HIMACHAL PRADESH UNIVERSITY

MASTER OF COMPUTER APPLICATIONS (MCA)
Effective: MCA I year from 2021
MCA II year from 2022

Duration: 2 Years (4 Semesters)

Eligibility:

Bachelor of Computer Applications (BCA) /B.Sc.(Computer Science)/ B.Sc. (IT)/ BA(Computer Science)/ BA (IT) OR any Graduate with 20-24 credits in the subjects of computer OR any graduate with minimum of 6 courses of computer studied in graduation (in case of degree not in credit system) with at least 50% marks (45% in case of SC/ST) from a university established by law in India.

Age Limit:

Maximum age limit for admission to MCA course is 26 years for general category, 29 years for SC/ST category and 28 years for girl candidates, as on the 1st July of the year concerned. The Vice-Chancellor may permit age relaxation up to a maximum of six months.

Basis of Admission:

The admission to MCA course will be made on the basis of merit of the Entrance Examination (written test) conducted by H.P. University.

Written Test 100 Marks

Duration 1:30 hours

The written test will consist of one paper of 100 marks and of 1:30 hour's duration and shall include the following three sections:

Section	Contents	Marks
A	General logical ability & aptitude	20
B	Mathematics of +2 level	20
C	Computer Awareness	60
Total		100

The minimum qualifying marks in the Entrance Examination (written test) for subsidized as well as non-subsidized seats will be 35% i.e. 35 marks out of total of 100 marks.

Reservation for MCA:

I). Subsidized Seats

(a) (i) 15% and 7.5% of the seats shall be reserved for bonafide Himachali Scheduled Castes and Scheduled Tribes candidates respectively who have passed their qualifying examination from Himachal Pradesh University or from any other University established by law in India which is equivalent to the qualifying examination of H.P. University.

(b) The remaining seats shall be filled as under

(i) 25% seats shall be open for all the candidates irrespective of the institution from where they have passed their qualifying examination.
(ii) 75% of the seats shall be filled out of the candidates who have passed their qualifying examination from Himachal Pradesh University or H. P. Krishi Vishva Vidyalaya or Dr. Y. S. Parmar University of Horticulture and Forestry or Himachal Pradesh Technical University or Central University of Himachal Pradesh or the candidates who are Himachal Pradesh domicile irrespective of passing qualifying examination from any other university established by law in India which is equivalent to the qualifying examination of Himachal Pradesh University, subject to the following reservation: 5% of the seats shall be reserved for Physically Handicapped candidates with a minimum of 40% disability and who are Himachal Pradesh Domicile.

(c) Two supernumerary seats shall be reserved for Himachali Bonafide only single child who is a girl. In this respect, an affidavit issued by a competent authority in original shall have to be submitted by the candidate at the time of counselling.

(d) There are 10% additional seats reserved for the Economically Weaker Section (EWS) category for admission. If these seats remain vacant then these seats neither be filled with other category nor will carry forward.

(e) Two supernumerary seats shall be reserved for the students of the state of Jammu and Kashmir Migrants.

(f) Few Supernumerary seats for foreign National who apply through ICCR are also available as per H.P. University Rules.

II) Non-Subsidized Seats

(a) 15% and 7.5% of the seats shall be reserved for bonafide Himachali Scheduled Caste and Scheduled Tribe candidates respectively who have passed their qualifying examination from Himachal Pradesh University or from any other University established by law in India which is equivalent to the qualifying examination of H.P. University.

(b) The remaining seats shall be filled as under
(i) 25% seats shall be open to all the candidates irrespective of the institution from where they have passed their qualifying examination, in which the graduates of this University shall also be eligible to compete through competitive test.
(ii) 75% of the seats shall be filled out of the candidates who have passed their qualifying examination from Himachal Pradesh University or H. P. Krishi Vishva Vidyalaya or Dr. Y. S. Parmar University of Horticulture and Forestry or Himachal Pradesh Technical University or Central University of Himachal Pradesh or the candidates who are Himachal Pradesh domicile irrespective of passing qualifying examination from any other university established by law in India which is equivalent to the qualifying examination of Himachal Pradesh University.

(c) Three supernumerary seats shall be reserved for wards of H.P. University Employee.

Scheme of Examination:

English shall be the medium of instruction and examination. The pass marks in each course shall be 40% in each written paper and in the internal assessment separately, and 40% in viva-voce, project work and semester course and 50% in the aggregate subject to the conditions that aggregate shall be determined at the end of the examination. Other rules shall be as per the rules of the university.

Theory Papers:

Each paper will be of 100 marks (75 marks for theory exam and 25 marks for internal assessment) and duration of each paper will be 3 hours. In respect of theory papers 25 marks in each paper shall be reserved for award of internal assessment based on such work as assignments/practical/periodical tests/quiz etc.

Practical Examination

Each paper will be of 100 marks (50 marks for practical exam and 50 marks for internal assessment) and duration of each paper will be 3 hours. In respect of practical papers, 50 marks shall be reserved for internal assessment in similar manner.

The marks awarded by the teacher on account of internal assessment in relation to theory/practical paper as mentioned above shall be submitted to the office of Chairman.
Conduct: Practical exam will be conducted by the external examiner from the panel submitted by Chairman, Department of Computer Science, Himachal Pradesh University and duly approved by the university authority/evaluation branch, Himachal Pradesh University, Shimla.

Project Work:

In 2nd year (fourth semester) the student has to develop one software project, which will be evaluated by the external examiner from the panel submitted by Chairman, Department of Computer Science, Himachal Pradesh University, and duly approved by the university authority/evaluation branch, Himachal Pradesh University, Shimla on the following basis:

System Development Project

System Design	100 Marks
Log Book and Interim Report	100 Marks
Seminars (2)	100 Marks
Project Report (3 + 1 Copies)	200 Marks
Viva-Voce	100 marks
Total	600 Marks

In fourth semester, the Chairman/Head of the Department will assign a guide/supervisor, to each candidate for his/her project work. The candidate shall be required to maintain his/her project diary (logbook) of work in the organization. Each student will be required to give at least two seminars on his/her project work. Each student is required to submit three copies of his/her project reports in the Department after completion of the project work which will be evaluated by external examiner.

S. No	Course No.	Paper	Credits	Lecture Hrs/ week	Tutorial Hrs/ week	Univ. Exam Marks	Internal Assess-ment
		First Year					
		Semester 1					
1	MCA-101	Programming Methodologies Using C	4	3	1	75	25
2	MCA-102	Data Structures & Algorithm Analysis	4	3	1	75	25
3	MCA-103	Computer Organization & Architecture	4	3	1	75	25
4	MCA-104	Data Communication & Computer Networks	4	3	1	75	25
5	MCA-105	Operating System	4	3	1	75	25
6	MCA-111	Practical-1(C)	2	6		50	50
7	MCA-112	Practical-2 (Data Structures & Algorithm Analysis)	2	6		50	50
		Semester 2					
1	MCA-201	Programming with Python	4	3	1	75	25
2	MCA-202	Data Base Management System	4	3	1	75	25
3	MCA-203	Software Engineering	4	3	1	75	25
4	MCA-204	Computer Graphics	4	3	1	75	25
5	MCA-E01	Elective – 1	4	3	1	75	25
6	MCA-211	Practical – 3 (Python)	2	6		50	50
7	MCA-212	Practical – 4 (DBMS)	2	6		50	50

S. No	Course No.	Paper	Credits	Lecture Hrs/ week	Tutorial Hrs/ week	Univ. Exam Marks	Internal Assess-ment
		Second Year					
		Semester 3					
1	MCA-301	Data Mining Using R	4	3	1	75	25
2	MCA-302	Web Technologies	4	3	1	75	25
3	MCA-303	Information Security	4	3	1	75	25
4	MCA-E02	Elective - 2	4	3	1	75	25
5	MCA-E03	Elective - 3	4	3	1	75	25
6	MCA-311	Practical-5 (R)	2	6		50	50
7	MCA-312	Practical-6 (Web Technologies)	2	6		50	50

S. No	Course No.	Paper	Credits	Univ. Exam Marks
Semester – 4				
1	MCA-401	System Development Project		
	(a)	System Design	4	100
	(b)	Log Book and Interim Report	4	100
	(c)	Seminars (2)	4	100
	(d)	Project Report (3+1 Copies)	6	200
	(e)	Viva-Voce	6	100

ELECTIVES

S. No	Course	Paper
1	MCA-E01	Theory of Computation
2	MCA-E02	Artificial Intelligence & Expert Systems
3	MCA-E03	Cloud Computing
4	MCA-E04	Cyber Law
5	MCA-E05	Distributed Data Base Management System
6	MCA-E06	Management of Software Projects
7	MCA-E07	Open Source Software
8	MCA-E08	Image Processing
9	MCA-E09	Distributed Systems
10	MCA-E10	Object-Oriented Software Engineering
11	MCA-E11	Simulation and Modeling
12	MCA- E12	Software Quality and Testing

Total Credits 96

MCA – 101 Programming Methodologies Using C **L** **T**
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Course Objectives:
This is an introductory course and covers the key features of the C language and its usage. The first unit help in thoroughly understanding the C syntax and basic programming paradigms. The remaining chapters focus on more complex concepts of the C language. This course will briefly touch upon some miscellaneous features and the mechanism used in the implementation of the same.

UNIT – I

Programming Tools- Problem analysis, Program constructs (sequential, decision, loops), Algorithm, Flowchart, Pseudo code, Decision table, Modular programming, Top Down and Bottom up approaches, Concept of High Level Languages, Low Level Languages, Assembly Languages, Assembler, Compiler, Interpreter, Type of errors.
Introduction- What is C, getting started with C, the first C program, compilation and execution, receiving input, C instructions, control instructions in C.
Decision Control Structure- if statement, if-else statement, use of logical operators, conditional operators.
Loop Control Structure- loops, while loop, for loop, odd loop, break statement, continue statement, do-while loop,
Case Control Structure- decisions using switch, switch vs if-else ladder, goto keyword.

UNIT – II

Functions and Pointers- what is a function, passing values between functions, scope rule of functions, calling convention, one dicey issue, function declaration and prototypes, call by value and call by reference, an introduction to pointers, pointer notation, back to function calls, recursion, recursion and stack, adding functions to the library.
Data Types Revisited- integers, long and short; integers, signed and unsigned; chars, signed and unsigned; float and double, storage classes in C.
C Preprocessor- features, macro expansion, file inclusion, conditional compilation, #if and #elif directives, miscellaneous directives.

UNIT – III

Arrays- what are arrays, array initialization, bounds checking, passing array elements to a function, pointers and arrays, two dimensional arrays, array of pointers, three dimensional array.
Strings- what are strings, more about strings, pointers and strings, standard library string functions, two-dimensional array of characters, array of pointers to strings, limitation of array of pointers to strings.
Structures- declaring a structure, accessing structure elements, how structure elements are stored, array of structures, additional features of structures, uses of structures.

UNIT – IV

Console Input/Output- types of I/O, console I/O functions.
File Input/Output- data organization, file operations, counting characters, tabs, spaces, file opening modes, string I/O in files, record I/O in files, text files and binary files, using argc and argv.
Miscellaneous Features- Enumerated data type, renaming data types with typdef, typecasting, bit fields, pointers to functions, functions returning pointers, functions with variable number of arguments, unions.

Text Book-

1.Yashwant Kanetkar, “Let us C”, BPB Publications.

Reference Books-

1.Mullis Cooper, “Spirit of C”, Jacob Publications.
2.Kerninghan B.W. & Ritchie D. M., “The C Programming Language”, PHI Publications.
3.Yashwant Kanetkar, “Pointers in C”, BPB Publications.
4.Gotterfied B., “Programming in C”, Tata McGraw Hill Publication

Course Outcomes:

By the end of the course, students will be able to
CO 1: Able to implement the algorithms and draw flowcharts for solving Mathematical and Engineering problems.
CO 2: Demonstrate an understanding of computer programming language concepts.
CO 3: Able to develop C programs and run them.
CO 4: Analyse and interpret the concept of pointers, declarations, initialization and ‘ ‘ operations on pointers and their usage.
CO 5: Able to define structure, union and enumeration user defined data types.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA – 102 Data Structures and Algorithm Analysis

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Course Objectives:

The objective of this course is to provide basic to advance level of knowledge to student regarding various types of data structures and to provide knowledge regarding various problem solving techniques like greedy, divide and conquer, dynamic and backtracking.

UNIT-I

Data Structures: Arrays and their Applications; Sparse Matrix, Stacks, Application of stacks (converting arithmetic expression from infix notation to polish and their subsequent evaluation, quick sort technique to sort an array, recursion),Queues, Priority Queues, Linked Lists(traversal, insertion, deletion),type(linear, circular, doubly linked, inverted), Trees, Binary Tree, Binary Search Tree, AVL Tree, Hashing.

UNIT –II

Performance Analysis of Algorithms and Recurrences: Time and Space Complexities; Asymptotic Notation, Recurrence Relations.

Divide and Conquer: The General Method, Merge Sort, Quick Sort, Selection sort.

The Greedy Method: The General Method Knapsack Problem, Job Sequencing With Deadlines, Huffman Coding.

UNIT-III

Graph Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Minimum Spanning Trees(Kruskal's Algorithm, Prim's Algorithm).

Dynamic Programming: The General Method Multistage Graphs, All Pairs Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack, Traveling Salesperson Problem.

UNIT – IV

Back Tracking: The General Method, The 8 Queens Problem, Sum Of Subsets, Graph Coloring, And Hamiltonian Cycles.

Complexity Theory: P and NP Class Problems; NP-completeness and Reducibility.

Text Book:

1. Seymour Lipschutz, "Data Structures", McGraw Hill Education.

Reference Books:

1. *Parag* H. *Dave*, *Himanshu* B. *Dave,* Design and Analysis of Algorithms, *Pearson* Education (2007).
2. Jean Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw Hill Publications.
3. Robert L. Kruse,"Data Structures & Program Design", PHI Publications.
4. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, Prentice-Hall of India, 2006.

5. J. Kleinberg and E.Tardos, Algorithms Design, Pearson Education, 2006.

Course Outcomes:

By the end of the course, students will be able to
CO 1. Implement different types of data structures.
CO 2. Differentiate between various types of problem solving techniques.
CO 3. Calculate the complexity of a problem.
CO 4. Differentiate between N and NP problems.
CO 5. Solve problems related to graph theory.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA-103 Computer Organization & Architecture L T
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Course Objectives:
To introduce the fundamental concepts of digital computer organization and architecture. To develop a basic understanding of the building blocks of a digital computer system. To enable understanding of how these building blocks are organized together to architect a digital computer system. To enable understanding of how various functional units of a digital computer system interacts to meet the processing requirements of the user.

UNIT – I

Digital Logic Circuit: Digital Computers, Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Flip Flops, Sequential Circuits
Digital Components& Data Representation: Decoders, Multiplexers, Registers, Shift Registers, Binary Counters, Memory Units, Data Types, Complements, Fixed Point Representation, Floating Point Representation, Other Binary Codes, Error Correction Codes

UNIT – II

Register Transfer and Micro-operations: Register Transfer Language, Register transfer, Bus and Memory Transfer –Three State Bus Buffer, Memory Transfer; Arithmetic Micro-operations – Binary Adder, Binary Adder-Subtractor, Binary Incrementer, Arithmetic Circuit; Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit.
Basic Computer Organization: Instruction codes – Stored Program Organization, Indirect Address; Computer Registers – Common Bus System; Computer Instructions – Instruction Set Completeness; Timing and Control; Instruction Cycle – Fetch and Decode, Determine the Type of Instruction, Register-Reference Instructions; Memory Reference Instructions; Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic

UNIT – III

Programming the Basic Computer: Machine Language, Assembly Language, Introduction to Assembler, Program Loops, Programming Arithmetic and Logic Operations
Micro programmed Control: Control Memory, Address Sequencing – Conditional Branching, Mapping of Instructions, Subroutines, Micro program Example – Computer Configuration, Microinstruction Format, Symbolic Microinstructions, Fetch Routine, Symbolic Micro program, Binary Micro program, Design of Control Unit – Micro program Sequencer
Central Processing Unit: Introduction, General Register Organization, Stack Organization – Register Stack, Memory Stack, Reverse Polish Notation, Evaluation of Arithmetic Expressions, Instruction Formats – Three-, Two-, One- and Zero-Address

Instructions, Addressing Modes, Data Transfer and Manipulation, Program Control – Status Bit Conditions, Conditional Branch Instructions, Subroutine Call and Return, Program Interrupt, Types of Interrupt, RISC & CISC Characteristics, Overlap Register Window

UNIT – IV

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors

Computer Arithmetic – Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operations, Decimal Arithmetic Unit and Operations

Input-Output Organization: Peripheral Devices, Input-Output Interface, Modes of Transfer – Programmed I/O, Interrupt-Driven I/O, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware

Text Book:

1. Computer System Architecture, by M. Morris Mano, Third Edition. 2007. Low Price Edition. Pearson Education

Reference Books:

1. Computer Architecture and Organization, by John P. Hayes. Third Edition. 2017. McGraw Hill Publication.
2. Computer Organization and Architecture: Designing for Performance, by William Stallings. Tenth Edition. 2016. Pearson Education India.

Course Outcomes:

By the end of the course, Students will be able to

CO 1: Explain the working of arithmetic, logic and shift units in a computer system

CO 2: Elucidate the role of instruction set and instruction cycle in program execution

CO 3: Explain concept of interrupts and their handling

CO 4: Elucidate significance of stack and instruction formats

CO 5: Explain various mode of data transfer between memory and I/O devices

CO 6: Elucidate organization and operation of – main memory, auxiliary memory, associative memory and cache memory

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA – 104 Data Communication & Computer Networks

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Course Objectives:

The key objective is to acquire a foundational understanding of computer network and communication technologies. As part of this course, students will be introduced to network models and standards, network protocols and their use, wired and wireless technologies, network security and detailed description of all layers in ISO/OSI and TCP/IP.

UNIT – I

Introduction: Data Communication, Network Components, Protocol & Standards, Standard Organization, Topologies, Transmission modes, Categories of Networks, Uses, Applications. The OSI Reference Model: Layered architecture, Functions of layers, TCP/IP reference model, Comparison of OSI & TCP/IP models.

Physical layer: Guided and wireless transmission media, Magnetic, twisted pair, coaxial cable, fibre optics, radio, microwave, infrared, Communication satellites, **IEEE standards**: 802.3 (Ethernet), 802.4 (TokenBus), 802.5 (Token Ring), 802.11(Wireless LAN), 802.15 (Bluetooth)

UNIT – II

Data Link and Mac Layer: Design issues, Framing techniques, Flow control, Error Control, Error Detecting code and Error Correcting codes, Data link Control and Protocols-- For noiseless Channel – Simplest Protocol, Stop-and-Wait Protocol, For Noisy Channel-- Stop-and-Wait ARQ, Go-Back-N ARQ, and Selective-Repeat ARQ Protocol, HDLC Protocol, and PPP Protocol, Multiple Access-- Random Access-- MA, CSMA, CSMA/CD, CSMA/CA, Controlled Access—Reservation, Polling, Token passing, Channelization--FDMA, TDMA, CDMA.

UNIT – III

Network Layer: Network layer design issues, Addressing, Routing algorithms-shortest path routing, flooding, distance vector routing ,link state routing, hierarchical routing, broadcast routing, multicast routing, routing for mobile hosts, Congestion Control algorithms – congestion prevention policies, congestion control in virtual circuit & datagram sub-networks, definition of quality of service, Internetworking – Tunneling, internet-work routing, fragmentation, Network layer in Internet –IP protocol, IP Address, OSPF, BGP, Internet multicasting, Mobile IP, IPv4, IPv6,Internet radio, VoIP.

Transport Layer: Concept of transport service, elements of transport protocols, TCP and UDP, A simple transport protocol, Remote procedure call, Performance issues in computer networks.

UNIT – IV

Application layer services &protocols: Domain name system, SMTP, File transfer protocol, HTTP, HTTPS, TELNET, World Wide Web.

Network Security: Attacks on Computers & Computer security-- Need for security, approaches, principles, types of attacks, Cryptography concept and techniques, Symmetric Key algorithms-- (DES), Asymmetric key algorithms--RSA, Digital signature , Firewalls. E-mail security, Web security, social issues in network security.

Text Book-

1. B.A. Forouzan, "Data Communication & Networking", 4th Edition Tata Mcgraw Hill.

Reference Books:

1. A.S. Tanenbaum, "Computer Networks", Prentice Hall, 1992, 4th edition.
2. William Stallings, "Data & Computer Communication", McMillan Publishing Co.
3. Black, "Data Networks", PHI, 1988.
4. Fred Halsall, "Data Communications, Computer Networks", Pearson Education.

Course Outcomes:

By the end of the course, Students will be able to

CO 1. Independently understand basic computer network technology.
CO 2. Understand and explain Data Communications System and its components.
CO 3. Different types of network topologies and protocols.
CO 4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
CO 5. Identify the different types of network devices and their functions within a network.
CO 6. Understand and build the skills of subnetting and routing mechanisms.
CO 7. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Note: In each theory paper, nine questions are to be set. Two questions are to set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA – 105 Operating System **L T**
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Course Objectives

The objective of this course is to provide basic as well as advance knowledge of functions of operating system. The entire course is divided into four parts; first unit covers the various types of operating system. Second unit is about process management where student can get the knowledge of basic to advance level of the process management. The third unit will clear the functional concept of memory management. Fourth unit is about file structure of the operating system.

UNIT – I

Introduction: Definition Of The Operating System, Functions Of An Operating System, Different Types Of Systems - Simple Batch System, Multi-Programmed Batched System, Time Sharing System, Personal Computer Systems, Parallel Systems, Distributed Systems, Real Time Systems, Computer System Structure-operation, I/O structure, storage structure, hardware protection, Operating System Services.

UNIT – II

Process Management: Process- Process Concept, Process Scheduling, Operation On Processes, Cooperating Processes, Threads, Inter-Process Communication, CPU Scheduling–scheduling criteria, scheduling algorithms – FCFS, SJF, priority scheduling, round robin scheduling, multilevel queue scheduling, multilevel feedback queue scheduling, multiple processor scheduling, real time scheduling.

Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions.

Deadlocks: Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery From Deadlock.

UNIT – III

Memory Management: Logical & physical address space, Swapping, Continuous Allocation (single partition, multiple partition), internal , external fragmentation, Paging, Segmentation, Segmentation With Paging, Virtual Memory, Demand Paging, Performance Of Demand Paging, Page Replacement, Page Replacement Algorithms– FIFO, optimal, LRU, LRU approximation algorithms, counting algorithms Thrashing, Demand Segmentation.

File System Interface: File Concept, Access Methods–sequential, direct, index, Directory Structure–single-level, two–level, tree-structured, acyclic-graph, general graph.

UNIT – IV

File System Implementation: File System Structure, Allocation Methods-contiguous allocation, linked allocation, indexed allocation, Free Space Management-bit vector, linked list, grouping, counting, Directory Implementation–linear list, hash table, Efficiency And Performance, Recovery– consistency checking, backup and restore.

Secondary Storage Structure: Disk Structure, Disk Scheduling, FCFS, SSTF, SCAN, C-SCAN, Look Scheduling, Selection of A Scheduling Algorithm, Disk Management-disk formatting, boot block, bad blocks.
Security: problem, authentication–passwords, program threats, system threats-worms, viruses, threat monitoring, encryption.

Text Book:

1. Silberschatz, Galvin, “Operating System Concepts”, Addison Wesley

   Publishing Company, 1989.

Reference Books:

1. William Stallings, “Operating Systems”, Macmillan Publishing Company.
2. Deitel H.M., “An Introduction To Operating System”, Addison Wesley Publishing Company, 1984.
3. Tanenbaum, A.S., “Modern Operating System”, Prentice Hall of India Pvt.Ltd..

Course Outcomes:-

By the end of this course, the student will be able to,
CO 1. Student will be able to differentiate between various types of operating system.
CO 2.Gain in depth knowledge of process basics and scheduling.
CO 3. Able to deal with situation of dead lock and how to overcome form it.
CO 4.Gain in depth knowledge of various page replacement techniques.
CO 5. Know about various types of storages media(s).
CO 6. Know about disk Scheduling.
CO 7. Know about threads and security of operating system.

Note: In each theory paper, nine questions are to be set. Two questions are to set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA 201 Programming with Python

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Course Objectives:

The course is designed to provide basic knowledge of Python and course leads students from the basics of writing and running Python scripts to more advanced features such as file operations, regular expressions, working with binary data, and using the extensive functionality of Python modules. Extra emphasis is placed on features unique to Python, such as tuples, array slices, and output formatting.

UNIT – I

Introduction to Python: Installation and Working with Python, Understanding Python variables, Python basic Operators, Understanding python blocks, Basic data types of Python, Conditional blocks using if, else and elseif, Simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else.

UNIT – II

Python Functions and Data Structures: Function Specifications, Global Variables, Modules, Passing parameters to Functions, Recursive functions, System functions and Parameters, importing modules, Lambda function in python, Python String, List, Tuple, Set, And Dictionary Manipulations, Programming using string, list, tuple, set and dictionary in built functions.

UNIT – III

File Handling: Opening a file, Understanding read functions: read(), readline() and readlines(), Understanding write functions: write() and writelines(), appending data to a file, closing files, Manipulating file pointer using seek, Programming using file operations. Python Object Oriented Programming:

Oops Concept of class, object and instances, Constructor, class attributes and destructors, Method overloading in python, Operator overloading, Inheritance.

UNIT – IV

Python Regular Expression and Exception Handling: Special symbols and characters for Regular expressions, Pattern matching and searching, Pattern searching using regex, Validation using regular expressions, What is exception, Handling an exception, try…except…else, try-finally clause, Argument of an exception, Python standard exception, Raising an exception, User-defined exceptions.

Python Database Connectivity: Introduction, SQL Database connection using python, creating and searching tables, Reading and storing config information on database, Programming using database connections.

Text Book:

1. **Think Python 2nd Edition by Allen B. Downey.**

Reference Books:

1. Learning Python, 5th Edition, by Mark Lutz, Released June 2013, Publisher(s): O'Reilly Media, Inc.
2. *Python* Programming, A modular approach: Naveen Kumar Sheetal Taneja 2017 Edition, *Pearson. education India.*

Course Outcomes:

By the end of the course, students will be able to:-
CO 1. Build problem solving and programming capability,
CO 2. Master the fundamentals of writing Python scripts,
CO 3.Learn core Python scripting elements such as variables and flow control structures,
CO 4. Discover how to work with lists and sequence data,
CO 5. Write Python functions to facilitate code reuse,
CO 6. Use Python to read and write files,
CO 7. Make their code robust by handling errors and exceptions properly,
CO 8. Work with the Python standard library,
CO 9. Implement Python's object-oriented features,
CO 10. Search text using regular expressions.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA -202 Data Base Management System **L T**
3 1

Course objectives:
The goal of this course is to teach the fundamentals of the database systems at master level. A variety of topics will be covered that are important for modern databases in order to prepare the students for real life applications of databases. The course aims to impart knowledge of the concepts related to database and operations on databases. It also gives the idea how database is managed in various environments with emphasis on security measures as implemented in database management systems.

UNIT – I

Basic Concepts: File Systems vs. DMBS, Characteristics of the Data Base Approach, Abstraction and Data Integration, Database users, Advantages and Disadvantages of a DBMS.
Data Base Systems Concepts and Architecture: Schema and Instances, DBMS architecture and Data Independence, Data Base languages and Interfaces, DBMS functions and component modules, Centralized and Client/Server Architectures for DBMS, Data Models.
Entity Relationship Model: Entity Types, Entity Sets, Attributes & keys, Relationships, Relationships Types, Roles and Structural Constraints, Design issues, E-R Diagrams, Design of an E-R Database Schema, Reduction of an E-R schema to Tables.
Relational Data Model: Relational model concepts, Integrity constraints over Relations, Relational Algebra– Basic Operations, Relational Calculus, Codd Rules.

UNIT – II

SQL: Data Definition and Data Types, Components of SQL: DDL, DML, and DCL, Schema Change Statement in SQL, Views, Joins& Queries in SQL, Specifying Constraints & Indexes in SQL, Database Triggers, SQL Injection.
Relational Data Base Management System: RDBMS, Basic structure, Date Base Structure & its manipulation in an RDBMS, Storage Organization.
Conventional Data Models: An overview of Network and Hierarchical Data Models.

UNIT – III

Relational Data Base Design: Functional Dependencies, Decomposition, Normal forms based on primary keys (1 NF, 2 NF, 3 NF, & BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Algorithms for Query Processing and Optimization;
Transaction Processing Concepts: Introduction to Transaction Processing, Transaction & System Concepts, Properties of Transaction, Schedules and Recoverability, Serializability of Schedules.
Concurrency Control Techniques: Locking Techniques, Time stamp ordering, Multi-version Techniques, Optimistic Techniques, Granularity of Data items.

UNIT – IV

Recovery Techniques: Recovery concepts, Recovery Techniques in centralized DBMS, Object and Object-Relational Databases; Database Security and Authorization.
Data Base Security: Introduction to Data base Security issues.
Enhanced Data Models: Temporal Database Concepts, Multimedia Databases, Deductive Databases, XML and Internet Databases; Mobile Databases, Geographic Information Systems, Genome Data Management, Distributed Databases and Client-Server Architectures.

Text Book:

1. Elmasri And Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson. ISBN-10: 0-13-397077-9.ISBN-13: 978-0-13-397077-7.

Reference Books:

1. Bipin C. Desai: An Introduction to Database System, Galgotia Publication, N. Delhi.
2. Raghu Rama krishnan& Johannes Gehrke: Database Management Systems, 2 nd edition, Mcgraw Hill International Edition.
3. Peter Rob, Carlos Colonel: Database system Design, Implementation, and Measurement, Cengage Learning, 2 nd Ed.
4. C.J. Date: An Introduction to Data Bases Systems 7 th Edition, Addison Wesley N. Delhi.
5. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts" Sixth Edition. ISBN 978-0-07-352332-3

Course Outcomes:

By the end of the course, Students will be able to
CO 1. Understand the concept of database and techniques for its management.
CO 2. Design different data models at conceptual and logical level and translate ER Diagrams to Relational Data Model.
CO 3. Normalize the database.
CO 4. Write queries using Relational Algebra.
CO 5. Describe the file organization schemes for DBMS.
CO 6. Describe and use features for Concurrency and Recovery.
CO 7. Understand data security standards and methods.

Note: In each theory paper, nine questions are to be set. Two questions are to set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA – 203 Software Engineering **L T**
3 1

Course Objectives:
Introduce students to software development life cycle and models for developing and effective and efficient software. Identify software requirements for manual or automated real-world systems. Compare and contrast software process models and software development methodologies. Provide the student with the opportunity to practice software development skills. Provide students with opportunities to develop basic computing skills with respect to preparation of documents and also to be able to check the correctness of a software design.

UNIT – I

Evolving Role of Software, Software Engineering, Changing nature of Software, Software Myths, Terminologies, Role of management in software development
Software Process Models: Software Process, Generic Process Model –Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Project Management, Component Based Development, Aspect-Oriented Software Development, Formal Methods, Agile Process Models –Extreme Programming (XP), Adaptive Software Development, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering
Software Life Cycle Models: Build & Fix Model, Water Fall Model, Incremental Process Model, Evolutionary Process Models, Unified Process, Comparison of Models, Other Software Processes, Selection of a Model
Software Requirements Analysis & Specifications: Requirements Engineering, Types of Requirements, Feasibility Studies, Requirements Elicitation, Developing Use Cases, Requirements - Analysis Documentation, Software Requirement and Specification (SRS) Document. Validation and Management .

UNIT – II

Software Architecture: Its Role, Views, Component & Connector View and its architecture style, Architecture Vs Design, Deployment View & Performance Analysis, Software Quality: McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring and (RMMM); Software Reliability.
Software Project Planning: Relationship to lifecycle, project planning, project control, project organization, configuration management, version control, quality assurance, metrics Size estimation, Cost Estimation, COCOMO, COCOMO – II, Software Risk Management Project Scheduling and Staffing, Time-line Charts.

UNIT – III

Function Oriented Design: Design principles, Module level Concepts, Notation & Specification, Structured Design Methodology and Verification.
Object-Oriented Design: OO Analysis & Design, OO Concepts, Design Concepts, UML – Class Diagram, Sequence & Collaboration Diagram, Other diagrams & Capabilities,

Design Methodology – Dynamic and Functional Modeling, Internal Classes & Operations
Detailed Design: PDL, Logic/Algorithm Design, State Modeling of Classes, Verification – Design Walkthroughs, Critical Design Review, Consistency Checkers.

UNIT – IV

Software Testing: Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Testing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing.
Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.

Text Book:

1. R.S. Pressman, **Software Engineering: A Practitioner's Approach** (6th ed.), McGraw-Hill, 2006

Reference Books-

1. P. Jalote, **An Integrated Approach to Software Engineering** (3rd ed.), Narosa Publishing House, 2005
2. K.K. Aggarwal and Y. Singh, **Software Engineering** (revised 2nd ed.), New Age International Publishers, 2006
3. Sommerville, **Software Engineering** (6th ed.), Pearson Education, 2004 Douglas Bell,
4. **Software Engineering for Students** (4th ed.), Addison-Wesley, 2005.

Course Outcomes:

By the end of the course, Student will able to :
CO 1: Describe the software development life cycle as well as describing the various software development model.
CO 2: Illustrate the software requirement specification, and system design.
CO 3: Understand the advantages and disadvantages of each model.
CO 4: Learn project planning and can apply in course projects.
CO 5: Understand type of testing and enhance skills in the field of software testing.
CO 6: Design high quality software products.
CO 7: Learn skill of software requirement specification and software quality assurance techniques.

Note: In each theory paper, nine questions are to be set. Two questions areto set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

MCA – 204 Computer Graphics **L T**
3 1

Course Objectives:
The Course is introduced to impart students with conceptual knowledge of the graphics techniques and algorithms. To study the multimedia concepts and various I/O technologies. It will enable the students to develop their creativity.

UNIT – I

Introduction: Definition Of Computer Graphics And Its Applications, Video Display Devices- Raster-Scan Displays, Random-Scan Displays, Color CRT Monitors, Direct View Storage Tubes, Flat Panel Displays Input Devices: Keyboard, Mouse, Trackball and Space ball, Joysticks, Digitizers, Image Scanners, Touch Panels, Light Pens, Voice Systems.

UNIT – II

Output Primitives: Line Drawing Algorithms (DDA, Bresenhaum's Circle) Generating Algorithm: Midpoint Circle Drawing Algorithm, Ellipse Generating Algorithm, Midpoint Ellipse Generating Algorithm, Character Generation, 2D Transformations: Translation, Rotation, Scaling, Reflection, Shear, Composite Transformation-Translation, Rotations, Scaling.

UNIT – III

Two Dimensional Viewing: Window-To-Viewport Coordinate Transformation, Clipping Operations, Point Clipping, Line Clipping–(Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping, Nicholl-Lee-Nicholl Line Clipping), Polygon Clipping–(Sutherland-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping), Curve Clipping, Text Clipping.
Three Dimensional Concepts: Three Dimensional Display Methods–Parallel Projection, Perspective Projection, Surface Rendering.
Three Dimensional Transformations: Translation, Rotation, Scaling, Reflection, Shear.

UNIT – IV

Curves and Surfaces: Bezier Curves, B-Spline Curves, Fractal Geometory Methods, Octrees.
Visible-Surface Detection Methods: Back Face Detection, Depth Buffer Method, A-Buffer Method, Scan Line Method, Depth Sorting Method.
Concept of Shading: Modeling Light Intensity, Diffuse And Specular Reflection, Refracted Light, Concept Of Shading Methods.

Text Book:

1. D. Hearn and M.P. Baker, **Computer Graphics** (4th ed.), Prentice–Hall of India, 2010.

Reference Books:

1. J.D. Foley, A van Dam, S.K. Feiner and J.F.Hughes, Computer Graphics: Principals and Practices (3rd ed.), Addison-Wesley, MA, 2013.
2. D.F. Rogers, Procedural Elements in Computer Graphics (4th ed.), McGraw Hill Book Company, 2019.
3. D.F. Rogers and A.J. Admas, Mathematical Elements in Computer Graphics (2nd ed.),McGraw Hill Book Company, 1990

Course Outcomes:

By the end of the course, students will be able to :
CO 1: Get Familiar with the principles of graphical user interfaces.
CO 2: Learn the introductory concepts in computer graphics and multimedia processing.
CO 3: Explain the core concepts of computer graphics, including viewing, projection, perspective, modelling and transformation in two and three dimensions.
CO 4: apply the concepts of color models, lighting and shading models, textures, ray tracing, hidden surface elimination, anti-aliasing, and rendering.
CO 5: Use techniques which will allow them to create user-friendly interfaces for computer applications.
CO 6: Learn the fundamentals of animation, parametric curves and surfaces, and spotlighting.
CO 7: Apply graphic programming techniques to design and create computer graphics.

Note: In each theory paper, nine questions are to be set. Two questions are to be set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.

Electives

MCA-E01 Theory of Computation L T
3 1

Course Objectives:
Understanding the inherent capabilities and limitations of computers is a fundamental question in computer science. To answer this question, we will define formal mathematical models of computation, and study their relationships with formal languages. Topics will consist of three central areas of the theory of computation: automata, computability, and complexity. Students will also learn that not all problems are solvable by computers, and some problems do not admit efficient algorithms. Throughout this course, they will strengthen their rigorous mathematical reasoning skills.

UNIT – I

Automata-introduction to finite automata, structural representations, automata and complexity, Alphabets, strings, languages, problems, Chomsky hierarchy, Deterministic Finite Automata, non-deterministic Finite Automata, Finite Automata With Epsilon Transition.
Regular Expression and languages- regular expressions, finite automata and regular expressions, applications, algebraic laws, pumping lemma for regular languages, closure properties, equivalence and minimization of automata.

UNIT – II

Context Free Grammars and languages- introduction to context free grammars, parse trees, applications of CFG, ambiguity in grammars and languages.
Pushdown Automata- definition of pushdown automata, languages of a PDA , equivalence of PDA and CFG, deterministic PDA, non-deterministic PDA, properties of context free languages, normal forms, pumping lemma, closure properties, decision properties.

UNIT – III

Turing Machine-problems that computer cannot solve, the turing machine, programming techniques for Turing machines, extensions to the basic turing machine, restricted Turing machines, Turing machines and computers.

UNIT – IV

Un-decidability- a language that is not recursively enumerable, an un-decidable problem that is RE, un-decidable problems about turing machines, other un-decidable problems.
Intractable problems- the classes P and NP, an NP complete problem, a restricted satisfiability problem, additional NP complete problems.

Text Book-

1. J. E. Hopcroft, R. Motwani, and J. D. Ullman, Introduction to Automata Theory,

languages, and computation (2nd ed.), Addison-Wesley, 2001.

Reference Books-

1. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, Elements of the Theory of Computation (2nd ed.), Prentice-Hall, NJ, 1997.
2. J.A. Anderson, Automata Theory with Modern Applications, Cambridge University Press, 2006.

Course Outcomes:

By the end of the course, students will be able to
CO 1: Understand key notions of computation, such as algorithm, computability, decidability, reducibility, and complexity, through problem solving.
CO 2: Explain the models of computation, including formal languages, grammars and automata, and their connections.
CO 3: State and explain the Church-Turing thesis and its significance.
CO 4: Analyse and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.
CO 5: Solve computational problems regarding their computability and complexity and prove the basic results of the theory of computation.

Note: In each theory paper, nine questions are to be set. Two questions are to set from each Unit and candidate is required to attempt one question from each unit. Question number nine will be compulsory, which will be of short answer type with 5-10 parts, out of the entire syllabus. In all, five questions are to be attempted.