of Equations: Bisection, Secant, Regula Falsi, Newton's Method, Roots of Polynomials: Interpolation: Lagrange and Hermite Interpolation

CO3: Linear Equations: Direct Methods for Solving. Systems of Linear Equations, Iterative Methods, The Algebraic Eigenvalue problem

CO4: Ordinary Differential Equations: Euler Method, Single-step Methods, Runge-Kutta's Method, Multi-step Methods, Milne-Simpson Method.

CO5: Monte Carlo Methods Random number generation, congruential generators, statistical tests of pseudo-random numbers

Computer Science: Paper I: Computer Hardware (Paper Code-0909)

CO1: Basic Components of Micro-computer: Basic Block, Interconnecting Components in a Micro-computer, The Registers of CPU, Memory addressing modes of P-8088

CO2: Block diagram with various parts of PC, The Mother Board of General P.C.: 8088 CPU; ROM & RAM, The Serial I/O ports, COM-1 & COM-2, Video Monitors; Monochrome and color

CO3: Introduction to UNIX, ENIX, SUN, The ROM-BIOS Serial Port Services, INT 14H, The Execution of the programs under DOS

CO4: Logical Structure of a Disk: Organization of disk for use; Boot record, Memory Management under DOS: EXEC loader; Memory Management & its functions;

CO5: Types of interrupts, Filters in operating systems, Setup Installation, Networking features, The Filters Supplied with DOS

Computer Science: Paper II: Computer Software (Paper Code-0910)

CO1: Introduction to DBMS: - Purpose of Data base systems, views of data, E-R Model: Basic concepts, Constraints, Keys

CO2: Relational Model: Structure of Relational Database, Relational Algebra, Domain Relational Calculus, Relational Database Design

CO3: Introduction to personal and Enterprises Oracle, DDL and DML: Creating Table, Rows in as Table, Block Structure in PL/SQL

CO4: Visual Basic: Event Driven Programming, IDE, Variables, Declaring, Scope, Arrays, Saving data to file, Sequential and Random access file

CO5: Concept of DAO, RDO, ADO, input validation, Using the ADO data control, Data Environment & Data Report

Information Technology: Paper II: Fundamental Data Structure (Paper Code-0929)

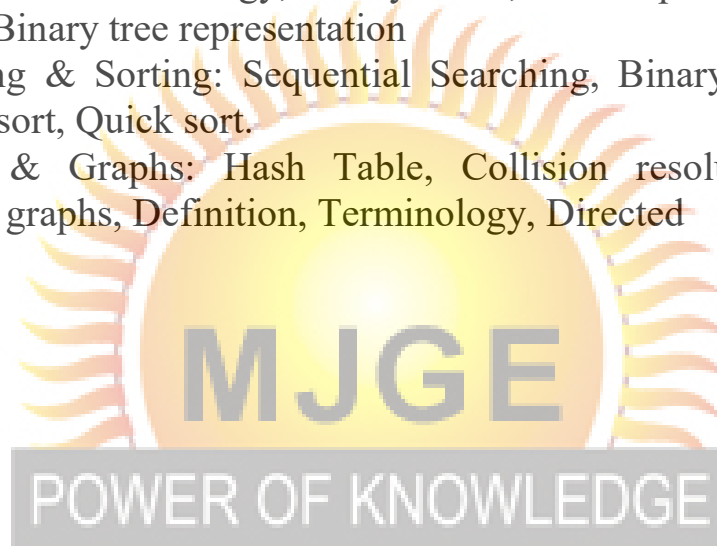
CO1: The concept of data structure, Abstract data structure, Introduction to stack & primitive operation on stack, Stack as an abstract data type

CO2: Introduction to the linked list of stacks, the linked list of queues, Header nodes, doubly linked list

CO3: Trees: Basic Terminology, Binary Trees, Tree Representations as Array & Linked list, Binary tree representation

CO4: Searching & Sorting: Sequential Searching, Binary search, Insertion sort, Selection sort, Quick sort.

CO5: Tables & Graphs: Hash Table, Collision resolution Techniques, Introduction to graphs, Definition, Terminology, Directed



M.Sc.: Master of Science (Mathematics)

Apply the knowledge of mathematical concepts in interdisciplinary fields, Understand the nature of abstract mathematics and explore the concepts in further details. Model the real-world problems in to mathematical equations and draw the inferences by finding appropriate solutions. Employ confidently the knowledge of mathematical software and tools for treating the complex mathematical problems and scientific investigation.

I Semester

Paper-I: Advanced Abstract Algebra (I)

CO1: Groups - Normal and Subnormal series. Composition series. Jordan-Holder theorem. Solvable groups. Nilpotent groups

CO2: Field theory- Extension fields. Algebraic and transcendental extensions. Separable and inseparable extensions

CO3: Perfect fields. Finite fields. Primitive elements. Normal extensions, Splitting field

CO4: Auto morphisms of extensions. Galois extensions. Fundamental theorem of Galois theory

CO5: Solution of polynomial equations by radicals. Insolvability of the general equation of degree 5 by radicals

Paper-II: Real Analysis (I)

CO1: Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test

CO2: Power series, uniqueness theorem for power series, Abel's and Tauber's theorems. Rearrangements of terms of a series

CO3: Functions of several variables, linear transformations, Derivatives in an open subset of \mathbb{R}^n , Chain rule, Partial derivatives

CO4: Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals

CO5: Partitions of unity, Differential forms, Stoke's theorem

Paper-III: Topology

CO1: Countable and uncountable sets. Infinite sets and the Axiom of Choice. Cardinal numbers and its arithmetic. Schroeder-Bernstein theorem

CO2: Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood Systems. Continuous functions and homeomorphism

CO3: Separation axioms; their Characterizations and basic properties. Urysohn's lemma, Tietze extension theorem.

CO4: Compactness. Continuous functions and compact sets. Basic properties of Compactness. Compactness and finite intersection property

CO5: Compactness in metric spaces. Equivalence of compactness, countable compactness and sequential compactness in metric space. Connected spaces.

Paper-IV: Complex Analysis (I)

CO1: Complex integration, Cauchy-Goursat. Theorem. Cauchy's integral formula. Higher order derivatives. Morera's Theorem

CO2: Maximum modulus principle. Schwarz lemma. The argument principle. Rouché's theorem Inverse function theorem

CO3: Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to $\arg z$, $\log z$ and z^a .

CO4: Definitions and examples of conformal mapping Bilinear transformations, their properties and classifications

CO5: Spaces of analytic functions. Hurwitz's theorem. Montel's theorem Riemann mapping theorem.

Paper-V: Advanced Discrete Mathematics (I)

CO1: Formal Logic-Statements. Symbolic Representation and Tautologies. Quantifiers, Predicates and Validity. Propositional Logic

CO2: Homomorphism of semigroups and monoids. Congruence relation and Quotient Semigroups. Sub semigroup and sub monoids

CO3: Lattices-Lattices as partially ordered sets. Their properties. Lattices as Algebraic Systems. Sub lattices, Direct products, and Homomorphism's

CO4: Direct Products and Homomorphism's. Join-Irreducible elements, Atoms and Minterms. Boolean Forms and Their Equivalence

CO5: Grammars and Languages-Phrase-Structure Grammars. Rewriting Rules. Derivations. Sentential Forms. Language generated by a Grammar.

II Semester

Paper-I: Advanced Abstract Algebra (II)

CO1: Modules - Cyclic modules. Simple modules. Semi-simple modules. Schuler's Lemma. Free modules.

CO2: Linear Transformations - Algebra of linear transformation, Singular and non-singular transformation

CO3: Canonical Forms - Similarity of linear transformations. Invariant subspaces. Reduction to triangular forms

CO4: Smith normal form over a principal ideal domain and rank. Fundamental structure theorem for finitely generated modules over a Principal ideal domain

CO5: Rational canonical form. Generalised Jordan form over any field.

Paper-II: Real Analysis (II)

CO1: Definition and existence of Riemann-Stieltjes integral, Properties of the Integral, integration and differentiation.

CO2: Lebesgue outer measure. Measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability

CO3: Measures and outer measures, Extension of a measure. Uniqueness of Extension. Completion of a measure

CO4: The Four derivatives. Lebesgue Differentiation Theorem. Differentiation and Integration **CO5:** Functions of Bounded variation. The L - spaces. Convex functions. Jensen's inequality.

Paper-III: General and Algebraic Topology

CO1: Tychonoff product topology in terms of standard sub-base and its characterizations. Projection maps.

CO2: Product spaces, separation axioms connectedness (Tychonoff's theorem). Compactness

CO3: Embedding and metrization. Embedding lemma and Tychonoff embedding. The Urysohnmetrization theorem

CO4: Nets and filter. Topology and convergence of nets. Hausdorffness and nets. Compactness and nets. Filters and their convergence

CO5: The fundamental group and covering spaces-Homotopy of paths. The fundamental group. Covering spaces

Paper-IV: Advanced Complex Analysis (II)

CO1: Weierstrass' factorisation theorem. Gamma function and its properties. Riemann Zeta function.

CO2: Analytic Continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve

CO3: Harmonic functions on a disk. Harnack's inequality and theorem. Dirichlet Problem

CO4: Canonical products. Jensen's formula. Poisson-Jensen formula. Hadamard's three circles theorem

CO5: The range of an analytic function. Bloch's theorem. The Little Picard theorem. Schottky's theorem

Paper-V: Advanced Discrete Mathematics (II)

CO1: Graph Theory-Definition of (Undirected) Graphs, Paths, Circuits, Cycles, & Subgraphs. Induced Subgraphs.

CO2: Spanning Trees, Cut-sets, Fundamental Cut -sets, and Cycle. Minimal Spanning Trees and Kruskal's Algorithm

CO3: Directed Graphs. In degree and Out degree of a Vertex. Weighted undirected Graphs. Dijkstra's Algorithm

CO4: Introductory Computability Theory-Finite State Machines and their Transition Table Diagrams

CO5: Finite Automata. Acceptors. Non-deterministic Finite Automata and equivalence of its power to that of Deterministic Finite Automata

III Semester

Paper-I: Integration Theory and Functional Analysis (I)

CO1: Signed measure. Hahn decomposition theorem, mutually singular measures. Radon-Nikodym theorem.

CO2: Lebesgue-Stieltjes integral, product measures, Fubini's theorem. Differentiation and Integration

CO3: Baire sets. Baire measure, continuous functions with compact support. Regularity of measures on locally compact spaces

CO4: Normed linear spaces. Banach spaces and examples. Quotient space of normed linear spaces and its completeness

CO5: Weak convergence and bounded linear transformations, normed linear spaces of bounded linear transformations.

Paper-II: Partial Differential Equation and Mechanics (I)

CO1: Examples of PDE. Classification. Transport Equation-Initial Value Problem. Non-homogeneous Equation.

CO2: Heat Equation-Fundamental Solution, Mean Value Formula, Properties of Solutions, Energy Methods

CO3: Generalized coordinates. Holonomic and Non-holonomic systems. Scleronomic and Rheonomic systems

CO4: Poisson's Bracket. Poisson's Identity. Jacobi-Poisson Theorem. Motivating problems of calculus of variations

CO5: Attraction and potential of rod, disc, spherical shells and sphere. Surface integral of normal attraction.

Paper-III(A): Fundamental of Computer Science (Object Oriented Programming and Data Structure)

CO1: Object Oriented Programming-Classes and Scope, nested classes, pointer class members.

CO2: Overloaded functions and operators; Templates including class templates;

CO3: Data Structures-Analysis of algorithms, q , W , 0 , o , w notations; Sequential and linked representations

CO4: Trees: Binary tree- search tree implementation, B-tree (concept only);

CO5: Sorting: Insertion sort, shell sort, quick-sort, heap sort and their analysis; Hashing-open and closed.

Paper-IV(A): Operation Research(I)

CO1: Operations Research and its Scope. Necessity of Operations Research in Industry

CO2: Other Algorithms for Linear Programming-Dual Simplex Method

CO3: Parametric Linear Programming. Upper Bound Technique. Interior Point Algorithm.

CO4: Transportation and Assignment Problems

CO5: Network Analysis-Shortest Path Problem. Minimum Spanning Tree Problem.

Paper-V(A): Programming in C(with ANSI features) (I)

CO1: An overview of programming. Programming language, Classification. C Essentials-Program Development. Functions

CO2: Scalar Data Types-Declarations, Different Types of Integers. Different kinds of Integer Constants. Floating-Point Types

CO3: Control Flow-Conditional Branching. The Switch Statement. Looping. Nested Loops. The break and continue Statements

CO4: Operators and Expressions-Precedence and Associativity. Unary Plus and Minus operators. Binary Arithmetic Operators

CO5: Arrays -Declaring an Array. Arrays and Memory. Initializing Arrays. Encryption and Decryption

IV Semester

Paper-I: Functional Analysis (II)

CO1: Uniform boundedness theorem and some its consequences. Open mapping and closed graph theorems.

CO2: Hahn-Banach theorem for real linear spaces, complex linear spaces and normed linear spaces. Reflexive spaces

CO3: Inner product spaces. Hilbert spaces. Orthonormal Sets. Bessel's inequality. Complete orthonormal sets and Parseval's identity

CO4: Structure of Hilbert spaces. Projection theorem. Riesz representation theorem. Adjoint of an operator on a Hilbert space

CO5: Self-adjoint operators, Positive, projection, normal and unitary operators. Abstract variational boundary-value problem

Paper-II: Partial Differential Equations and Mechanics (II)

CO1: Non-linear First Order PDE-Complete Integrals, Envelopes, Characteristics, Hamilton Jacobi Equations.

CO2: Representation of Solutions-Separation of Variables, Similarity Solutions, Fourier and Laplace Transform

CO3: Asymptotic, Power Series (Non-characteristic Surfaces, Real Analytic Functions

CO4: Hamilton's Principle. Principle of least action. Poincare Cartan Integral invariant. Whittaker's equations

CO5: Hamilton-Jacobi equation. Jacobi theorem. Method of separation of variables. Lagrange Brackets

Paper-III(A): Operating System and Database Management System

CO1: Database Systems-Role of database systems, database system architecture and data modelling.

CO2: Introduction to relational algebra and relational calculus

CO3: Introduction to SQL: Basic features in clouding views; Integrity constraints;

CO4: Operating Systems- Overview of operating system, user interface, processor management

CO5: I/O management, concurrency and Security, network and distributed systems

Paper-IV(A): Operation Research (II)

CO1: Dynamic Programming-Deterministic and Probabilistic Dynamic programming.

CO2: Game Theory-Two-Person, Zero-Sum Games. Games with Mixed Strategies. Graphical. Solution

CO3: Integer Programming-Branch and Bound Technique

CO4: Applications to Industrial Problems-Optimal product mix and activity levels.

CO5: Nonlinear Programming-One/and Multi-Variable Unconstrained Optimization.

Paper-V(A): Programming in C (with ANSI features) (II)

CO1: Storage Classes-Fixed vs. Automatic Duration. Scope. Global variables. The register Specifier

CO2: Pointers Pointer Arithmetic. Passing Pointers as Function Arguments. Accessing Array Elements through Pointers

CO3: Functions-Passing Arguments. Declarations and Calls. Pointers to Functions. Recursion

CO4: Structures and Unions-Structures. Dynamic Memory Allocation. Linked Lists. Unions, enum Declarations

CO5: Input and Output-Streams, Buffering. The <Stdio.h> Header File. Error Handling. Opening and Closing a File

M.Sc.: Master of Science (Computer Science)

To Understand the basic language implementation techniques, develop ability to learn and write small programs in different programming Languages, to classify the problem and apply the appropriate design strategy to develop algorithm, to design algorithm in context of space and time complexity and apply asymptotic notation, to understand detailed architecture, define objects, load data, query data and performance tune NoSQL databases

I Semester

Paper-I: Mathematical Foundation of Computer Science

CO1: Notations, Algebra of Propositions & Propositional functions, logical connectives, Sets, Subsets, Power sets, Complement, Union and Intersection, De-Morgan's law Cardinality

CO2: Lattices as Algebraic System, Sub lattices, some special Lattices, Axiomatic definitions of Boolean algebra as algebraic structures with two operations, Switching Circuits.

CO3: Groups, axioms, permutation groups, subgroups, Definition, Structure, Minimal Polynomials, Irreducible Polynomials

CO4: Simple Graph, Multigraph & Pseudograph, Degree of a Vertex, Types of Graphs, Sub Graphs and Isomorphic Graphs

CO5: Trees, Properties of trees, pendant vertices in a tree, centre of tree, Spanning tree, Binary tree, Tree Traversal

Paper-II: Advance Operating System

CO1: What is operating system, basic concept, terminology, batch processing, spooling, multiprogramming, time sharing, real time systems

CO2: Multi- threaded operating system architecture micro-kernels operating system architecture multiple operating system- subsystem and environments

CO3: Virtual address space, description of user process and kernel, virtual memory architecture of Pentium group of processor

CO4: Deadlock introduction, deadlock characterization, Disk structure, disk attachment, disk scheduling, disk management, RAID structure

CO5: Virtual file systems and v-node architecture, distributed file system, network file system, remote procedure call

Paper-III: Data Structure through algorithms using 'C'

CO1: Basic terminology, Elementary data organization, Data structure, Data structure operation, Algorithms: complexity

CO2: Basic Terminology, Storing String, Character Data Type, String Operations, Word Processing, Pattern Matching Algorithms. Linear Array

CO3: Linked list, Representation of linked lists in memory, traversing a linked list, Searching a linked list, Memory Allocation; Garbage Collection,

CO4: Binary Trees, Representing Binary Trees in Memory, traversing binary tree, Traversal Algorithms using stacks, header nodes; threads

CO5: Sorting, Insertion Sort, Selection Sort, Merging, Merge Sort, Radix Sort, Searching and data modification, hashing

Paper-IV: Object Oriented Programming using ‘C++’

CO1: Advantages of OOP, The Object Oriented Approach, History of C++, Data Types, Constants and Variables

CO2: structures, specify the structures, defining a structure variable, Passing Value, Reference Argument, Passing struct variable

CO3: Object and Class, Using the class, class construct, class destructors, object as function argument, struct and classes

CO4: Pointers:& and * operator pointer variables, pointer to void, pointer and array, pointer and function, pointer and string

CO5: Virtual member function, accesses with pointer, Late binding, File and Stream: C++ streams, Stream class

Paper-V: Computer System Architecture

CO1: Number system, Integer & Floating point representation Character code (ASCII, EBCDIC), Error Detect and Correct code

CO2: Concepts of bus, data movement along registers, a language to represent conditional data transfer, data movement from its memory

CO3: Instruction code, Computer Instructions, Timing and Control, Execution of Instruction, Input and Output Interrupt, Design of Computer

CO4: Programming Language, Assembly Language, Assembler, Program Loops, Input /Output Programming, System Software. Central Processor Organization

CO5: Input –Output Organization: Peripheral Devices, Input/output Interface, Memory Organization: Auxiliary Memory

II Semester

Paper-I: RDBMS (SQL Programming with Oracle)

CO1: Data, Information and knowledge, Increasing use of data as a corporate resource, data processing verses data management

CO2: Entity - Relationship model as a tool for conceptual design-entities, Relational Algebra: select, project, cross product different types of joins

CO3: SQL constructs, Nested queries, and correlated nested queries,Types – internal, user-defined

CO4: PL/SQL tables and records, Functions - procedures – input-output parameters

CO5: Normalization concept in logical model, Normal forms, Data Organization

Paper-II: Advance Computer Network

CO1: The Concept of Networking, Data Communication, Required network elements, The role of Standards Organization, Design Issues for the Layers. Interfaces and services,

CO2: Shannon's and Nyquist theorems for maximum data rate of a channel, The Concept of Multiplexing- FDM, TDM, WDM. The Concept of Switching- Circuiting

CO3: Line Discipline, Flow Control- stop and wait, sliding window, Routing algorithms- shortest path first, Distance Vector, Link State

CO4: The Concept of client and Server in terms of Socket addressing in Transport layer, The concept of ATM

CO5: X.25, Frame Relay, ATM, SONET, SMDS, ISDN, The importance of Security in Networking

Paper-III: Programming in Visual Basic

CO1: The Visual Basic Program Development Process, Numeric Constants; String Constants; Variables; Data Types and Data Declarations; Operators and Expressions

CO2: Visual Basic Control Tools; Control tool Categories; Working with controls; Naming Forms and Controls; Building Drop-down Menus

CO3: Syntax Errors; Logical Errors; Setting break Points; Defining Watch Values, Modules and Procedures, Array, Object Oriented Principles

CO4: Introduction to ActiveX Components and Component Object Model, Creating an ActiveX Control; Benefits of ActiveX Control,

CO5: Data Access Technology with VB; The ActiveX Data Object Model; Advantages of ADO, Data Environment Designers

Paper-IV: Principles of Compiler Design

CO1: Introduction to Compilers: Overview, Structure, implementation. Programming Language Grammars: Inter Language grammars

CO2: Scanning and Parsing Techniques: The Scanner, parser, translation, elementary symbol table organization, structures

CO3: Memory Allocation: Static and dynamic memory allocation, array allocation and access, allocation for strings, structure allocation

CO4: Compilation of Control Structures: Control transfers, procedural calls, conditional execution, integration control constructs

CO5: Code Optimization: Major issues, optimizing transformations, local optimizations, program flow analysis, Global Optimization

Paper-V: Numerical Analysis

CO1: Bisection method, Regula-falsi method & Newton's method, Solution of Cubic & Biquadrate Equation

CO2: Gauss-Jordan method, Cholesky's method, Reduction to lower or upper Triangular forms, Inversion of matrix, method of partitioning

CO3: Divided difference table for evenly or unevenly spaced data, polynomial curve-fitting - Newton's, Gauss and Lang ranges form of interpolation

CO4: Forward and Backward differential operators, Newton - cotes integration formula: Trapezoidal Rule, Simpson's Rule

CO5: Numerical Solution of ordinary differential equations, one step method, Taylor's Series, Predictor- Corrector Method

III Semester

Paper-I: Programming in Java

CO1: History and features of Java, Difference between C, C++ & JAVA, Structure of Java program, JAVA tokens and Statements, Constants & Variables, Data types, Operators

CO2: Specifying sub class, types of inheritance, visibility control: public, private, protected, package, packages, naming conventions, Creation threads, Extending Thread class

CO3: Managing errors, types of errors, exceptions, Java I/O package, Byte/Character Stream, Applet Vs. Application, Creating applets, life cycle

CO4: Components and Graphics, Containers, Frames and Panels, Layout Managers, Border layout, Java database connectivity, Types of JDBC drivers

CO5: Networking basics, Sockets, port., Internet addressing, Introduction Servlet API Overview, Writing and running Simple Servlet

Paper-II: Computer Graphics

CO1: Introduction of computer Graphics and its applications, Overview of Graphics systems, Video display devices, Raster scan display

CO2: Line drawing algorithms, DDA, Bresenham's, Circle generating, Mid-point circle algorithm, Ellipse generating

CO3: Basic transformation's, Translation, Rotation, Scaling, Matrix representation's & homogeneous co-ordinates, Composite transformation's

CO4: Spline representation, Cubic spline, Bezier curve, Bezier surfaces, Beta spline, B-spline surfaces, B-spline curve

CO5: Fractal's geometry Fractal generation procedure, Classification of Fractal, Fractal dimension, Fractal construction methods.

Paper-III: Linux

CO1: Introduction to Multi-user System, Emergency and history of Unix, Feature of Unix File System

CO2: Introduction to shell feature, wild card characters, i/out redirections, standard error redirection, system and user created shell variables

CO3: Features, changing the login shell, cshrc, login, logout files, Process management, process states and transition

CO4: I/O Sub system, terminal drives, disk drives, messages, shared memory, semaphores, memory management, System Calls

CO5: Process and Scheduling, Security, Basic System Administration: - Adding a User, User Passwords, Delete of a User

Paper-IV: Image Processing

CO1: Digital Image fundamentals: Introduction, An image model, sampling & quantization, basic relationships between Pixels, imaging geometry

CO2: Image Transforms: Properties of 2 – D Fourier transform, FFT algorithm and other separable image transforms

CO3: Image Enhancement: Background, enhancement by point processing, Image filtering and restoration: degradation model

CO4: Image compression: Fundamentals, image compression modes, Image segmentation: Detection of discontinuities

CO5: Representation and description: Various schemes for representation, boundary descriptors, Image reconstruction from Projections

Paper-V: Object Oriented Design Analysis and Design

CO1: Two views of software Developments: SSAD and OOAD, Object Oriented Design –Booch, Object Modelling Techniques

CO2: Unified Approach: Diagramming and Notational Techniques using the UML, UML Notation, Generalization/Specialization, Aggregation and composition, Rational Unified Process, Four Major phases

CO3: Behavioural Analysis, Domain Analysis or Business Object Analysis, Use-case Driven Object Oriented analysis

CO4: Translating Analysis Concept into Design, Optimizing classes and Objects: The Multi- Tiered Architecture View, Mapping System functions to objects.

CO5: Designing for Extensibility, Design for reusability, The Cood Data Management Domain, Object Persistence

IV Semester

Paper-I: Software Engineering

CO1: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Requirement engineering, requirement elicitation techniques like FAST

CO2: Size Estimation like lines of Code & Function Count, Cost Estimation Models, COCOMO, Cohesion & Coupling, Classification of Cohesiveness

CO3: Software measurements: What & Why, Token Count, Importance, Hardware Reliability & Software Reliability, Failure and Faults

CO4: Testing process, Design of test cases, Introduction to functional testing, Integration and System Testing, Debugging, Alpha & Beta Testing

CO5: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing

Paper-II: Artificial Intelligence and Expert System

CO1: The AI problems; what is an AI technique, General problem solving; production systems; control strategies: forward and backward and backward chaining

CO2: Hill climbing; Branch and Bound technique, Minimax search procedure; Alpha-Beta cut-offs; Additional Refinements

CO3: First order predicate calculus; Solemnization Resolution principle, Introduction to Lisp, Syntax and Numeric functions; List manipulation functions

CO4: Parsing technique; context—context- free grammar, An example Domain: The Blocks Word; Component of planning systems

CO5: Introduction to expert systems and Applications, Role learning; learning by induction

Paper-III: Data Mining and Data Warehouse

CO1: What is data mining? Data Mining: On what kind of data? Data mining functionality, Are all the patterns interesting? Classification of data mining systems

CO2: Why pre-process the data? Data cleaning, Data integration and transformation, Data reduction, Discrimination and concept hierarchy generation

CO3: Association rule mining, mining single-dimensional Boolean association rules from transactional databases, Mining multilevel association rules from transactional databases

CO4: What is classification? What is prediction? Issues regarding classification and prediction, Classification by decision tree induction, Bayesian Classification

CO5: Multidimensional analysis and descriptive mining of complex data objects, mining spatial databases, mining multimedia databases, Mining time-series and sequence data

P.G.D.C.A.

The broad objective of the PGDCA programme is to prepare Post Graduates for productive careers in software industry, corporate sector, govt. organisations and academia by providing skill based environment for teaching and research in the core and emerging areas of the discipline. PGDCA graduates who will have successful careers based on their understanding of formal and practical methods of Application Development using the concepts of computer programming, software and design principles

I Semester

Paper-I: Introduction to Software Organization

CO1: Computers – Introduction, Computer System Characteristics, Strength and Limitations of Computer, Development of Computers, Types of Computers

CO2: Central Processing Unit – Arithmetic Logic Unit, Control Unit, Registers, Instruction Set, Processor speed. Storage Devices.

CO3: Basics of Software – needs of Software, Types of Software; Free Domain Software; Open Source Software; Compiler, Interpreter and Assembler

CO4: Introduction, Comparison between Human and Computer Language; Program; Data, Information and Knowledge; Characteristics of Information

CO5: Communication – Introduction, Communication process, Communication Types, Communication Protocols, Communication Channels/Media. Networks – Introduction; Types of Network

Paper-II: Programming in ‘C’

CO1: Introduction Character set, Identifiers and Keywords, Variables, displaying variables, Reading Variables, Character and Character String, Qualifiers

CO2: Control Structure: If - statement, If -else statement, Multi decision, Compound Statement, Loops: For - loop, While -loop, Do-While loop

CO3: Function main, Functions accepting more than one parameter, User defined and library functions, Concept associatively with functions, Arrays

CO4: Pointers: Definition and use of pointer, address operator, pointer variable, referencing pointer, void pointers, pointer arithmetic

CO5: Declaring and using Structure, Structure initialization, Structure within Structure, Operations on Structures, Array of Structure, Array within Structure

Paper-III: Office Automation & Tally

CO1: Windows Concepts, Features, Structure, Desktop, Icons, Taskbar, Start Menu, My Computer, Recycle Bin, my document, creating shortcut. Accessories

CO2: Word: Creating, Editing, & Previewing Documents, Formatting, Advanced Features, Worksheet Basics, Creating, Opening, & Moving in Worksheet

CO3: Creating a presentation, modifying visual Elements, adding objects, Applying Transitions, animations and linking, preparing handouts, presenting a slide show

CO4: Introduction to MS Access, The Tables of a Database, Introduction to the Record of a Table, Introduction to Controls Design, Details on Controls Design, The Characteristics of a Table, The Characteristics of a Form

CO5: Setting up Ledger & Groups. Study of recording of transactions in the 'Voucher', Study of Final A/C preparation

II Semester

Paper-I: Programming in Visual Basic

CO1: Editions of Visual Basic, Event Driven Programming, Terminology, working environment, Introduction to objects, controlling objects, Properties, methods and events, Working with forms

CO2: Overview of variables, Declaring, Scope, arrays, User-defined data types, Comparison and logical operators, if...Then statements, Select Case Statements looping structures

CO3: Types of controls, Overview of standard controls, Combo Box and List Box, Overview of run-time errors, error handling process, The Err object, Errors and calling chain, Errors in an error-handling routine

CO4: Sequential and Random Files - Saving data to file, basic filling, data analysis and file, Overview of ActiveX data Objects, Visual Basic data access features

CO5: Overview of Report, Data Report, add groups, Data Environment, Connection to database, Overview of drag and drop, Mouse events, Drag-and drop basics, Date Time Control, Calendar

Paper-II: Database Management System

CO1: Data, Information and knowledge, concept of DBMS, Advantages of DBMS, data independence, database administration roles, DBMS architecture

CO2: Entity - Relationship model as a tool for conceptual design-entities, attributes and relationships. ER diagrams

CO3: Structure to Relational Database, Relational Algebra, Extended Relational- Algebra Operation, Simple and complex queries

CO4: Pitfalls in Relational Database Design, Decomposition, Functional Dependencies, Normalization: 1NF, 2NF, BCNF, 3NF, 4NF, 5NF

CO5: Creating Table, Specify Integrity Constraint, Modifying Existing Table, Management of Roles, Changing Password, Granting Roles & Privilege

Paper-III: Essentials of E-Commerce and HTML

CO1: The scope of E-commerce; Size, growth and future projection of E-commerce Market Worldwide and in India; Internet and its impact on traditional businesses

CO2: Security of Data/Information in Internet/web environment; Client security, Network security; Virus protection and Hacking

CO3: Concept of a Web Site, Web Standards, what is HTML? HTML Versions, Naming Scheme for HTML Documents,

CO4: Netscape, Microsoft and Advanced Standard Elements List, FONT, BASEFONT and CENTER. Insertion of images using the element IMG

CO5: Concept of static web pages and dynamic web pages. Hosting & promotion of the web site, Domain Name Registration, Web Space allocation

