FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABUS

FOR

MASTER OF COMPUTER APPLICATIONS
(Three Years Course)
(Credit Based Evaluation and Grading System)

(Semester: I – VI)

Examination: 2019–20

GURU NANAK DEV UNIVERSITY
AMRITSAR

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   Defaulters will be prosecuted.

(ii) Subject to change in the syllabi at any time.
   Please visit the University website time to time.
# MASTER OF COMPUTER APPLICATIONS (MCA)
(Credit Based Evaluation and Grading System)

<table>
<thead>
<tr>
<th>Sr. no.</th>
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<td>CSL411 Introduction to Programming</td>
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*Credits not to be counted towards SGPA

**Note:** PSL-053 ID Course Human Rights & Constitutional Duties (Compulsory Paper) Students can opt. in any semester except Semester 1st. This ID Paper is one of the total ID Papers of this course.

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<td>CSL516 Data Base Management System</td>
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**List of Electives**

| CSL518 Software Testing               | 4        | 0           |
| CSL519 Object Oriented Programming using JAVA | 4 | 0 |

**Sub Total** 20 0 2

**Grand Total** 22 600
# MASTER OF COMPUTER APPLICATIONS (MCA)
(Credit Based Evaluation and Grading System)

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<td>CSL529 Evolutionary and Intelligent Computing Theories &amp; Applications</td>
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**List of Electives-I**

| CSL526 Computer Graphics       | 4     | 0     | 0     |
| CSL528 Digital Image Processing| 4     | 0     | 0     |

**Sub Total** 20 0 2

**Grand Total** 22

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**Sub Total** 20 0 2

**Grand Total** 22

**List of Electives**

| CSL614 Artificial Neural Networks | 4     | 0     | 0     |
| CSL616 Fundamentals of Cloud Computing | 4     | 0     | 0     |
| CSL632 Distributed Systems        | 4     | 0     | 0     |
| CSL633 System Simulation          | 4     | 0     | 0     |
| CSL637 Introduction to Machine Learning | 4     | 0     | 0     |
| CSL635 Introduction to Data Analytics | 4     | 0     | 0     |

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**Sub Total** 0 0 26

**Grand Total** 26

*Credits not to be counted towards SGPA*
CSL 410: Computer Fundamentals

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section A

SECTION –B
Operating System Concepts: Role of an Operating System, Types of operating systems, Batch processing, Multiprograming, timesharing, real time, mobile, portable etc, Booting procedure and its types, Components and functions of operating system. Data Communication and Internet: Introduction to Data Communication, Types of Networks, Transmission Media, Internet and its applications, Working knowledge of Search engines and use of electronic mail, Virus, Information level threats, Network level threats, Classification of threats Hacking Prevention Mechanism: Anti – Viruses, Firewalls, Biometrics Controls for security, cryptography and encryption.

SECTION –C
Introduction to Cloud Computing: Overview of distributed computing: Trends of computing, introduction to parallel/distributed computing, Introduction to Cloud Computing including benefits, challenges, and risks, Different types of clouds, Security and Privacy issues in the Cloud, Introduction to distributed and Object Oriented database.
Introduction to Big data: Introduction to database, introduction to data mining, structural/unstructural data, Define and describe Big Data and its characteristics, Critique, Applications in different areas, Tools & Techniques of implementation.
SECTION –D

Introduction to DBMS: Database models, fundamental of relational model, 3–Level architecture, query languages, query optimization, normalization, DBA: security, recovery, concurrency.

References:
4. Martin, James: Telecommunications and the Computer, PHI
5

MASTER OF COMPUTER APPLICATIONS (MCA)
(Credit Based Evaluation and Grading System) (SEMESTER – I)

CSL411: INTRODUCTION TO PROGRAMMING

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION –A
Introduction to Program Development: Problem Analysis, Designing a solution.
Overview of C: Brief history of C, introduction to different versions of C. General Structure of a C program, stages in the development of a C program.
Data Types, Operators & Expressions: Constants and variables, data types, declaring variables, storage classes, different types of expressions and their evaluation, conditional expression, assignment statement, enumerated data type, redefining/creating data types, type casting.
Console Input/Output: Standard input/output devices, unformatted input/output functions (character I/O functions and string I/O functions), formatted input/output functions (scanf( ) function and printf ( ) function).
Control Statements: Decision making using if, if – else, elseif and switch statements, Looping using for, while and do – while statements, transferring program control using break and continue statements
Arrays & Strings: Introduction to arrays, declaring arrays, initializing arrays, processing of arrays, introduction to strings.
Structures & Unions: Introduction to structures, declaring structures, initializing structures, accessing elements of structures, array of structures, nested structures, passing structures as arguments to a function, introduction to unions.

SECTION –B
Functions: Defining a function, local variables, return statement, invoking a function, specifying and passing arguments (including arrays, strings) to a function, function prototyping and use of header files, building own library, recursion.
Pointers: Why pointers? Declaring pointers, accessing values via pointers, pointer arithmetic, pointers to arrays, Array of pointers, pointers to strings, pointers to structures, self–referential structures.
**MASTER OF COMPUTER APPLICATIONS (MCA)**

*(Credit Based Evaluation and Grading System) (SEMESTER – I)*

**Program Structure:** Program structure revisited, managing multi–file programs using traditional approach of separate compilations and project facility of Turbo C compiler, storage classes revisited.

**File I/O:** Introduction to files, different ways of file processing (standard I/O & system I/O), description of various library functions for file handling, updating files.

**SECTION –C**

**Introduction to Object Oriented Paradigm** – Object Oriented programming and C++, Structured Programming methodology, its shortcomings, advantages of OOPS (Object Oriented Programming Style).

**OOP concepts:** Abstraction, Encapsulation, Data Hiding, Inheritance, Polymorphism. Overview of C++ – Data types, Input/output statements, Flow of control – looping statements, branching statements, Pointers & references, namespaces.

**SECTION –D**

**Class design:** constructors, destructors, operator overloading, reuse through inheritance, virtual functions, exception handling. I/O with stream classes, memory management

**The Standard Template Library (STL):** containers, algorithms, iterators, adaptors, function objects.

**References:**
4. R. G. Dromey, How to Solve it by Computer, Prentice–Hall of India.
CSL 412: COMPUTER ORIENTED NUMERICAL & STATISTICAL METHODS

Credits

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Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION – A
Floating–Point Numbers: Floating–point representation, Rounding, Chopping, Error analysis.
Non–Linear Equations: Generalized Newton Raphson method, Secant method, Rate of convergence of secant method, Muller’s method.
Central Difference Interpolation: Gauss forward, Gauss Backward, stirling Interpolation methods.

SECTION – B
Numerical Differentiation and Integration: Numerical differentiation using Interpolation method, Boole’s Rule, Weddles’s rule of numerical integration, Romberg Integration.
Dispersion: Meaning, Characteristics for an ideal measure of dispersion. Measures of dispersion (Mean deviation, Standard Deviation and variance.)
Principle of least Square: correlation and regression coefficients (two variables only)

SECTION – C
Analysis of Statistical Data: Frequency distribution; Frequency curve and histogram; Measure of central tendency and dispersion.
Random Variables and probability distributions: Basic concepts of probability and its properties, Conditional probability and independent events; Random variable, Notion of sample space; distribution functions; Mathematical expectation, Poisson, Rectangular, Exponential and Normal distributions.

SECTION – D
Sampling distributions: Notion of random sample and sampling distributions; Parameter and statistics; Standard error, Chi–square, t, F distributions; Basic ideas of testing of hypothesis; Testing of significance based on normal, Chi–square, t and F distributions.

Recommended Books:
MASTER OF COMPUTER APPLICATIONS (MCA)
(Credit Based Evaluation and Grading System) (SEMESTER – I)

ECL491: PRINCIPALS OF DIGITAL ELECTRONICS

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
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SECTION A
Semiconductors : Junction diodes, Bipolar and FET transistors, MOSFET: D and E-type, biasing techniques, transistor as switch.
Information Representation: Numbers, character codes (BCD, ASCII, EBCDIC, GRAY, EXCESS-3), Error detecting and correcting codes.

SECTION B
Digital IC’s: Logic gates, clocks and timers.

SECTION C
Sequential Circuits: Flip-Flops - SR Flip-Flop, JK Flip-Flop, D-Flip-Flop, T Flip-Flop, Edge Triggered Flip-Flops, Level Triggered Flip-Flops, Registers - Serial In Serial Out (SISO), Serial In Parallel Out (SIPO), Parallel In Serial Out (PISO), Parallel In Parallel Out (PIPO), Counters - Synchronous and Asynchronous Counters.
Combination al Circuits: Adder, decoder/de-multiplexer, encoder/multiplexer design.

SECTION D
Logic Design: ITL, STIL, CMOS logic families.
Data Converters: Analog to digital and Digital to analog conversion techniques, Microprocessor compatible ADCs and basic interfacing techniques.
Digital Peripherals: Keyboard, multiplexed seven segment display, CRT displays schemes, Printers, Control interfaces (parallel and serial) for the peripheral units.
References:
MTL408: MATHEMATICAL ELEMENTS OF COMPUTER SCIENCE

Credits

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4  0  0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
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SECTION –A


Algebraic Systems: Operations, Semigroups, Groups, Subgroups, Normal Subgroups and Homomorphisms, Rings, Fields, Polynomials over a field.

SECTION –B

Graph Theory: Graphs and Multigraphs, Subgraphs, Isomorphic and Homeomorphic Graphs, Walks, Paths and Cycles, Eulerian Graph, Hamiltonian Graph, Connectivity, Bridges of Königsberg, Traversable Multigraphs, Labeled and Weighted Graphs, Complete, regular and Bipartite Graphs, Tree graphs, Planar Graphs, Regions, Euler’s Formula, Graph Colorings, Chromatic Number, Welch–Powell Algorithm, Representing Graphs in Computer Memory.

SECTION –C

Recurrence Relations and Generating Functions: Polynomial expressions, recursion theorem, closed form expression, generating function, solution of recurrence relation using generating function.


SECTION –D

Books Recommended:

CSP401: PROGRAMMING LABORATORY–I

Credits
L T P
0 0 2

Total Marks: 100

Practical Exercises on Programming in C/C++

Implementation of numerical & statistical methods using C/C++ language

File management using Linux/Unix/ Windows based operating system
CSP 411: COMMUNICATION SKILLS

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

UNIT–I
Theories of communication, Goals- Organizational and Personal, Psychology of communication, Channels, Cost and Barriers to communication, Informal and Formal communication

UNIT–II
Listening and Speaking Skills, Familiarizing to different tones and accents, Oral communication practice, Public speaking, Grammar and Vocabulary, Speech, Extempore

UNIT–III
Basics of Telephone Etiquette in Business communication, Practice of Interview skills and Group Discussions
Students must carry out Group discussions and Mock interviews during the lab session.

Books Recommended:
CSL420: DATA & FILE STRUCTURES

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION–A
Preliminaries: Various data structures, common operations on data structures, algorithm complexity, big O notation, time–space tradeoff between algorithms.
Arrays: Arrays defined, representing arrays in memory, various operations on linear arrays, Multi–dimensional arrays, Records.
Linked Lists: Types of linked lists, representing linked lists in memory, advantage of using linked lists over arrays, various operation on linked lists

SECTION–B
Stacks: Description of stack structure, implementation of stack using arrays and linked lists. Applications of stacks – converting arithmetic expression from infix notation to polish and their subsequent evaluation, quicksort technique to sort an array, parenthesis checker.
Queues: Description of queue structure, implementation of queue using arrays and linked lists, description of priorities queues. Applications of queues – Operating system simulations

Trees: Description of tree structure and its terminology, binary search tree, implementing binary search tree using linked lists, various operations on binary search trees, AVL Trees, Threaded Binary Trees, B–Trees, B+ trees.

SECTION C
Greedy Method: Knapsack Problem, Prim's and Kuruskal's Algorithm to find MSTs.
Heaps: Description of heap structure, implementing heaps using arrays, various operations on heaps, Applications of heaps – heapsort technique to sort an array, implementation of priority queues.
Graphs: Description of graph structure, implementing graphs in memory using adjacency matrix or adjacency lists, various graphs traversing algorithms, finding shortest path between two nodes, Dijkstra’s shortest path algorithm., finding biconnected component, strongly connected component and finding cycles in the graphs.
SECTION D

Searching and Sorting: Sorting Types, External and Internal sort Linear Search, Binary search, Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Shell Sort, Quick sort, Radix Sort. Hash Tables: Direct address tables, hash tables, collision resolution by chaining, hash functions, open addressing – linear probing, quadratic probing, double hashing.


References:
CSL421: COMPUTER ORGANIZATION AND ARCHITECTURE

Credits

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Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION A

Basic computer Organisation and design: Register Transfer and Micro–operations: Register Transfer Language, various Arithmetic, Logic & Shift micro–operations, instruction codes, computer registers, timing & control, instruction cycle, design of a complete basic computer & it’s working.

SECTION B

Programming & controlling the basic computer: Machine & Assembly Language, hardwired & Micro–programmed control, Design of a control unit.

CPU Architecture: General register & stack organization, instruction formats and addressing modes, ALU & Control unit architecture.

SECTION C

Memory Organisation: Memory hierarchy, main, auxiliary, cache memory, virtual memory, paging and segmentation.

I/O Organization: Peripheral Devices, input–output interface, Modes of data transfer, programmed & interrupt initiated I/O, DMA, I/O Processors.

SECTION D

Parallel & Multiprocessing Environment: Introduction to parallel processing, pipelining, RISC Architecture, vector & array processing, Multiprocessing concepts, memory & resource sharing, interprocessor communication & synchronisation.

References:
CSL423: COMPUTER BASED OPTIMIZATION TECHNIQUES

**Credits**

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**Mid Semester Examination:** 20% weightage

**End Semester Examination:** 80% weightage

**Instructions for the Paper Setters:**

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**SECTION A**

**Linear Programming:** Mathematical formulation of linear programming problems, Canonical and standard forms of linear programming problems, Solution by Graphical & Simplex method, Revised simplex method, Two phase & Big-M method, Duality, Primal-Dual Relationship, Dual Simplex method, Economic Interpretation of Optimal simplex Solution. Sensitivity Analysis: Changes in RHS values, Objective Function Coefficients, Constraint Coefficients, Addition of a new constraint/variable. (13 Lectures)

**SECTION B**

**Special Types of LPP:** Transportation and Assignment Problems, Optimality, Special cases in Transportation and Assignment Problems, Game Theory: Two-person zero sum games, maximin-minimax principle, games without saddle points (Mixed strategies), graphical solution of 2 x n and m x 2 games, dominance property, arithmetic method of n x n.

**SECTION C**


**PERT / CPM:** Project Planning, Scheduling, Activity cost

**SECTION D**

**Evolutionary Techniques:** Introduction to Evolutionary Computing & Genetic Algorithms, GA as a search and optimization technique. Implementation of SGA using MATLAB/Scilab. 

**Advanced Computing Techniques:** Introduction to Neural Networks, Fuzzy Systems and other Soft Computing techniques. Introduction to Swarm Intelligence and Optimization.

**Books Recommended:**

1. Gass, S. L.: Linear Programming
CSL424: DESIGN OF PROGRAMMING LANGUAGES

Mid Semester Examination: 20% weightage  
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
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SECTION A
Study of Programming Languages: Brief History, Feature of a good language

Programming Language Processor: Translator and software simulator computer, syntax semantics and virtual computers.

Specifications and Implementation of Elementary and Structured Data Types. Type equivalence, checking and conversion.

SECTION B
Vectors and Arrays, Lists, Structures, Sets, Files.

Abstraction, encapsulation and information hiding subprograms, type definitions, abstract data types

Sequence control with Expressions, Conditional Statements, Loops, Exception handling. Subprogram definition and activation, simple and recursive subprogram, subprogram environment.

SECTION C
Scope – Static and Dynamic, Block structures, Local Data and Shared Data, Parameters and Parameter Transmission. Local and Common Environments, Tasks and Shared Data.

Static and Stack-Based Storage management. Fixed and Variable size heap storage management, Garbage Collection.

SECTION D
Syntax and Translation: Syntactic elements of a language, stages in translation, formal definition of syntax

Operating and Programming Environment: Batch processing, interactive, embedded, programming environments

Text/References:
1. Programming languages: design and implementation, Terrence W. Pratt., Pearson
3. Programming Language Pragmatics, Scott, ELSEVIER
CSL426: COMPUTER NETWORKS

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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SECTION A


Analog and Digital Transmission and their conversions: composite signals and Fourier analysis.

SECTION B


Data Link layer: Framing, Error detection and correction, Elementary data link and sliding window protocols, Channel allocation in LAN and WAN, Multiple access protocols.

SECTION C

Design issues of network layer: Routing algorithms, Congestion control algorithms, internetworking, Repeaters, Routers.

Services and elements of transport protocols

IEEE standards used in Computer networks.

SECTION D


Text/References:
1. Forouzon Behrouz: Data Communication & networking 5E, Tata McGraw Hill.
2. Jm Geier, Wireless Networks First Step, CISCO Press
CSP420: PROGRAMMING LABORATORY–II

Credits

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Total Marks: 100

- Implementation of Data and File Structures using C/C++
- Implementation of Computer Oriented Optimization Techniques
- Network Administration – User management, File & Resource Sharing
CSP421: PERSONALITY DEVELOPMENT

Credits
L T P
0 0 1

Slide Preparation and oral presentation principles

Written Presentation of technical material

Preparation of Bibliography

Basics of Official Correspondence

Preparation of Bio-data/CV

Students should be asked to prepare and present seminars and presentations on their core subjects of second semester.

Books Recommended:
MASTER OF COMPUTER APPLICATIONS (MCA)
(Credit Based Evaluation and Grading System) (SEMESTER –III)

CSL511: THEORY OF COMPUTATION

Credits
L  T  P
4  0  0

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION A
Non Deterministic Finite Automata, Deterministic Finite Automata, $\varepsilon$ - moves, regular expressions, crossing sequence. Moore and Mealy machines.

SECTION B
Pumping lemma for regular sets, Minimisation algorithm, Context free grammar, derivation Trees, Chomsky & Greibach normal forms.

SECTION C
Pushdown automata, pumping lemma for CFL’s, Ogden’s lemma, Turing machines. Undecidability,

SECTION D
Recursive and recursively enumerable languages, Rice theorem, Post’s correspondence problem.

References:
CSL512: MICROPROCESSOR AND ITS APPLICATIONS

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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SECTION A

Introduction: Introduction to Microprocessor, Microcontroller and Microcomputer, different types of microprocessors - Intel, AMD, Motorola, and their suitability to different types of applications. Evolution of the microprocessor product line.

Architecture of a Microcomputer: General Architecture of a microcomputer system. Microprocessor unit, input unit, output unit, memory unit and auxiliary storage unit.

SECTION B

Architecture of 8086/ 8088 Microprocessor: Description of various pins, configuring the 8086/8088 microprocessor for minimum and maximum mode systems description of maximum system mode interfaces, internal architecture of the 8086 / 8088 microprocessor, system clock, Bus cycle, instruction execution sequence.

Memory Interface of the 8086 / 8088 microprocessor: Address space and Date organization, generating memory addresses, hardware organization of the memory address space, memory bus status codes, memory control signals, read/write bus cycles, the role of stack in interrupts and subroutine cells; demultiplexing the address data bus, program and data storage memory, dynamic RAM system.

SECTION C

Input /Output Interface of the 8086 / 8088 microprocessor: I/O Interface, I/O address space and data transfers, I/O instructions, I/O bus cycles, Output ports, 8255A Programmable Peripherals Interface (PPI), memory– mapped, I/O, serial communication interface (USART and UART) – the RS–232 C interface, 8251A programmable communication interface, special purpose interface controllers.

Interrupt Interface of 8086/8088 microprocessor: What is interrupt? Types of interrupt, Interrupt Vector Table (IVT)

SECTION D

8086/8088 assembly language programming: General structure of an assembly language program, steps in the development of an assembly language program, Assembly language V/S machine language, addressing modes, Instruction set: data movement instructions, arithmetic instructions, logical instructions, shift and rotate instructions, jumping and looping instructions, string processing, interrupt instructions, stack operations, subroutines, handling instructions, defining and using macros.

Programming exercises must be designed to show how the input/output is performed. How decisions are made and how loops can be set in an assembly language program.
References:

CSL516: DATA BASE MANAGEMENT SYSTEMS

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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SECTION A

ER Model: Overview, ER diagrams, Database design using ER model.
The Relational Model: Relational Data Objects: Domains and relations, Integrity Constraints, Relational Algebra, Relational Calculus and SQL Language.

SECTION B

Working knowledge of DDL, DML and DCL based statements for generating queries is to be provided.
Relational Database Design: Concepts of functional dependencies, multivalued dependencies, 1NF, 2NF, 3NF, BCNF, Higher Normal Forms.

SECTION C


SECTION D

Introduction to Big Data: Structured and Unstructured data, Data Analytics, Big data management and Big data analytics
Techniques of Data Management: Storage and Analysis of data, Extraction of relevant information
Applications of Big Data: Distributed databases, Hadoop, NoSQL, NewSQL, Dimensionality reduction, processing unstructured data
Reference:

CSL517: OPERATING SYSTEM

**Total Marks: 100**

**Mid Semester Examination: 20% weightage**

**End Semester Examination: 80% weightage**

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**SECTION A**

**Basic Concepts:** History & Evolution of Operating System, OS as resource manager, Various views of OS, System calls, interrupt Mechanism.

**Process Management:** States of Processes, process scheduling algorithms, race condition, Critical section Problem, Context Switching, Semaphores, Monitors. Deadlock conditions, deadlock prevention, avoidance, detection and recovery.

**SECTION B**

**Memory Management:** Basic Memory management Schemes, Partition memory management, demand paged memory management, segmented memory management, swapping, hierarchy of memory, Virtual Memory, Working Set Model.

**Device Management:** Dedicated devices, shared devices, virtual devices, channels, I/O traffic controller, I/O scheduler, I/O device handlers, Storage devices, buffering, disk scheduling algorithms.

**SECTION C**

**Information Management:** File Attributes, File Organization in directories, Simple file system, Symbolic file system, logical file systems, physical file systems, security of file systems, Sequential, Indexed and indexed sequential allocations.

**Distributed Systems:** Definition, Characteristics, Goals and application of Distributed Systems, Basic Design issues and User Requirements

**SECTION D**

**Distributed OS:** Introduction, The Kernel, Process and Threads, Communication.

**Case Studies:** Windows NT, Unix / Linux

**References:**
CSP510: PROGRAMMING LABORATORY – III

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*Total Marks: 100*

Hands on practice of SQL statements with different clauses available using Oracle 8i or higher version

Implementation of OO Concepts using C++
CSL518: Software Testing (Elective)

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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SECTION A

SECTION B
Types of testing - volume testing, stress testing, usability testing, performance testing, security testing, storage testing, compatibility testing, configuration testing, reliability testing, recovery testing, acceptance testing. Testing strategies and techniques – structural versus functional testing, automated versus manual testing, static versus dynamic testing.

SECTION C
Debugging – debugging by brute force, by induction by deduction, by backtracking, by testing; debugging principles – for locating errors, repairing errors. Testing Internet Applications – types of application architectures – e.g. client/server; strategies for testing; testing tools; testing event driven systems; testing graphical user Interfaces. Working experience of any one tool.

SECTION D
Software security testing – software vulnerabilities fundamentals; security policy; enforcing security policy; threat modelling; Security testing of standalone and web applications Basic security testing with Kali Linux.

Recommended Readings:
- Introduction to Software Testing by Paul Ammann and Jeff Offutt. published in Feb 2008 by Cambridge

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CSL519: OBJECT ORIENTED PROGRAMMING USING JAVA (Elective)

Total Marks: 100

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Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION A
Evolution of Java, Importance of JAVA to Internet, Features of JAVA, Bytecode, Object Oriented Approach. Various Data Types and Operators, Type Conversion and Casting, One Dimensional and Multidimensional arrays, Selection Statements, Iterative Statements, Jumping statements. Class Fundamentals, Declaring objects, Introducing Methods, Constructors, this keyword, Overloading constructors and Methods, Recursion, Nested and Inner classes.

SECTION B

SECTION C
Multithreaded Programming The Java Thread Model, Thread Priorities, Synchronization, Interthread communication, Suspending, Resuming and Stopping Threads. Java I/O Basics, Streams, reading Console input and writing console output, PrintWriter class, Reading & writing Files, Byte Streams, Character Streams & Serialization.

SECTION D

References:
# CSL525: INFORMATION SYSTEMS

**Total Marks: 100**

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| Mid Semester Examination: 20% weightage |
| End Semester Examination: 80% weightage |

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## SECTION A

**An Introduction to Information System:** Information Concepts, System Concepts, Business Information Systems, Information Systems in society, business and Industry, Ethical and Social issues, Global Challenges in Information Systems

**Information Systems in Organizations:** organizations and Information systems, competitive Advantage, careers in Information System

## SECTION B

**Management Information System:** Fundamental types of Management, Information Systems, Management Decision, Pitfalls in MIS Development Making Process

Building and Maintaining Information Systems, Information System Security and Control


## SECTION C

**Knowledge Management systems:** Fundamentals of Knowledge Based Decision Support; Artificial Intelligence and Expert systems, Expert System & its integration with DSS.

Other Information Systems like Supply chain management, Customer Relationship Management (CRM), Electronic Commerce and Mobile Commerce

## SECTION D

**Distributed Information System (DIS):** Distributed processing systems, Advantages and disadvantages, Historical context of DIS.

The Internet and Internet Applications as a Distributed Information System Security, data integrity and availability of DIS, Network management issues
References:

CSL529: EVOLUTIONARY AND INTELLIGENT COMPUTING THEORIES AND APPLICATIONS

Credits

Total Marks: 100

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End Semester Examination: 80% weightage

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SECTION A
Introduction to AI
AI concept, Importance of AI, Evolution of AI, Applications of AI.
Knowledge
Introduction and Importance of Knowledge, Knowledge based systems, Knowledge Representation, First Order Predicate Logic (FOPL), Syntax and Semantics of FOPL, Knowledge Organization and Manipulation.

SECTION B

SECTION C

SECTION D

References:
CSL530: WEB TECHNOLOGIES

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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SECTION A
Web Essentials, Markup languages, CSS
Basics of Client side programming, Java script language, java script objects, host objects, Browsers and DOM

SECTION B
Basics of Server side programming, Java servlets- Life cycle, Servlet API, Reading Servlet parameters, Handling HTTP requests and responses, Cookies and Session Tracking ASP/JSP, Basics of ASP/JSP objects, simple ASP and JSP pages

SECTION C
Representing Web data, Data base connectivity, JDBC, Dynamic web pages, XML, DTD, XML schema, DOM, SAX, XQuery, Building web applications, cookies, sessions, open source environment
Introduction to PHP, basics, PHP File handling, file upload, cookies, error handling, PHP MySQL introduction

SECTION D
Middleware technologies, Ecommerce architecture and technologies, Ajax, Advanced web technologies and tools

Case Studies: PHP and MySQL case studies.

References:
CSL526: COMPUTER GRAPHICS

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SECTION A

Elements of Computer Graphics: Introduction to computer graphics; graphics display devices; interactive control devices; output devices; display processors.

2D Graphics

Elementary Drawing Algorithms: Line drawing using direct method, simple DDA, integer DDA, incremental method, and Bresenham’s algorithm; Circle drawing using incremental method and Bresenham’s algorithm, drawing arcs, sectors, etc. Flood Fill Algorithms, Boundary Fill Algorithms

Geometric Transformations: Translation, rotation, scaling, reflection and shear; concept of homogenous coordinates, Building composite transformations.

SECTION B

Viewing Transformations: Concept of windows & viewport, window–to–viewport mapping, clipping operations – point clipping, line clipping algorithms (Cohen – Sutherland, mid–point subdivision, Cyrus – Beck), Sutherland – Hodgman polygon clipping algorithm.

3D Graphics

Drawing 3D Shapes: Coordinate systems, representation of 3D shapes, designing curves and surfaces (Hermite, Bezier, and B–Spline).

Geometric Transformations: Translation, rotation, scaling and reflection.

SECTION C

Projective Transformations: Parallel projections – orthographic, axonometric (isometric, diametric and trimetric), oblique projections; and perspective projections (one, two and three vanishing points).

Viewing Transformations: Viewing a 3D object, 3D clipping (extension of specified 2D algorithms to handle 3D objects).
SECTION D

**Hidden line/surface Removal:** Back face removal, z–buffer algorithm, Painters (depth sort) algorithm, subdivision algorithms – Warnock’s algorithm, scan line algorithms – scan line z–buffer algorithm.

**Rendering:** Introduction, a simple illumination model, shading – Gouraud shading & Phong shading, ray tracing, shadows, textures.

**References:**

CSL528: DIGITAL IMAGE PROCESSING

Total Marks: 100

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

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SECTION A


SECTION B


Wavelets and Multi-Resolution Processing: Wavelet functions, Wavelet transformations in one and two dimensions, fast wavelet transform.

SECTION C

Image Compression: Image Compression Models, Data Redundancies, Lossy Compression Techniques, Lossless Compression Techniques, Image Compression standards.

Image segmentation: Pont, Line and Edge Detection, Edge linking and boundary detection, Thresholding, region based segmentation.
SECTION D

**Representation and Description:** Image Representation, Boundary and Regional Descriptors, Relational Descriptors.

**Object Recognition:** Pattern and pattern classes, recognition based on Decision Theoretic Methods, Structural Methods.

**References:**

CSP520: PROGRAMMING LABORATORY – IV

Total Marks: 100

Development of Websites, JAVA 2.0 / Front Page 2000 / HTML 4.0, ASP.
Implementation of Computer Graphics using C/C++
CSL611: System Software

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Note for Paper Setter:
There will be eight questions of equal marks, two in each of the four sections (Section A to D), corresponding to the distribution of the syllabus. The paper setters are requested to make sub-section (not exceeding 4) of the questions and allocate appropriate marks to each sub section.

Note for Candidate:
Attempt five questions in all by selecting one question from each section and the fifth question may be attempted from any sections.

Unit I
Introduction to System Software, Evolution of System software, Components of System software, Translators, Loaders, Interpreters, Assembler and Compiler
Overview of Assembly Process

Unit II
Design of One pass and Two pass Assembler
Macro definition and expansion, Concatenation of macro parameters, Generation of unique labels, Conditional macro expansion, Recursive macro expansion

Unit III
Phases of compilation process, Lexical analysis, parsing, Storage management optimisation
Incremental compilers, Cross compilers, P code compilers

Unit IV
Basic loader functions. Relocation, program linking, linkage, editors, dynamic linking bootstrap loaders
Other system software: Operating system, DBMS, text editors, Interactive debugging systems

References:
CSL612: Software Engineering

Total Marks: 100

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Unit I

Unit II

Unit III
Unit IV


References:
4. Pankaj Jalote, Software Engineering, Wiley
8. Pfleeger, Software Engineering, Macmillan Publication
CSP610: Programming Laboratory - V

Total Marks: 100

Practical Exercises on System Programming concepts and Assembly Language.

Working knowledge of distributed version control system Git.
Note for Paper Setter:  
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Total Marks: 100

Note for Candidate: Attempt five questions in all by selecting one question from each section and the fifth question may be attempted from any sections.

Unit I  
Basics of Neural Networks: Connectionist Models and their structures, Multilayer Perception & Back Propagation Networks, Gradient Descent.

Some Representation Issues: Representing Boolean function, Distributed Representation, Representing Real – valued Functions.

Unit II  

Autoassociators and one-shot learning: Linear Autoassociators and the interproduct Training Rule

Hopfield Model, Associative Memories.

Unit III  
Mean Squared Errors (MSE) Algorithms: MSE Approximation, The Widrow–Hoff Rule, ADALINE


Unit IV  
Back Propagation: Algorithms, Derivation, Practical Considerations

Introduction to Some Applications: NETTALK, Handwritten Character Recognition, Travelling Salesman Problem

References:
MASTER OF COMPUTER APPLICATIONS (MCA)  
(Credit Based Continuous Evaluation Grading System) (SEMESTER – V)

CSL616: FUNDAMENTALS OF CLOUD COMPUTING (Elective-I)  
Total Marks: 100

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Note for Candidate:  
Attempt five questions in all by selecting one question from each section and the fifth question may be attempted from any sections.

UNIT – I  
Virtualization: Definition, Type of Virtualization, Benefits, Limitations, Virtualization and Cloud, Virtual Appliance.

UNIT – II  
Cloud Computing Architecture: Service Models, Deployment Models, Cloud Entities, Cloud Clients, Service Level Agreement (SLA) and Quality of Service (QoS) in Cloud Computing.

UNIT – III  

UNIT – IV  

Textbooks:  

Reference Books:  
CSL632: DISTRIBUTED SYSTEMS (Elective-I)  

**Total Marks: 100**

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**Note for Candidate:**  
Attempt five questions in all by selecting one question from each section and the fifth question may be attempted from any sections.

**Goals:**
- To understand how large-scale computational systems are built
- To study the key design principles of distributed systems to understand the challenges of large systems.
- To realize the importance of coordination in distributed systems.
- To learn to create secure and reliable systems

**Pre-requisites:** Operating System, Computer System Architecture, Computer Networks

**Unit – I**
Distributed Systems – Basic characteristics, benefits over centralized systems, challenges, Design Issues, fallacies; System Models – physical, architectural, and fundamental, client-server and peer to peer systems;

**Unit – II**
Role of middleware; communication - message passing and distributed shared memory  
Inter process communication – direct, multicast, indirect, RPC, RMI, IPC in UNIX.

**Unit – III**
Operating System support; Time and Global states; Coordination and agreement; Distributed transactions and concurrency control; Replication.  
Security challenges – perimeter defence, authentication schemes, and access control technologies.
Unit – IV


Recommended Readings:

CSL633: SYSTEM SIMULATION (Elective-I)

Total Marks: 100

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Note for Candidate:
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Unit – I
Introduction: Concept of a system, stochastic activities, continue and discrete system, system modeling, mathematical modeling, principle used in modeling.
Simulation of Systems: Concepts of simulation of continuous systems with the help of two examples; use of integration formulas; concepts of discrete system simulation with the help of two examples, Generation of random numbers, Generation of non-uniformly distributed numbers.

Unit – II
Simulation in Inventory Control and Forecasting: Elements of inventory theory, inventory models

Unit – III
Generation of Poisson and Erlang variants, forecasting and regression analysis
Design and Evaluation of Simulation Experiments: Experimental layout and validation.

Unit – IV
Simulation Languages: Continuous and discrete simulation languages, Block–Structured continuous simulation languages, expression based languages, discrete system simulation languages, simscript, GPSS, SIMULA, Simpack, GASP IV, CSIM, factors in selection of a discrete system simulation languages.
Case Studies: Analytic Vs Simulation Models, Applications to Operating Systems, Databases, Computer Networks Architectures

Recommended Readings:
CSL637: Introduction to Machine Learning (Elective-I)

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Total Marks: 100

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Note for Candidate:
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Unit I
Introduction, linear classification, Perceptron update rule Perceptron convergence, generalization, Maximum margin classification, Classification errors, regularization, logistic regression, Linear regression, estimator bias and variance, active learning, Active learning (cont.), non-linear predictions

Unit II
Kernels, Kernel regression, kernels, Support vector machine (SVM) and its implementation in PYTHON, kernels, kernel optimization, Model selection, Model selection criteria
Description length, feature selection, Combining classifiers, boosting, margin, and complexity, Margin and generalization.

Unit III
Mixture models, Mixtures and the expectation maximization (EM) algorithm, EM, regularization, clustering, Spectral clustering
Programming in PYTHON: Markov models, Hidden Markov models (HMMs).

Unit IV

References:
CSL635: INTRODUCTION TO DATA ANALYTICS (Elective-I)  

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**Note for Candidate:**
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**Pre-requisites:** This course requires that you are familiar with high-school level linear algebra, and calculus. Knowledge of probability theory, statistics, and programming is desirable.

**Unit I**

**Unit II**
Regression & ANOVA: Regression ANOVA (Analysis of Variance).

**Unit III**
WEKA implementation of Supervised Learning with Regression and Classification techniques -1: Bias-Variance Dichotomy Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression and Classification Trees, Support Vector Machines.
WEKA implementation of Supervised Learning with Regression and Classification techniques -2 Ensemble Methods: Random Forest Neural Networks Deep learning.

**Unit IV**
Unsupervised Learning and Challenges for Big Data Analytics, Clustering Associative, Rule Mining Challenges for big data analytics, Prescriptive analytics, Creating data for analytics through designed experiments, Creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning.

**References:**
3. NOC: Introduction to Data Analytics - Video coursehttp://nptel.ac.in
CSL620: MAJOR PROJECT

A candidate should work on the project for 5 months and 6–8 hours on each working day.

I\textsuperscript{st} synopsis (containing mainly literature survey corresponding to the problem taken up for the project work and line of attack to solve the problem) within one month of joining the training is to be submitted and will be evaluated for 4 credits.

II\textsuperscript{nd} synopsis (containing essentially the progress of work in comparative details) within three months of joining the training is to be evaluated will be evaluated for 7 credits.

Credits for Final Project Report & Viva Voce: 15
All the candidates of MCA final project are required to submit a project report based on the work done by him/her during the project period. A student will submit his/her project report in the prescribed format. A student has to submit: three hard copies of the project report, and a soft copy of project on CD/DVD in a thick envelope pasted inside of the back cover of the project report.

Prescribed outline for the project report
1. Title Page (format as in Anenxure -1)
2. Declaration (format as in Anenxure -1)
3. Certificate from the Project Guide on letter head of an organization (format as in Anenxure -1)
4. Acknowledgement
5. Abstract
6. Index
7. List of Figures
8. List of Tables
9. List of acronyms and abbreviations
10. Introduction to the project
11. Statement of the Problem
12. Theoretical Background / Literature review
13. Software Development Life Cycle and its deliverables as the project progressed
   - Requirement Gathering and Analysis
   - Feasibility Study
   - Design
   - Coding -complete code is not required. You can add important code snippets.
   - Implementation and Testing
   - Building and Deployment
14. Limitations of the project
15. Conclusions and Future Work
16. References
17. Annexures (optional)
Annexure – I

DECLARATION
The work embodied in this project entitled “Name of your project” submitted to the Department of Computer Science, Guru Nanak Dev University, Amritsar, for the award of degree of Master of Computer Application has been done by me. The project report is entirely based on my own work and not submitted elsewhere for the award of any other degree. All ideas and references have been duly acknowledged.

Name & Signature of the Candidate
Date

CERTIFICATE

This is to certify that this project entitled, “Name of the project”, submitted to the Department of Computer Science, Guru Nanak Dev University, Amritsar, for the degree of Master of Computer Application was carried out by Mr./Ms. __________________________ Roll No. ____________ is an authentic work carried out by him/her at ____________________________ under my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Supervisor
Dated:
MASTER OF COMPUTER APPLICATIONS (MCA)  
(Credit Based Continuous Evaluation Grading System) (SEMESTER – VI)

Title of the Project Report  
(Times New Roman, Font size = 24)

Project Report  
(Times New Roman, Font Size= 16)

Submitted to the Faculty of Engineering and Technology

for the partial fulfilment of the requirements of

Master of Computer Applications  
(Times New Roman, Font Size= 14)

Supervised by:  
Name of Supervisor

Submitted by:  
Name and Roll no of student

(Times New Roman, Font Size= 14)

University LOGO

Department of Computer Science  
Guru Nanak Dev University  
Amritsar- 143005  
India

Month, Year  
(Times New Roman, Font Size= 16)