

ORDINANCES

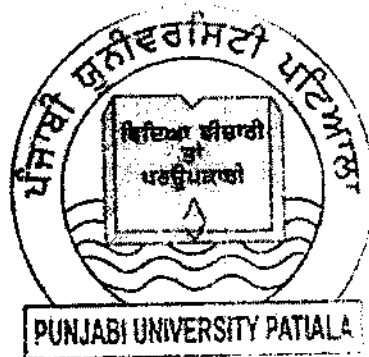
of

**MASTER OF COMPUTER APPLICATIONS
(MCA)**

(TWO-YEAR REGULAR COURSE AS PER AICTE SCHEME)

CHOICE BASED CREDIT SYSTEM

Effective from Session 2021-22 onwards



**FACULTY OF COMPUTING SCIENCES,
PUNJABI UNIVERSITY,
PATIALA – 147002**

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**ORDINANCES OF
MASTER OF COMPUTER APPLICATIONS (MCA)
(TWO-YEAR REGULAR PROGRAMME)**

Notwithstanding the integrated nature of a course spread over more than one semester, the ordinances in force at the time, a student joins a course shall hold good only for the examination held during or at the end of the semester. Nothing in these ordinances shall be deemed to debar the University from amending the ordinances subsequently and the amended ordinances, if any, shall apply to all the students whether old or new. In case of any dispute arising out of these Ordinances, the decision of the Vice Chancellor shall be final and binding.

1. Structure and Duration of the Programme:

- (i) The course for the degree of Master of Computer Applications (MCA) shall be spread over two years to be called Semester I, II, III and IV. The end-semester examination for odd semesters, i.e. Semester I and III shall be held in the month of November/ December and for even semesters, i.e. Semester II and IV in the month of May/ June or on such other dates as may be decided by Punjabi University, Patiala.
- (ii) The programme of instruction will consist of:
 - Core courses
 - Elective courses
 - Project work

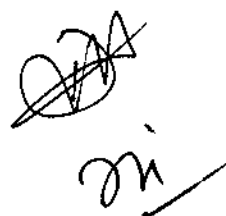
The nomenclature, modalities and other details of the core courses, elective courses and the project work will be as decided by the concerned academic bodies of the University.
- (iii) Semester I, II and III will be regular semesters consisting of theory and practical classes in the Department and Semester IV will be reserved for project work wherein the student is required to undertake project development in an IT/ software development company.
- (iv) The outlines of tests and syllabi and the evaluation of the project shall be such as prescribed by the concerned Board of Studies from time to time.
- (v) Maximum period for completing the MCA two-year degree (including the period of bridge course, if applicable) shall be four years.
- (vi) The medium of instructions as well as examination shall be English.

2. Number of Seats:

Total number of seats in MCA two-year course shall be ~~80~~ 80. The distribution of seats and other additional seats will be as per Punjabi University Patiala norms as decided upon from time to time.

3. Eligibility of Admission:

The admission to MCA two-year course shall be open to candidates who are eligible under the following conditions:



(a) Passed BCA/ Bachelor's Degree in Computer Science/ Engineering/ B.Sc. (Mathematics and Computing)/ B.Sc. (Computer Science, Statistics and Mathematics)/ B.Voc. (Software Development) or equivalent degree of minimum 3 years' duration of any statutory university with at least 50% marks in aggregate (45% marks for SC/ST and differently-abled persons with at least 40% disability).

OR

(b) Passed B.Sc./ B.Com./ B.A. degree of minimum 3 years' duration of any statutory university with at least 50% marks in aggregate (45% marks for SC/ST and differently-abled persons with at least 40% disability), with Mathematics at 10+2 level or at Graduation level. In addition, Candidates must have passed Postgraduate Diploma in Computer Applications (P.G.D.C.A) or equivalent postgraduate diploma of minimum one-year duration from a recognized university with at least 50% marks in aggregate (45% marks for SC/ST and differently-abled persons with at least 40% disability).

OR

(c) Passed B.Sc./ B.Com./ B.A. degree of minimum 3 years' duration of any statutory university with at least 50% marks in aggregate (45% marks for SC/ST and differently-abled persons with at least 40% disability), with Mathematics at 10+2 level or at Graduation level. **Such candidates will be required to qualify the additional Bridge Course, as per Clause 8 of the Ordinance.**

4. Basis for Admission:

Admission to First year of MCA two-year course will be made purely on the basis of the merit of the qualifying examination and/or entrance test to be determined by Punjabi University, Patiala.

5. Attendance:

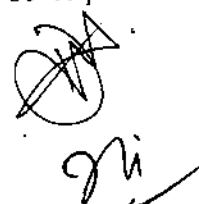
Attendance is taken compulsorily by the teacher.

A candidate admitted to the MCA Course must fulfill the following requirements:

- i. Has been on the rolls of the Department throughout the semester preceding the examination.
- ii. Every candidate will be required to attend a minimum of 75% of the delivered number of periods in each paper. For Teaching/ Seminars/ Tutorials and Lab Practicals, period of one hour's duration shall be counted as one attendance.
- iii. For late admission, the counting of lectures will be considered from the date of deposit of fee.
- iv. In case of students, whose names are struck off on account of non-payment of fee, their periods, for the time they were not on the rolls, shall not be accounted for.
- v. The shortage in the attendance of lectures by the candidate will be condoned as per University rules applicable from time to time.

6. Schedule for Examination Fees:

Candidates shall submit their Examination forms for admission to the examination duly countersigned by the Head of the Department. The candidate will be required to pay



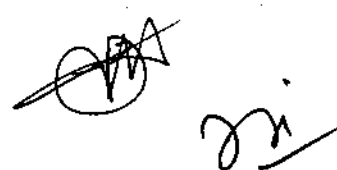
examination fees as per the schedule prescribed by the University from time to time. Also, the candidates admitted with the condition of qualifying Bridge Course as per clause 3 (c) shall be required to submit separate examination forms along with the prescribed fee for admission to the bridge course examination.

7. Minimum Requirements to Continue the Programme:

- (I) (a) In each theory paper, 50% of the total marks are assigned to the continuous assessment and 50% marks to the University examination; and in each laboratory practical paper, 60% of the marks are assigned for continuous assessment and 40% marks for University examination. The minimum number of marks required to pass each theory and practical examination shall be 40% in each paper in aggregate, provided the candidate gets minimum 40% marks individually in the continuous assessment as well as minimum 40% marks individually in the university examination.
- (b) When a candidate has failed or is placed under 'reappear' in the University examination but passes in the continuous assessment, the marks of continuous assessment shall be carried forward for subsequent examinations. If a candidate has failed or is placed under 'reappear' in the continuous assessment, but passes in the University examination, the marks in the University examination shall be carried forward for subsequent examinations. In that case, the candidate will have to improve his/her score in the continuous assessment by taking only a single test covering entire syllabus for that subject, which will consist of total marks assigned to Internal Assessment for that paper (theory or practical). Such candidate will have to inform the Department in writing and in turn the test will be scheduled by the Department. The grace marks shall be allowed to the student as per general ordinances of University.
- (II) (a) There will be no condition of passing papers for promotion from odd semester to even semester in an academic session.
- (b) To qualify for admission to Second year of the MCA two-year course, the candidate must have passed at least 50% of total papers of the two semesters of the First year (and must have qualified at least 50% of the total papers of the Bridge Course, if applicable).
- (c) A candidate placed under re-appear in any paper, will be allowed two chances to clear the reappear which should be availed within consecutive two years/chances, i.e. to pass in a paper, the candidate will have a total of three chances, one as regular student and two as a reappear candidate.

The examination of the reappear papers of odd semester will be held with regular examination of the odd semester and reappear examination of even semester will be held with regular examination of even semester. But if a candidate is placed under reappear in the last semester of the course, he/she will be provided chance to pass the reappear with the examination of the next semester, provided his/her reappear of lower semester does not go beyond next semester. Option of re-evaluation shall be available to the candidates as per the general ordinances of the University.

- (III) Subject to fulfillment of requirements of Ordinance 7 (i) and 7 (II), a candidate shall be allowed to join:

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- (a) Second Semester: Provided that he/she has undergone a regular course of studies of First Semester as provided under the regulations and fulfills the conditions as laid in Ordinance 5 for each semester.
- (b) Third Semester: provided that he/she has undergone a regular course of studies of First and Second Semesters as provided under the regulations in sequential order and fulfills the conditions as laid in Ordinance 5 for each semester.
- (c) Fourth Semester: Provided that he/she has undergone a regular course of studies of First, Second and Third semesters as provided under the regulations in sequential order and fulfills the conditions as laid in Ordinance 5 for each semester.

8. Bridge Course:

The students admitted to MCA two-year course as per eligibility under clause 3 (c) with a condition of Bridge Course will be required to qualify the bridge course within the stipulated time period, failing which the degree will not be awarded to such students.

- (i) The Bridge Course will be spread over two semesters of the MCA First Year and will be additional course along with the regular MCA course.
- (ii) The Bridge Course will comprise of the papers as decided by the concerned Board of Studies from time to time.
- (iii) The scheme of papers, tests and syllabi, and other modalities of the bridge course will be decided by the concerned Board of Studies of the University.
- (iv) There will not be any direct teaching classes held for the papers of the Bridge Course by the Department. The students will be required to cover the syllabi of the Bridge Course of their own along with the regular courses of the MCA course and appear for the End-Semester examinations.
- (v) There will not be any Internal Assessment component for the papers of the Bridge Course and students will be required to appear for the final end-semester examinations for the papers of the bridge course.
- (vi) The End-Semester examinations of the bridge course will be held along with the regular papers of First and Second semesters of MCA First year.
- (vii) The rules of re-appear/ re-evaluation for Bridge Course will be same as applicable to the MCA regular course.
- (viii) The bridge course will be qualifying in nature and the marks obtained/ credits earned in the bridge course by the students will not be counted towards the MCA degree.
- (ix) If a candidate fails to qualify the Bridge Course within the maximum stipulated period as prescribed in the MCA Ordinances, he/she will not be awarded the MCA Degree.

9. System of Tests and Weightage:

The system of tests will comprise of Internal assessment and University examination for theory papers and laboratory papers for Semester I, Semester II and Semester III for MCA two-year course. The evaluation of the Project work under Semester IV will be as per the regulations passed by the concerned Board of Studies of the University. The following will be the criteria of weightage for each theory paper/ practical lab paper:



Continuous Assessment (Theory Papers)	Continuous Assessment (Practical Labs)
<ol style="list-style-type: none"> 1. Two tests will be conducted during the semester. Both the tests will be considered for assessment: 60% of the marks allotted for continuous assessment. 2. Assignments/Quizzes: 20% of the marks allotted for continuous assessment. 3. Attendance: 10% of the marks allotted for continuous assessment. 4. Class Participation and behaviour: 10% of the marks allotted for continuous assessment. 	<ol style="list-style-type: none"> 1. Two tests will be conducted during the semester. Both the tests will be considered for assessment: 60% of the marks allotted for continuous assessment. 2. Lab Assignments: 30% of the marks allotted for continuous assessment. 3. Attendance: 10% of the marks allotted for continuous assessment.
University Examination (Theory Papers)	University Examination (Practical Labs)
<p>Maximum Marks for End-Semester theory examination: 50.</p> <p>End-Semester Examination for theory papers will be of 3 hours' duration. The question paper will consist of three Sections: A, B and C. Sections A and B will have four questions each from the respective section of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short-answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.</p>	<p>Maximum Marks for End-Semester Practical examination: 40.</p> <p>The evaluation will be done jointly by the team of internal and external examiners. The examiners will give due weightage to Logic development/Program execution, Lab records and viva-voce of the student while awarding marks to the student during end-semester final practical examination.</p>

10. Declaration of Results:

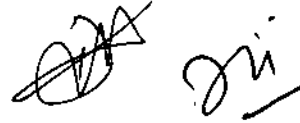
After the termination of examination or as soon thereafter as possible, the Registrar shall publish the result of the candidates. Each candidate shall receive a certificate indicating details of marks obtained in each examination. Successful candidates at the end of Semester IV examination shall receive a degree stating the Division/Cumulative Grade Points according to Ordinance 11.

11. Award for Division and Distinction:

Successful candidates who obtain 60% or more of the aggregate number of marks of all the four semester examinations taken together, shall be placed in the First division. Those who obtain 50% marks or more but less than 60% in the Second division and below 50% marks shall be placed in the Third Division. Successful candidates who obtain 75% marks or more in aggregate in a single attempt without any reappear in any subject/paper shall be placed in First division with distinction.

12. Award of University Medals:

University medal will be awarded to MCA two-year regular course candidate who secured first position in the University on the basis of the marks of all four semesters taken together. In addition to this condition, candidate must complete his/her MCA two-year regular course degree in minimum duration with single attempt in all subjects/papers. However, the general rules and conditions of the University for the award of medal/prizes etc. will be applicable in the award of University medal to the topper of the respective admission batch.

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PUNJABI UNIVERSITY, PATIALA

**SYLLABI
OUTLINES OF TESTS AND
COURSES OF READINGS**

FOR

MASTER OF COMPUTER APPLICATIONS (MCA)

FIRST YEAR (SEMESTER I & II)

(Sessions 2021-22 & 2022-2023)

Programme Code: MCA M2 PUP

CHOICE-BASED CREDIT SYSTEM

(As per RUSA Guidelines)



**PUNJABI UNIVERSITY,
PATIALA 147002**

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**M.C.A. (MASTER OF COMPUTER APPLICATIONS)
FIRST YEAR-FIRST SEMESTER EXAMINATIONS**

Sessions 2021-22& 2022-2023 Programme Code - MCAM2PU

Paper Code	Title of Paper	L	T	P	C	Internal Marks		External Marks	
						Max	Pass	Max	Pass
MCAM1101F	Computer Organization and Architecture	4	0	0	4	50	20	50	20
MCAM1102T	Data Structures and Algorithms	4	0	0	4	50	20	50	20
MCAM1103T	Object Oriented Programming using C++	4	0	0	4	50	20	50	20
MCAM1104T	Statistics and Probability	4	0	0	4	50	20	50	20
MCAM1105E	Elective-I	4	0	0	4	50	20	50	20
MCAM1106L	Programming Lab-I (Data Structures and Algorithms)	0	0	4	2	60	24	40	16
MCAM1107L	Programming Lab-II (OOP using C++)	0	0	4	2	60	24	40	16
	Total	20	0	8	24	370		330	

*Elective - I: Any one of the following papers:

Paper Code	Title of Paper
MCAM1105E1	Information Systems
MCAM1105E2	Mathematics for Machine Learning
MCAM1105E3	Programming Languages
MCAM1105E4	E-Commerce
MCAM1105E5	System Software

*Note: The electives will be offered to the students depending upon the availability of the teachers. The decision of the Head of the Department in this respect will be final. Student can also opt for any MOOC as an elective in place of the above offered electives. The list of MOOCs must be passed by the ACD.

CONTINUOUS ASSESSMENT (THEORY PAPERS)

1.	Two tests will be conducted during the semester. Both the tests will be counted for assessment.	:	60% of the total marks allotted for continuous assessment.
2.	Assignment/Quizzes	:	20% of the total marks allotted for continuous assessment.
3.	Attendance	:	10% of the total marks allotted for continuous assessment.
4.	Class Participation and behaviour	:	10% of the total marks allotted for continuous assessment.

CONTINUOUS ASSESSMENT (PRACTICAL LAB)

1.	Two tests will be conducted during the semester. Both the tests will be counted for assessment.	:	60% of the total marks allotted for continuous assessment.
2.	Lab Assignments	:	30% of the total marks allotted for continuous assessment.
3.	Attendance	:	10% of the total marks allotted for continuous assessment.

**M.C.A. (MASTER OF COMPUTER APPLICATIONS)
FIRST YEAR-SECOND SEMESTER EXAMINATIONS**

Programme Code **MCAM2PUP** Sessions 2021-22 & 2022-2023

Paper Code	Title of Paper	L	T	P	C	Internal Marks		External Marks	
						Max	Pass	Max	Pass
MCAM1201T	Data Communication and Computer Networks	4	0	0	4	50	20	50	20
MCAM1202T	Operating Systems	4	0	0	4	50	20	50	20
MCAM1203T	Relational Database Management System	4	0	0	4	50	20	50	20
MCAM1204T	Data Science using Python	4	0	0	4	50	20	50	20
MCAM1205E	Elective-II	4	0	0	4	50	20	50	20
MCAM1206L	Programming Lab-III (RDBMS and Minor Project)	0	0	4	2	60	24	40	16
MCAM1207L	Programming Lab-IV (Data Science & Python Lab)	0	0	4	2	60	24	40	16
	Total	20	0	8	24	370		330	

***Elective - II: Any one of the following papers:**

Paper Code	Title of Paper
MCAM1205E1	Ethical Hacking
MCAM1205E2	Computer Based Optimization Techniques
MCAM1205E3	Object Oriented Modelling and Design using UML
MCAM1205E4	ERP Systems and Processes
MCAM1205E5	Software Project Management

***Note:** The electives will be offered to the students depending upon the availability of the teachers. The decision of the Head of the Department in this respect will be final. Student can also opt for any MOOC as an elective in place of the above offered electives. The list of MOOCs must be passed by the ACD.

CONTINUOUS ASSESSMENT (THEORY PAPERS)

1.	Two tests will be conducted during the semester. Both the tests will be counted for assessment.	:	60% of the total marks allotted for continuous assessment.
2.	Assignment/Quizzes	:	20% of the total marks allotted for continuous assessment.
3.	Attendance	:	10% of the total marks allotted for continuous assessment.
4.	Class Participation and behaviour	:	10% of the total marks allotted for continuous assessment.

CONTINUOUS ASSESSMENT (PRACTICAL LAB)

1.	Two tests will be conducted during the semester. Both the tests will be counted for assessment.	:	60% of the total marks allotted for continuous assessment.
2.	Lab Assignments	:	30% of the total marks allotted for continuous assessment.
3.	Attendance	:	10% of the total marks allotted for continuous assessment.

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**Master of Computer Applications
Semester-I**

Computer Organization and Architecture (Subject Code: MCAM11017)

**Maximum Marks: 50
Minimum Pass Marks: 40%**

**Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55**

This course will introduce students to the fundamental concepts underlying modern computer organization and architecture. Main objective of the course is to familiarize students about hardware design including logic design, basic structure and behavior of the various functional modules of the computer and how they interact to provide the processing needs of the user. The emphasis is on studying and analyzing fundamental issues in architecture design and their impact on performance. By the end of this course, students should be able to:

- understand the basics of computer hardware and how software interacts with computer hardware
- understand how computers represent and manipulate data
- understand computer arithmetic and convert between different number systems
- understand basics of Instruction Set Architecture

Course content

SECTION A

Number System: Number conversions, Arithmetical operations, Concepts about bits, bytes and word. Representation of Information: Integer and floating point representation, Complement schemes, Character codes (ASCII, EBCDIC, BCD, 8421, 2421, Excess-3, Grey, Hamming, Parity). Basic Building blocks: Boolean Algebra, K-maps. Combinational logic design: half-adder/subtractor, full adder/subtractor, parallel adder, Multiplexers, Demultiplexers, Decoders, Encoders. Sequential circuits- concept, flip-flops (RS, D, JK, JK-Master-Slave, T), counters (Asynchronous, Synchronous) Mod-3, Mod-5, Decade Counter. Computer organisation: Structure of Computer, Instruction codes, Instruction formats, Instruction cycle, Addressing modes.

SECTION B

Register Transfer Language, Arithmetic, Logic and Shift micro-operations, Control Memory: Design of control unit, Micro program Sequencer, Micro programmed and hardwired control unit (overview only), Features of RISC and CISC. Memory organisation: Concepts of semiconductor memory, CPU- memory interaction, organization of memory modules, Cache memory and related mapping and replacement policies, Virtual memory. I/O organisation: I/O interface, Modes of data transfer: Programmed - initiated, Interrupt initiated, DMA, I/O controllers. Architecture of 8085, Assembly language programming of 8085 machine.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Digital Principles & Applications, D. P. Leach, A. P. Malvino, Goutam Saha, Tata McGraw-Hill.
2. Computer Organization and Architecture, William Stallings, Pearson Education.
3. Structured Computer Organization, A.S. Tanenbaum, Prentice-Hall of India.
4. Fundamentals of Computer Organization and Architecture, JyotsnaSengupta, Deep and Deep Publications.
5. Computer System Architecture, M.Morris Mano, Prentice-Hall of India.
6. Computer Systems Design and Architecture, Vincent. P. Heuring, Harry. F. Jordan, T.G. Venkatesh, Pearson Education.
7. Computer Architecture, Nicholas Carter, Schaum's Outlines, Tata McGraw Hill.

Scheme of Examination

- English will be the medium of instruction and examination.
- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks for written examination to be held at the end of each semester.
- The duration of written examination for each paper shall be three hours'.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours' duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.

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**Master of Computer Applications
Semester-I**

Data Structures and Algorithms (Subject Code: MCAM1102T)

Maximum Marks: 50

Maximum Time: 3 Hrs.

Minimum Pass Marks: 40%

Lectures to be delivered: 45-55

Objective of this course is to introduce the concept of algorithm development, programming and program validation. It includes a special emphasis on the design and application of data and file structures. Upon completion of this course, students will:

- Be familiar with basic techniques of algorithm analysis
- Be familiar with writing recursive methods
- Master the implementation of linked data structures such as linked lists and binary trees
- Be familiar with advanced data structures such as balanced search trees, hash tables, priority queues and the disjoint set union/find data structure

Course content

SECTION A

Basic Data Structures and Operations on them: Arrays, Stacks and Queues (Circular queues, Priority queues, Double-ended queues), Linked List (singly, doubly, singly circular, doubly circular) and their Applications.

Binary Tree: Linked and static Representation, Binary Tree Traversals. Binary Search Tree (create, delete, search, insert, display), AVL Trees. Heap and Heap Sort Algorithm.

Graphs and Their Application, Sequential and Linked Representation of Graph-Adjacency Matrix, Operations on Graph, Traversing a Graph (DFS and BFS), Minimal Spanning Tree.

SECTION B

Introduction to algorithm analysis: Introduction to algorithms, Algorithm Specifications, performance analysis, case study on analysis of algorithms.

Divide and conquer technique of problem solving: Quick sort and Merge Sort Algorithms and their Performance Analysis.

Greedy algorithms: General Method, Case Study based on Greedy Algorithm (Knapsack Problem, Single source shortest paths, transitive closure and APSP problem).

Dynamic Programming: General Method, Multistage graphs, All Pair Shortest Paths, Optimal Binary Search Trees, String Editing.

Hashing: Introduction to hash table, hash function, resolving collision by chaining and open addressing, deleting items from a hash table.

Intractable Problems: Nondeterministic Algorithms, NP Hard and NP complete Problems, NP Hard Graph Problem (Travelling Salesman problem), NP Hard Scheduling Problems (Job Shop Scheduling)

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

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Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

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Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

- A, Tenenbaum, Y. Langsam and M.J. Augenstein: Data Structures Using C++, Pearson Education.
- Data Management and File Structures, Mary E.S. Loomis, PHI.
- Data Structures with C, Seymour Lipschutz, Schaum's Outlines, Tata McGraw-Hill.
- Robert Sedgewick: Algorithms in C++: Fundamentals, Data Structures, Sorting, Searching, Parts 1-4, Pearson Education.
- Heilemau G. L.: Data Structures, Algorithm and Object Oriented Programming, T.M. H. Publications
- Mark A. Weiss: Data Structures and Algorithm Analysis in C++, Pearson Education.
- Goodman S.E. and Hedeniemi: Introduction to the Design and Analysis and Algorithms, TMH Publications.
- Sara Baose, Gelder A.V. : Computer Algorithms: Introduction to Design and Analysis, Pearson Education.
- Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, Universities Press.
- John Hubbard: Schaum's Outline of Data Structures With C++, Tata McGraw-Hill.

Scheme of Examination

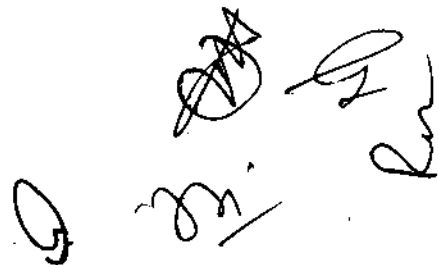
- English will be the medium of instruction and examination.
- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks for written examination to be held at the end of each semester.
- The duration of written examination for each paper shall be three hours'.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours' duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.



Master of Computer Applications
Semester-I
Object Oriented Programming Using C++ (Subject Code: MCAM103T)

Maximum Marks: 50**Maximum Time: 3 Hrs.****Minimum Pass Marks: 40%****Lectures to be delivered: 45-55**

This module teaches the basic principles of object-oriented programming, design and testing. The main objective is to provide in-depth coverage of object-oriented programming principles and techniques using C++. Topics include classes, overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, templates, exceptions, container classes, and low-level language features. On completion of course, Students should be able to:

- Understand the basic components of an object-oriented program including methods and attributes.
- Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.
- Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
- Demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.
- Learn syntax, features of, and how to utilize the Standard Template Library.

Course content

SECTION A

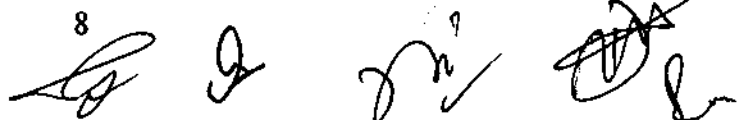
Evolution of OOP: Procedure Oriented Programming, OOP Paradigm, Advantages and disadvantages of OOP over its predecessor paradigms. Characteristics of Object Oriented Programming: Abstraction, Encapsulation, Data hiding, Inheritance, Polymorphism, Code Extensibility and Reusability, User defined Data Types. Introduction to C++: Identifier, Keywords, Constants, data types, Modifiers. Reference variables. Operators: Arithmetic, relational, logical, conditional and assignment. sizeof operator, Operator precedence and associativity. Type conversion, Variable declaration, expressions, statements, manipulators. Input and output statements, stream I/O, Conditional and Iterative statements, breaking control statements. Storage Classes: Automatic, Static, Extern, Register.

Arrays, Arrays as Character Strings, Structures, Unions, Bit fields, Enumerations and User defined types. Pointers: Pointer Operations, Pointer Arithmetic, Pointers and Arrays, Multiple indirections, Generic pointers. Functions: Prototyping, Definition and Call, Scope Rules. Parameter Passing: by value, by address and by reference, Functions returning references, recursion, function overloading, Default Arguments, Const arguments. Pointer to functions, Inline functions. Command line arguments, Pre-processor directives: #define, #error, #include, #if, #else, #elif, #endif, #ifdef, #ifndef, #undef, Type casting: static_cast, const_cast, dynamic_cast, reinterpret_cast. Classes and Objects: Class Declaration and Class Definition, Defining member functions, making functions inline, Nesting of member functions, Members access control, const data members, const member functions, this pointer. Union as space saving classes. Objects: Object as function arguments, array of objects, functions returning objects. Static data members and Static member functions. Friend functions and Friend classes: Global functions as friends of class, member functions as friends of another class, class as friend of another class. Constructors: properties, types of constructors (Default, parameterized and copy), Dynamic constructors, multiple constructors in classes. Destructors: Properties, Destroying objects. Rules for constructors and destructors. Array of objects. Dynamic memory allocation using new and delete operators, Nested and container classes. Scopes: Local, Global, Namespace and Class

SECTION B

Inheritance: Defining derived classes, inheriting private members, single inheritance, types of derivation, function redefining, constructors in derived class. Types of inheritance: Single, Multiple, Multilevel and Hybrid. Types of base classes: Direct, Indirect, Virtual, Abstract. Code Reusability. Polymorphism: Methods of achieving polymorphic behavior. Operator overloading: overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function. Function overloading: early binding, Polymorphism with pointers, virtual functions, late binding, pure virtual functions and abstract base class. Virtual

8



destructors. Difference between function overloading, redefining, and overriding. Templates: Generic Functions and Generic Classes, Overloading of template functions. Exception Handling catching class types, handling derived class exceptions, catching exceptions, restricting exception, rethrowing exceptions, terminate and unexpected, uncaught exceptions.

Files and streams: Classes for file stream operations, opening and closing of files, stream state member functions, binary file operations, structures and file operations, classes and file operations, I/O with multiple objects, error handling, sequential and random access file processing. STL: Containers, Algorithms, Iterators, RTTI

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

- Herbert Schildt, C++: The Complete Reference, Tata McGraw-Hill.
- Paul Deitel and Harvey Deitel, C++ How to Program, Pearson Education.
- Robert Lafore, Object Oriented Programming in C++, Pearson Education.
- Bjarne Stroustrup, The C++ Programming Language, Addison Wesley Publication Co.
- Stanley B. Lippman, Josee Lajoie, Barbara E. Boo, C++ Primer, Addison Wesley Publication Co.
- E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw-Hill

Scheme of Examination

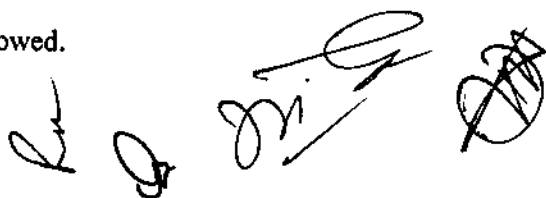
- English will be the medium of instruction and examination.
- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks for written examination to be held at the end of each semester.
- The duration of written examination for each paper shall be three hours'.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours' duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.



Master of Computer Applications
Semester I
Statistics and Probability (Subject Code: MCAAM1104T)

Maximum Marks: 50**Maximum Time: 3****Hrs.****Minimum Pass Marks: 40%
delivered: 45-55****Lectures to be**

This Course will help students gain deep understanding of the concepts of basic statistics and probability theory used to make numerical conjectures about problems. The main objective is to provide students with pragmatic tools for assessing statistical claims and conducting their own analyses through various tools of descriptive statistics and probability. On completion of this course, the students will be able:

- Learn the nature of statistics and how it plays an important role in our daily lives.
- Organize and summarize data, and represent graphically the important information contained in a data set.
- Compute numerical quantities that measure the central tendency and dispersion of a set of data.
- Understand the elementary properties of probability.
- Compute the correlation among variables using different methods.
- Find the least squares regression line.
- Learn the concepts of mathematical expectation, random variable and probability distribution.

Course content

Section A

Introduction: Definition, importance and scope of statistics, Limitations of statistics, Concepts of statistical population and a sample - quantitative and qualitative data - collection of primary and secondary data, Sources of data, Techniques of data collection. Designing a questionnaire and a schedule. Sampling: Theoretical basis of sampling, Methods of sampling. Classification and tabulation of data. Diagrammatic and graphical representation of data. Construction of univariate and bivariate frequency distributions.

Univariate data: Concepts of Central Tendency, Mean, Median, Mode and Quartiles, Partition values and Measures of Dispersion, Range, Quartile Deviation, Mean Deviation and Standard Deviation, Box plot. Skewness and kurtosis. Their measures based on quartiles and moments.

Section B

Bivariate data: Definition, Scatter diagram. Principle of least squares.

Correlation Analysis: Introduction, Types of Correlation, Correlation versus causation. Measurement of Correlation: Karl Pearson's Product Moment Coefficient of Correlation, Spearman's Rank Correlation.

Regression Analysis: Introduction, Utility, Method of Least Squares, Regression equations, Coefficient of Regression, Properties of regression coefficients, Standard Error of Estimate.

Probability and Expected Value: Probability: Introduction, random experiments, sample space, events and algebra of events. Approaches to probability - classical, empirical, subjective and axiomatic. Theorems on probabilities of events, laws of addition and multiplication. Conditional probability, independence of events. Bayes' theorem and its applications. Concepts of Mathematical expectation, random variable and probability distribution.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Miller & Freund's Probability and Statistics for Engineers, R.A. Johnson, Irwin Miller and John Freund, Pearson Education India.

Reference Books:

1. Fundamentals of Statistics, A.M. Gun, M.K. Gupta and B. Dasgupta, World Press Pvt. Ltd.
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger, Wiley.
3. Introduction to Theory of Statistics, A.M. Mood, F.A. Graybill and D.C. Boes, McGraw-Hill.
4. Statistical Methods, S.P. Gupta, Sultan Chand and Sons.

Scheme of Examination

- English will be the medium of instruction and examination.
- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks for written examination to be held at the end of each semester.
- The duration of written examination for each paper shall be three hours.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.

**Master of Computer Applications
Semester-I**

Programming Lab - I (Data Structures and Algorithms) (Subject Code: MCA11062)

Maximum Marks: 100*

Maximum Time: 3 Hrs.

Minimum Pass Marks: 40%

Practical units to be conducted: 35-45

This laboratory course will mainly comprise of exercises on the basis of the theory paper: MCA-112(Data Structures and Algorithms)

*The splitting of marks is as under:

- Maximum Marks for Continuous Assessment: 60
- Maximum Marks for University Examination: 40

CONTINUOUS ASSESSMENT (PRACTICAL LAB)

1.	Two tests will be conducted during the semester. Both the tests will be counted for assessment.	:	60% of the total marks allotted for continuous assessment.
2.	Lab Assignments	:	30% of the total marks allotted for continuous assessment.
3.	Attendance	:	10% of the total marks allotted for continuous assessment.

NOTE: The examiner will give due weightage to Logic development/ Program execution, Lab records and viva-voce of the student while awarding marks to the student during end-semester final practical examination.



Master of Computer Applications
Semester-I
Programming Lab - II (OOP using C++) (Subject Code: MCA1107L)

Maximum Marks: 100*
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Practical units to be conducted: 35-45

This laboratory course will mainly comprise of exercises on the basis of the theory paper: MCA-113 (Object Oriented Programming using C++)

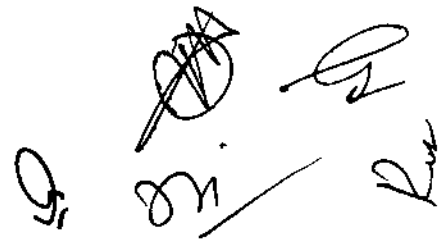
*The splitting of marks is as under:

- Maximum Marks for Continuous Assessment: 60
- Maximum Marks for University Examination: 40

CONTINUOUS ASSESSMENT (PRACTICAL LAB)

1.	Two tests will be conducted during the semester. Both the tests will be counted for assessment.	:	60% of the total marks allotted for continuous assessment.
2.	Lab Assignments	:	30% of the total marks allotted for continuous assessment.
3.	Attendance	:	10% of the total marks allotted for continuous assessment.

NOTE: The examiner will give due weightage to Logic development/ Program execution, Lab records and viva-voce of the student while awarding marks to the student during end-semester final practical examination.



Master of Computer Applications
Semester-I
Information Systems (Subject Code: MCAM 1105E1)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

This course will focus on what Information systems are, how they influence your current or prospective jobs, why they impose specific - and sometimes seemingly absurd - operational procedures, and how to use this knowledge to your advantage in your professional life. On completion of this course, students should be able to:

- Understand the conceptual foundations of information systems in organizations
- Appreciate the salient peculiarities and differences among data, information, knowledge and other high-level concepts
- Become familiar with the theories of decision making and its related concepts
- Understand the treatment of quantitative decision problems
- Explain the elements and working of systems in general and information systems in particular
- Describe the different types of information systems and their relevance and functions in modern day organizations.

Course content

Section A

Conceptual foundations: Understanding Data and Information, Difference between data and information, Types of data. Data processing operations, Characteristics of information, Types of information on the basis of purpose, recurrence, source, application and levels of management, Quantitative versus qualitative information. Definition and characteristics of knowledge, Information versus knowledge and experience, Explicit knowledge and tacit knowledge.

Decision-making: Definition and elements of decision-making, Decision making process, Role of information in decision making, Simon's model of decision-making, Bounded rationality and concept of Satisficing, Types of decisions, structured and unstructured decisions, Strategic, tactical and operational decisions.

Section B

Quantitative decision models: Representing quantitative decision problems, Generalized Payoff matrix, Decision-making under assumed certainty model, Decision-making under risk model and Decision-making under uncertainty model, Criterion for choosing alternatives and their computations under different quantitative decision models.

Information Systems: Systems and basic systems concepts, Types of systems, Information systems: definition and characteristics, Types of an information system: Operations Support Systems and Management Support Systems, Comparison of EDP/MIS/DSS. Definition and characteristics of Management Information Systems, Framework for understanding MIS: Robert Anthony's hierarchy of management activity, Information requirements and levels of management, Functional information systems: A brief study of marketing, personnel, financial and production information systems.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

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Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

2. D. P. Goyal, Management Information Systems: Managerial Perspectives, Macmillan India Ltd.

Reference Books:

5. Jerome Kanter, Management Information Systems, Prentice Hall of India.
6. Gordon B. Davis & M.H. Olson, Management Information Systems: Conceptual Foundations, structure & Development, McGraw-Hill Publishing.
7. Robert G. Murdick, Joel E. Ross & James R. Claggett, Information Systems for Modern Management, Prentice Hall of India.
8. W. S. Jawadekar, Management Information Systems, Tata McGraw Hill Publishing.
9. Bryan Bergeron, Essentials of Knowledge Management, John Wiley and Sons.

Scheme of Examination

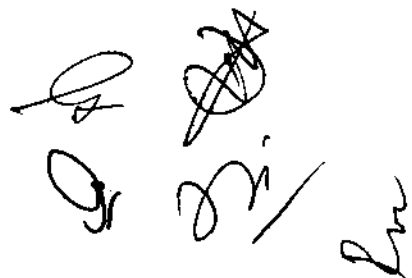
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- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours' duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.



Master of Computer Applications
Semester-I
Mathematics for Machine Learning (Subject Code: *ACAM1105E2*)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

Course content

SECTION-A

Linear Algebra: Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces.

Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions, Orthogonal Projections, Rotations.

Matrix Decompositions: Matrix Decompositions, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation, Matrix Phylogeny.

Vector Calculus: Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation and Automatic Differentiation, Higher-Order Derivatives, Linearization and Multivariate Taylor Series.

SECTION- B

Continuous Optimization: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization.

Linear Regression: Problem Formulation, Parameter Estimation, Bayesian Linear Regression, Maximum Likelihood as Orthogonal Projection.

Dimensionality Reduction with Principal Component Analysis: Problem Setting, Maximum Variance Perspective, Projection Perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice, Latent Variable Perspective.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

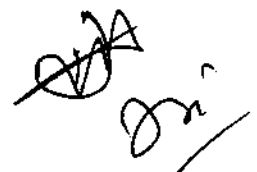
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Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:



1. Mathematics for Machine learning. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong. Cambridge University Press, 2020.

Reference Books:

1. Matrix Analysis (2nd ed.). Roger A. Horn, Charles R. Johnson. Cambridge University Press, 2013.
2. Introduction to Probability (2nd ed.). Dimitri P. Bertsekas, John N. Tsitsiklis. Athena Scientific, 2008.
3. The Elements of Statistical Learning (2nd ed.). Trevor Hastie, Robert Tibshirani, Jerome Friedman. Springer, 2008.

Scheme of Examination

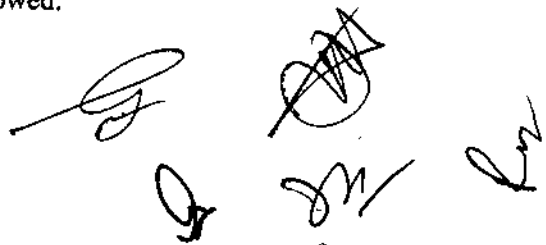
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The external paper will carry 50 marks and would be of three hours duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

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- Use of non-programmable scientific calculator is allowed.

The image shows several handwritten signatures and initials in black ink. There are three distinct signatures on the top row and three sets of initials on the bottom row. The signatures are stylized and difficult to read, but they appear to be official marks of approval or authorization.

Master of Computer Applications
Semester-I
Programming Languages (Subject Code: ~~MCAM 1105E3~~)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

The objective of the course is to develop a greater understanding of the issues involved in programming language design and implementation. It will help in developing an in-depth understanding of functional, logic, and object-oriented programming paradigms. On completion of this course, student will be able to:

- Implement several programs in languages other than the one emphasized in the core curriculum
- Understand design/implementation issues involved with variable allocation and binding, control flow, types, subroutines, parameter passing
- Improve the background for choosing appropriate programming languages for certain classes of programming problems
- Increase the ability to learn new programming languages
- Increase the capacity to express programming concepts and choose among alternative ways to express things

Course content

SECTION A

Need of studying Programming Languages, Evolution of Programming Languages, Criterion for Language Design, Computer Hardware, Firmware Computers, Translators and Software Simulators, Virtual Computers and Binding Times.

Type Checking, Strong Typing, Type Compatibility, Scope and Lifetime, Referencing Environment. Elementary and Structured Data Type.

Sequence Control: Within Expression, Between Statements, Non-arithmetic Expressions.

Subprogram Control: Sequence Control, Data Control, Parameter Transmission, Explicit Common Environment, Co-routines. Storage Management: Elements Requiring Storage, Programmer and System Controlled Storage, Static Storage, Heap Storage Management. Exception Handling

SECTION B

Functional Programming: Functions, Recursion, Control Structures, Implementation,

Introduction to Logic Programming: Concepts, Computing with Relations; Rules, Facts and Queries.

Concurrent Programming: Concepts, Parallelism in H/W, Implicit Synchronization, Concurrency as Interleaving, Liveness Properties, Safe Access to Shared Data, Concurrency in ADA Synchronized Access to Shared Variables.

Object Oriented Programming: Concepts, Objects, Classes, Instances, Abstraction, Data Encapsulation, Information Hiding, Inheritance, Polymorphism its Implementation in C++.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

- T.W. Pratt, M.V. Zelkowitz, *Programming Languages: Design and Implementation*, Pearson Education.
- Robert W. Sebesta, *Concepts of Programming Languages*, Pearson Education.
- Ravi Sethi and K.V. Viswanatha, *Programming Languages: Concepts and Constructs*, Pearson Education.
- Michael Marcotty and Henry F. Ledgard, *Programming Languages Landscape: Syntax, Semantics and Implementation*, SRA Publishers.
- Allen B. Tucker, Robert E. Noonan, *Programming Languages: Principles and Paradigms*, Tata McGraw Hill.

Scheme of Examination

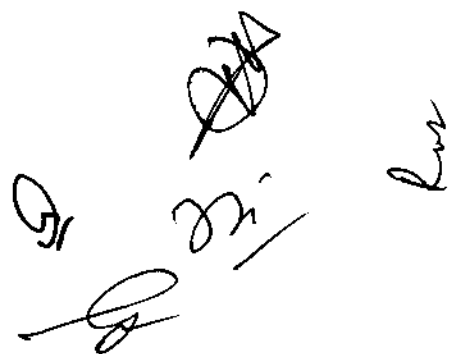
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- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks for written examination to be held at the end of each semester.
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Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.



Master of Computer Applications
Semester-I
E-Commerce (Subject Code: ~~MCAM1105E4~~)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Times: 3 Hrs.
Lectures to be delivered: 45-55

This course provides an overview of e-commerce from both technological and managerial perspectives. It introduces e-commerce frameworks, and technological foundations; and examines basic concepts such as strategic formulation for e-commerce enterprises, management of their capital structures and public policy. This course is designed to familiarize students with current and emerging electronic commerce technologies using the Internet. Topics include Internet technology for business advantage, managing electronic commerce funds transfer, reinventing the future of business through electronic commerce, business opportunities in electronic commerce, electronic commerce Web site design, social, political and ethical issues associated with electronic commerce, and business plans for technology ventures. Upon successful completion, the student will be able to:

- Demonstrate an understanding of the foundations and importance of E-commerce
- Analyze the impact of E-commerce on business models and strategy
- Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
- Describe the infrastructure for E-commerce
- Discuss legal issues and privacy in E-Commerce
- Recognize and discuss global E-commerce issues

Course content

SECTION A

Meaning and concept of electronic commerce, Potential benefits of E-commerce, E-commerce technologies, Types of E-commerce, Business models of E-commerce. Framework of E-commerce, Technology behind E-commerce, Anatomy of E-commerce applications.

E-commerce security issues: threats and impacts. Messaging security issues, Cryptography: encryption technique and mechanism, Firewall: components and functionality, Factors in firewall design.

Regulatory and legal environment for E-commerce.

SECTION B

Electronic Data Interchange: meaning and types of EDI, Benefits and functionality of EDI.

Electronic payment mechanism: Issues in electronic payment systems, Types of electronic payment schemes: smart card, debit card, credit card, electronic cash, electronic cheque. Risk and electronic payment systems.

Web Based Marketing: online advertising mechanism, Internet marketing techniques, Marketing strategies for Internet, Factors in E-commerce website design. E-commerce in India: present status and future scope.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Ravi Kalakota, Andrew B. Whinston, *Frontiers of Electronic Commerce*, Pearson Education.

Reference Books:

1. Efrain Turbon, Lee, David King : "Electronic Commerce-A managerial Perspective", Prentice-Hall.
2. Grenstein, Feinnman, "Electronic Commerce", Tata McGraw-Hill.
3. Pete Loswin, Paul A Murphy : "Electronic Commerce", Jaico Publishing House.

Scheme of Examination

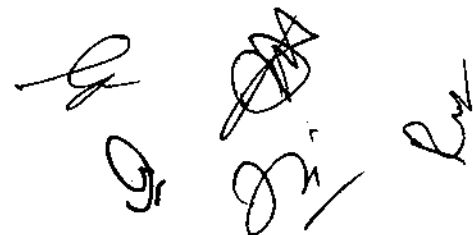
- English will be the medium of instruction and examination.
- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks for written examination to be held at the end of each semester.
- The duration of written examination for each paper shall be three hours.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.

Handwritten signatures and initials in black ink, including a large signature on the left, a signature with a large 'A' on the right, and initials 'Dr', 'Di', and 'Rw' below.

Master of Computer Applications
Semester-I
System Software (Subject Code: MCAM-110565)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

This course demonstrates an in-depth understanding system software loader, linker, assembler, compiler, and parsing techniques. The students learn basic concepts of operating systems and system software's. It also familiarize students with the functioning of the principal parts of an operating system. After completion of this course the student will be able to:

- Identify different system software
- Write macros as and when required to increase readability and productivity
- Design hand written lexical analyzer
- Design new language structures with the help of grammars
- Appreciate the role of Operating System functions such as memory
- Management as pertaining to run time storage management
- Appreciate role of Intermediate Code Generation in connection with language designing
- Apply optimization principles on given code

Course content

SECTION A

Introduction to systems software: Definition, features of system programming, system programming vs. application programming, type of system programmes.

Machine Architecture: Organization of simple computer, Instruction types, addressing modes.

Machine Language: Features of machine language, Machine instruction format of 8086/88 family.

Assembly Language: Features, various types of statements, data types of 8086/88

Assembler: general design procedure of an assembler, two-pass assembler, single pass assembler.

Macro processor: macro instructions, features of macro facility, implementation, one pass macro pre-processor, two pass macro pre-processor, macro assemblers.

SECTION B

Compilers: Overview of compilation process, lexical analysis, syntax analysis, semantic analysis, intermediate code generation, code optimisation techniques, Error Processing.

Loaders and Linkers: Various Loading and Linking Schemes, Design of Assemble and Go loading scheme, Absolute Loader, Re-Locatable loaders, dynamic loading and linking concepts.

Introduction to device drivers, functions and structure of text editor.

Operating System: Introduction, various types of operating system - batch processing, Multiprogramming, Multitasking, time sharing, parallel, distributed and PC operating system.

Resource Manager's View of Operating System: Components of Operating System, User's View of Operating System: Operating System Services, Operating System Structure – Simple structure, Layered Approach, Micro kernel approach.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

22

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. John. J. Donovan, Systems programming, Tata McGraw-Hill.

Reference Books:

1. A.V. Aho, Ravi Sethi, J.D. Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley Publishing Co.
2. D.M. Dhamdhare, "Systems Programming and Operating System", Tata McGraw Hill.
3. Infosys Campus Connect Foundation Program Volume 1 – 3, Education & Research Department, Infosys Technologies Ltd , Bangalore.

Scheme of Examination

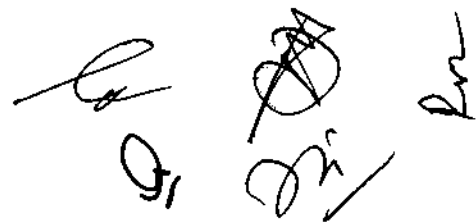
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- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks for written examination to be held at the end of each semester.
- The duration of written examination for each paper shall be three hours.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.

Handwritten signatures and initials, including a large signature on the left, a circled signature in the middle, and initials on the right.

Master of Computer Applications**Semester-II****Data Communication and Computer Networks (Subject Code: MCA41201T)****Maximum Marks: 50****Minimum Pass Marks: 40%****Maximum Time: 3 Hrs.****Lectures to be delivered: 45-55**

This course serves as a general introduction for students seeking to acquire a foundation in current network technologies for local area networks (LANs), wide area networks (WANs) and the Internet. The course provides an introduction to hardware, software, terminology, components, design, and connections of a network. Network concepts such as the OSI model, topologies, and major protocols, as well as the basic functions of system administration and operation are also included. Upon completion of this course, students will:

- Learn how computer network hardware and software operate
- Investigate the fundamental issues driving network design
- Learn about dominant network technologies
- Understand and be able to describe for common services, system services, such as name and address lookups, and communications applications.

Course content**SECTION A**

Introduction to Computer Networks: Uses of Computer Networks, Network Hardware (PAN, MAN, WAN, internetworks), Network Software (protocol hierarchies, design issues for the layers, connection-oriented vs. connectionless services, service primitives), Reference Models (ISO-OSI, TCP/IP and their comparison)

Data Communications: Data and Signals (Analog and Digital Signals, periodic analog signals, digital signals, Transmission Impairments). Digital Transmission (digital-to-digital conversion, analog-to-digital conversion). Analog transmission (digital-to-analog conversion, analog-to-analog conversion) Bandwidth utilization – Multiplexing and spread spectrum. Transmission Media (twisted pair, coaxial cable, fibre optics), Unguided media: (Radio waves, microwave, Infrared, Bluetooth, Wi-Fi, Wi-Max).

The Data link layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols.

The Medium Access sub layer: The Channel Allocation Problem, Multiple Access Protocols, The Ethernet (The physical layer, Ethernet MAC sub layer Protocol, The Binary Exponential Back off Algorithm, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-gigabit Ethernet) IEEE 802.2: Logical Link Control.

SECTION B

The Network Layer: Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality Of Service (Requirements, Techniques for Achieving Good Quality Of Services), Internetworking, IPv4, IPv6, ICMP, and ICMPv6.

The Transport Layer: The Transport Service (Services Provided To The Upper Layers And Transport Service Primitives), Elements Of Transport Protocols, The Internet Transport Protocols: UDP (Introduction To UDP, Remote Procedure Call), TCP (Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modelling TCP Connection Management, TCP Transmission Policy And TCP Congestion Control)

The Application Layer: Domain Name System, Domain Name Space, DNS in the Internet, Electronic Mail, WWW (Architectural overview), HTTP, introduction to SNMP, Multimedia (introduction to audio, voice over IP, introduction to video, video on demand).

Network Security: Introduction to cryptography, substitution ciphers, transposition ciphers, one-time pads, two fundamental cryptographic principles, digital signatures (symmetric-key signatures, public key-signatures, message digests and the birthday attack).

Pedagogy:

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The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Andrew S. Tanenbaum, Computer Networks, Pearson Education.

Reference Books:

1. Data Communications & Networking by Forouzan, Tata McGraw Hills.
2. Cloud Computing a Practical approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, Tata McGraw-HILL,

Scheme of Examination

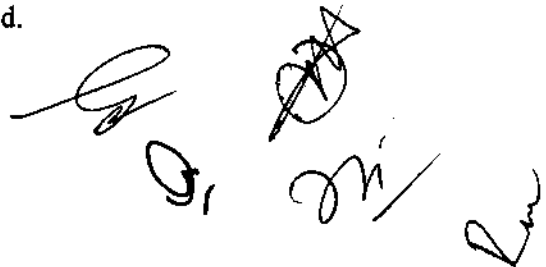
- English will be the medium of instruction and examination.
- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
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- The duration of written examination for each paper shall be three hours.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.



Master of Computer Applications
Semester-II
Operating Systems (Subject Code: *MCAAM 1202T*)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

The student will be taught principles of modern operating systems. In particular, the course will cover details of concurrent processes, multi-threads, CPU scheduling, memory management, file system, storage subsystem, and input/output management. Upon completion of this course, students will:

- Learn the principles operating systems
- Understand relationship between subsystems of a modern operating system
- Evaluate the efficiency aspect of using system resources (processor, memory, disk).
- Understand what a process is and how processes are synchronized and scheduled.
- Understand different approaches to memory management.
- Be able to use system calls for managing processes, memory and the file system.
- Understand the data structures and algorithms used to implement an OS.

Course content

SECTION A

Introduction: Operating System as Resource Manager, types of operating system - batch processing, Multiprogramming, Multitasking, time sharing, parallel, distributed and PC operating system. Operating system structure, System services, system calls, system design and implementation.

Process management: Process Concept, process scheduling, operations on process, co-operating process, inter process communication. CPU scheduling Criteria, scheduling algorithms and algorithm evaluation.

Process synchronisation: critical section problem, semaphores, critical regions, monitors.

Deadlock: necessary conditions, deadlock prevention, deadlock avoidance, deadlock detection and recovery.

File System: file concept, access methods, directory structure, directory implementation, allocation methods, examples of MS-DOS and i-node structure of Unix file system.

Disk scheduling: FCFS, SSTF, LOOK, C-LOOK, SCAN, C-SCAN algorithms.

SECTION B

Memory Management: Local vs. physical addresses space, swapping, contiguous allocation, paging, segmentation, and segmentation with paging.

Virtual memory: demand paging, page replacement algorithms, thrashing.

Security: security problem, user authentication, program threats, system threats, securing systems and facilities, intrusion detection, cryptography, security-classifications.

Introduction to distributed systems: topology, network types, communication, design strategies.

Distributed file system: naming and transparency, remote file access.

Distributed co-ordination: event ordering, mutual exclusion, atomicity, concurrency control, deadlock handling.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

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Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

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Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Abraham Silberschatz, Peter B. Galvin, Gerg Gegne, Operating System Concepts, Wiley.

Reference Books:

1. Hansen, Per Brinch, "Operating System Principles", Prentice-Hall.
2. N. Haberman, "Introduction to Operating System Design", Galgotia Publication.
3. Hansen, Per Brich, "The Architecture of Concurrent Programs", PHI.
4. Shaw, "Logical Design of Operating System", PHI.
5. Infosys Campus Connect Foundation Program Volume:1 – 3, Education & Research Department, Infosys Technologies Ltd , Bangalore.

Scheme of Examination

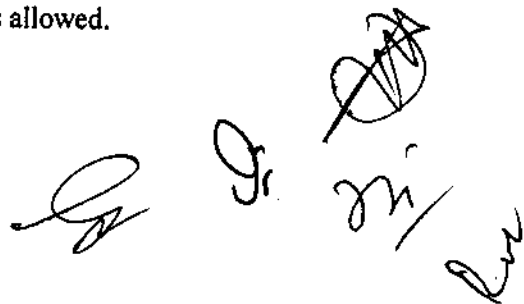
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Instructions for candidates

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Master of Computer Applications
Semester-II
Relational Database Management System (Subject Code: ~~MSCA203T~~ 203T)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

The course aims to introduce relational database management concepts to the students. On completion of this course, the students will be able to

- Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.
- Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.
- Analyze Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.
- Apply and create Relational Database Design process with Normalization and De-normalization of data.
- Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins, co-related sub query and indexes, cursor, stored function and procedure, triggers etc.

Course content

Section A

Database and Database Management Systems: Introduction-History of Database Management Systems, Characteristics of DBMS, Meaning and Definition of Database objectives of database, advantages of database and disadvantages of traditional file environment systems, meaning and definition of Database Management Systems[DBMS] Database trends: Distributed Databases- data warehousing- and data mining- Object-oriented hypermedia Databases.

Introduction to ER Model, mapping cardinalities, generalization, specialization, aggregation.

Relational Database [RDBMS]: The Relational Database Model, Techniques Components of Relational Model, Definition of Relational Terms, Features of RDBMS, CODD's 12 rules for a fully RDBMS. Keys in relational model, Integrity in Relational model, Integrity rules, user-defined Integrity rules.

Normalisation: Benefits of normalization, Functional Dependency, Determinants, Decomposition, Normal forms up to 5NF. Introduction to NoSQL.

Section B

Oracle: Overview: Personal Databases, Client/Server Databases, Oracle an introduction

SQL *Plus Environment: SQL, Logging into SQL *Plus, SQL *Plus Commands, Errors & Help, Alternate Text Editors, SQL *Plus Worksheet, iSQL *Plus.

Oracle Tables: Naming Rules and conventions, Data Types, Constraints, Creating Oracle Table, Displaying Table Information, Altering an Existing Table, Dropping, Renaming, Truncating Table, Table Types, Spooling, Error codes.

Working with Table: Data Management and Retrieval, DML, adding a new Row/Record, Customized Prompts, Updating and Deleting an Existing Rows/Records, retrieving Data from Table, Arithmetic Operations, restricting Data with WHERE clause, Sorting, Revisiting Substitution Variables, DEFINE command, CASE structure.

Functions and Grouping: Built-in functions, Grouping Data.

Multiple Tables: Joins and Set operations.

PL/SQL: A Programming Language, Fundamentals, Block Structure, Comments, Data Types, Other Data Types, Declaration, Assignment operation, Bind variables, Substitution Variables, Printing, Arithmetic Operators.

Control Structures and Embedded SQL: Control Structures, Nested Blocks, SQL in PL/SQL, Data Manipulation, Transaction Control statements.

PL/SQL Cursors and Exceptions: Cursors, Implicit & Explicit Cursors and Attributes, Cursor FOR loops, SELECT...FOR, UPDATE - WHERE CURRENT OF clause, Cursor with Parameters, Cursor Variables, Exceptions, Types of Exceptions.

PL/SQL Composite Data Types: Records, Tables, arrays.
Named Blocks: Procedures, Functions, Packages, Triggers, Data Dictionary Views.

Pedagogy:

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Class Participation:

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Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Elmasri & Navathe, Fundamentals of Database Systems, Addison-Wesley.
2. Connolly & Begg, Database Systems, Pearson Education.
3. Ivan Bayross, SQL, PL/SQL The programming language of Oracle, BPB Publications.

Reference Books:

1. H. F. Korth & Silverschatz, A., Database System Concepts, Tata McGraw Hill.
2. Hoffer, Prescott, Mcfadden, Modern Database Management, Paperback International.
3. Martin Gruber, Understanding SQL, BPB Publication.
4. Joel Murach, Oracle SQL and PL/SQL, Shroff Publishers and Distributors.

Scheme of Examination

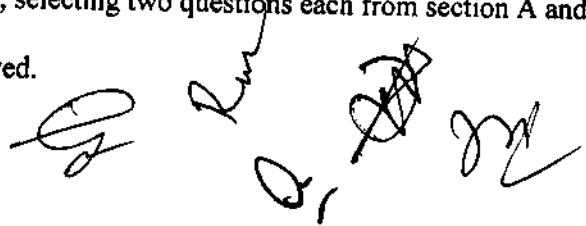
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Instructions for candidates

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Master of Computer Applications
Semester-II
Data Science using Python (Subject Code: ~~MCAAM31204T~~)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

This Course will help students gain data scientist skillset by learning data science using analytical tools and also enables them to master analytical techniques like data exploration, data visualization and various predictive analytic techniques. On completion of this course, the students will be able:

- To analyze the need and usage of various facets of data and data science process.
- To understand and apply various visualization techniques.
- To understand and perform Exploratory Data Analysis.
- To implement how to manage, manipulate, cleanse and analyze data.
- To understand the steps in model fitting and parameters fine-tuning.
- To apply model validation techniques.

Course content

Section A

Introduction to Big data and Data Science: Meaning of Big data and Data Science, Challenges of big data, Relationship between Big Data and Data Science, Benefits and uses of data science and big data. Facets of data: Structured versus Unstructured data, natural language, machine-generated data, graph-based data, audio, image and video data, Data Science Process: Goal setting, retrieving data, data preparation, data cleansing, data integration and transformation, exploratory data analysis, data visualization, Model building and performance evaluation, presentation.

Data Set and its features: Meaning of the terms: observations and variables, Discrete and continuous variables, quantitative and qualitative variables, dependent and independent variables, variables classified on scale: Nominal, Ordinal, Interval and Ratio variables.

Data Preparation: need for data preparation, Data cleansing, Methods of data cleansing – data entry errors, sanity checks, outlier detection, treatment of missing values, discrepancies in data, use of metadata, codes and rules. Data Integration, Types of data integration. Data Transformation strategies – Normalization, Data Discretization and discretization methods.

Section B

Exploratory Data Analysis: Introduction and purpose of EDA, EDA techniques, Descriptive statistics: measurements of location and variability, mean, median and mode and their relationship, variance and measures of variance: range, standard deviation, variance. Concept of Skewness, Coefficient of Skewness, Correlation – Meaning and types of correlation, Methods to calculate simple correlation, Correlation and causation. Normal Distribution, Normal Curve and its characteristics, Empirical rule.

Data Visualization: Purpose and techniques of data visualization: Histograms, Box Plots, Scatterplots.

Model building and Validation: Building a model and variable selection, Types of Machine Learning models: Classification models, Regression models. Dimensionality reduction: Principle of parsimony, Feature selection methods: forward selection and backward selection procedure, stepwise selection procedure. Splitting the dataset: training versus testing datasets, Concepts of overfitting and under-fitting. Model validation and comparison: MSE, Confusion matrix: accuracy, precision and recall, Cross-validation methods: Hold-out method, K-folds cross validation technique, Leave-1 out, Repeated splits technique.

Python for Data Science: Features of Python for data science, Introduction to various Python libraries for data science, Basics of NumPy, creating and indexing arrays, Installing and importing Pandas, Creating DataFrames, DataFrame attributes, Reading data, DataFrame operations. Handling duplicates, Dealing with missing values, Removing null values, Imputation. Descriptive statistics, Correlation among variables. Slicing DataFrames by

column and row, Conditional selections. Introduction to Matplotlib, Visualization by plotting, Guidelines for effective visualization, Plotting scatterplots, Boxplots and histograms in Matplotlib.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

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Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, *Introducing Data Science - Big Data, Machine Learning and More Using Python Tools*, Manning Publications Co.

Reference Books:

1. Joel Grus, *Data Science from Scratch*, O'Reilly.
2. Rachel Schutt & Cathy O'Neil, *Doing Data Science*, O'Reilly
3. Jiawei Han, Micheline Kamber, Jian Pei, *Data Mining Concepts and Techniques*, Morgan Kaufmann

Scheme of Examination

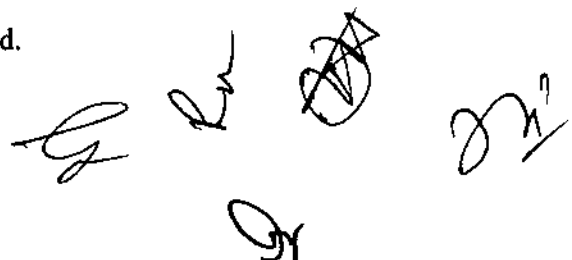
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- The duration of written examination for each paper shall be three hours.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.



**Master of Computer Applications
Semester-II**

Programming Lab-III (RDBMS and Minor Project) (Subject Code: MCA1206L)

Maximum Marks: 100*
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Practical units to be conducted: 55-65

This laboratory course will mainly comprise of exercises on what is learnt under the paper MCA-123: Relational Database Management System.

For the minor projects in a team of maximum size two will be allowed and the team will submit joint project report. The student team members must highlight their role and/or contributions in the joint project report.

*The splitting of marks is as under

- Maximum Marks for Continuous Assessment : 60
- Maximum Marks for University Examination : 40

CONTINUOUS ASSESSMENT (PRACTICAL LAB)

1.	Two tests will be conducted during the semester. Both the tests will be counted for assessment.	:	60% of the total marks allotted for continuous assessment.
2.	Lab Assignments	:	30% of the total marks allotted for continuous assessment.
3.	Attendance	:	10% of the total marks allotted for continuous assessment.

For University Examination the evaluator will distribute the marks for the minor project work according to the following guidelines:

Demonstration of Project	50% of the marks allotted for University Examination
Presentation and Viva Voce	25% of the marks allotted for University Examination
Project Report Document	15% of the marks allotted for University Examination
Source Code	10% of the marks allotted for University Examination.



Master of Computer Applications
Semester-II
Programming Lab-IV (Data Science and Python) (Subject Code: MCAM1207L)

Maximum Marks: 100*
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Practical units to be conducted: 55-65



This laboratory course will mainly comprise of exercises on what is learnt under the paper MCA-124: Data Science using Python.

*The splitting of marks is as under

- Maximum Marks for Continuous Assessment : 60
- Maximum Marks for University Examination : 40

CONTINUOUS ASSESSMENT (PRACTICAL LAB)

1.	Two tests will be conducted during the semester. Both the tests will be counted for assessment.	:	60% of the total marks allotted for continuous assessment.
2.	Lab Assignments	:	30% of the total marks allotted for continuous assessment.
3.	Attendance	:	10% of the total marks allotted for continuous assessment.


Dr. M. S. /


Master of Computer Applications
Semester-II
Ethical Hacking (Subject Code: ~~HCAM 1205~~ E1)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

Ethical Hacker is a skilled professional who understands and knows how to look for weaknesses and vulnerabilities in target systems and uses the same knowledge and tools as a malicious hacker, but in a lawful and legitimate manner to assess the security posture of a target system(s). Ethical Hacking course objective is to educate, introduce and demonstrate hacking tools used by hackers to compromise the security of enterprise networks and information systems. Upon completion of this course, the students will be able to:

- Apply knowledge into an interactive environment where they are shown how to scan, test, hack and secure their own systems.
- Remember in-depth knowledge and practical experience with the current essential security systems.
- Understand how perimeter defenses work and then be led into scanning and attacking their own networks, no real network is harmed.
- Evaluate how intruders escalate privileges and what steps can be taken to secure a system.
- Analyze Intrusion Detection, Policy Creation, Social Engineering, DDoS Attacks, Buffer Overflows and Virus Creation.

Course Content

Section A

Introduction: Understanding the importance of security, Concept of ethical hacking and essential Terminologies- Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking.

Footprinting: Introduction to footprinting, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase.

Scanning: Detecting live systems-on the target network,- Discovering services running listening on target systems, Understanding port scanning techniques, Identifying TCP and LIDP services running on the target network, Understanding active and passive fingerprinting.

System-Hacking-Aspect of remote password-guessing Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing, DoS.

Section B

Session Hijacking: Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools.

Hacking Webservers: Hacking Web Applications, SQL Injections.

Hacking Wireless Networks: Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DoS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.

Cryptography: Understand the use of Cryptography over the Internet through PKI, RSA, MD5, Secure Hash Algorithm and Secure Socket Layer.

PEDAGOGY:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Rajat Aare, Network Security and Ethical Hacking, Luniver Press, 2006
2. Ankit Podia, Menu Zacharia, Network intrusion alert cm ethical hacking guide to intrusion detection, Thomson Course Technology PTR, 2007
3. Thomas Mathew, Ethical Hacking, 0571 Publisher, 2003.
4. Joel Seatnbra V and George Kurtz, Hacking Exposed: Network Security Secrets & Solutions, Stuart McClure, McGraw-Hill, 2005

Course learning outcomes (CLOs):

On completion of this course, the students will be able to

1. Apply knowledge into an interactive environment where they are shown how to scan, test, hack and secure their own systems.
2. Remember in-depth knowledge and practical experience with the current essential security systems.
3. Understand how perimeter defences work and then be led into scanning and attacking their own networks, no real network is harmed.
4. Evaluate how intruders escalate privileges and what steps can be taken to secure a system.
5. Analyze Intrusion Detection, Policy Creation, Social Engineering, DDoS Attacks, Buffer Overflows and Virus Creation.

Scheme of Examination

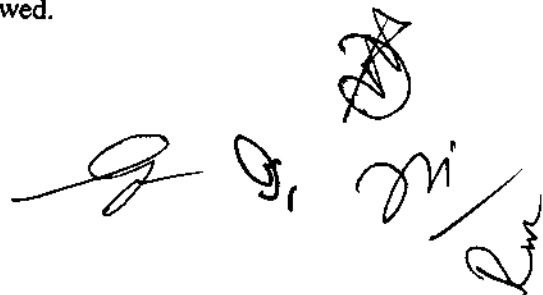
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- The duration of written examination for each paper shall be three hours'.
- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

Instructions to the External Paper Setter

The external paper will carry 50 marks and would be of three hours' duration. The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry 7.5 marks. Section C will consist of 10 short answer type questions of 2 marks each covering the entire syllabus uniformly and will carry 20 marks in all. Candidates will be required to attempt four questions in all from section A and B selecting not more than two questions from each of these groups. Section C shall be compulsory.

Instructions for candidates

- Candidates are required to attempt five questions in all, selecting two questions each from section A and B and compulsory question of section C.
- Use of non-programmable scientific calculator is allowed.

Handwritten signatures and initials in black ink, including a large stylized signature, the initials 'G', 'Mi', and 'Rm'.

Master of Computer Applications
Semester-II
Computer Based Optimization Techniques (Subject Code: ~~MCA~~ 20552)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

The objective of the course is to introduce various optimization techniques and their computer implementation. This course aims towards learning of linear programming. The course also teaches students about job sequencing, Inventory problem and network analysis using CPM, PERT. The general objectives of the course is

- to introduce the fundamental concepts of Optimization Techniques;
- to make the learners aware of the importance of optimizations in real scenarios;
- to provide the concepts of various classical and modern methods of for constrained and unconstrained problems in both single and multivariable.

Course content

SECTION A

OR models, solving the OR Model, Introduction to Linear Programming, two-variable LP model, Graphical LP Solution, Graphical sensitivity Analysis, Simplex Method, Big M Method, Two Phase Method, Special cases in Simplex Method Application.

Duality and Sensitivity Analysis: Definition of the Dual problem, Primal dual relationship, Additional Simplex Algorithm for LP, Post optimal or Sensitivity Analysis.

Transportation Model, Transportation Algorithm, Assignment Model.

SECTION B

Networks Models: Definition, Minimum spanning trees algorithms, Shortest Route Problem, Maximum flow Model, Minimum Cost Capacitors flow problem, PERT & CPM.

Non-Linear Programming: Unconstrained Algorithms, Direct search Method, Gradient Method, Constrained Algorithm, Separable programming, Quadratic Programming, Geometric Programming

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

The Instructor of class will engage in a combination of academic reading, analyzing case studies, preparing the weekly assigned readings and exercises, encouraging in class discussions, and live project based learning.

Case/Class Discussion Assignments:

Students will work in groups of up to four to prepare a brief write-up due before the start of each class covering the case study or class material to be discussed in the next session. Questions may include a quantitative analysis of the problem facing the decision-maker in the case.

Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. H.A. Taha, Operations Research: An Introduction, Pearson Education.

Reference Books:

1. Kanti Swarup, "Operations Research"
2. N.G. Nari, "Operations Research"
3. Heera and Gupta, "Operations Research"
4. S.B. Sharma, "Operations Research"
5. Goel and Mittal, "Operational Research"
6. V.K. Kapoor, "Problems and Solutions in Operations Research"

Scheme of Examination


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- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
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Instructions for candidates

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Handwritten signatures and initials, including a circled signature at the top, and the name 'S. B. Sharma' written in the middle.

**Master of Computer Applications
Semester-II**

Object Oriented Modelling and Design using UML (Subject Code: ~~MCA41205E3~~)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Times: 3 Hrs.
Lectures to be delivered: 45-55

This Object-Oriented Analysis and Design Using UML teaches how to effectively use object-oriented technologies and software modelling as applied to a software development process. This course starts with object oriented concepts and moves towards the preparation of standard UML diagrams using an UML modeling tool. After completing this class, student will be able to:

- Describe the three pillars of object-orientation and explain the benefits of each.
- Create use case documents that capture requirements for a software system.
- Create class diagrams that model both the domain model and design model of a software system.
- Create interaction diagrams that model the dynamic aspects of a software system.
- Explain the facets of the Unified Process approach to designing and building a software system.
- Describe how design patterns facilitate development and list several of the most popular patterns.

Course content

SECTION A

Introduction to Object: Object Orientation, Development, Modelling, Object Modelling technique.

Object modelling: Objects and classes, Links and Association, Generalization and inheritance, Grouping constructs, Aggregation, Abstract Classes, Generalization as extension and restriction, Multiple inheritance, Meta data, Candidate keys, Constraints.

Dynamic modelling: Events and states, Nesting, Concurrency, Advanced Dynamic Modelling concepts

Functional modelling: Functional Models, Data flow diagrams, Specifying operations, Constraints, Relation of Functional model to Object and Dynamic Models.

Design Methodology, Analysis: Object modelling, dynamic modelling, Functional modelling, Adding operations, Iterating Analysis.

System design: Subsystems Concurrency, Allocation to processor and tasks, Management of data stores, Handling Global Resources, Handling boundary Conditions, Setting Trade-off priorities.

Object Design: Overview, Combining the three models, Designing Algorithms, Design Optimization, Implementation of Control, Adjustment of Inheritance, Design of Associations, Object Representation, Physical Packaging, Documenting design decisions

SECTION B

UML: Basics, Emergence of UML, Types of Diagrams.

Use Case: Actors, Use Case Diagram, Relationship between Use Cases.

Classes: Class Diagram, Classes, Objects, Attributes, Operations, Methods, Interfaces, Constraints, Generalization, Specialization, Association, Aggregation.

Behavioural Diagrams: Activity Diagram, Collaboration Diagram, Sequence Diagram, State chart Diagram.

Implementation Diagrams: Component Diagram, Deployment Diagram

Comparison of methodologies: Structured Analysis/Structured Design, Jackson Structured Development.

Implementation: Using Programming Language, Database System, outside Computer.

Programming Style: Object Oriented Style, Reusability, Extensibility, Robustness, Programming-in-the-large.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

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Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. James R. Rumbaugh, Object Oriented Modeling and Design, Pearson Education.
2. Bernd Oestereich, Developing Software with UML, Pearson Education.

Reference Books:

1. Grady Booch, Object Oriented Analysis and Design with Applications, Addison-Wesley.
2. Pierre-Alain Muller, "Instant UML", Shroff Publishers
3. Booch, Rumbaugh, Jacobson, "The Unified Modeling Language User Guide", Addison Wesley
4. Booch, Rumbaugh, Jacobson, "The Unified Modeling Language Reference Manual", Addison Wesley
5. Rebecca Wirfs-Brock, "Design Object Oriented Software", PHI

Scheme of Examination

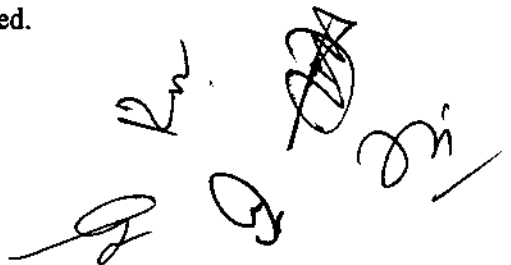
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**Master of Computer Applications
Semester-II**

ERP Systems and Processes (Subject Code: MCAM 20554)

Maximum Marks: 50

Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.

Lectures to be delivered: 45-55

This course will explore the concepts, principles, and state-of-the-art methods in successfully integrating Enterprise Resource Planning (ERP) systems into extant enterprise architectures. At the completion of the course, students will be able to

- Describe the role of an ERP in carrying out business processes in a company
- Explain how 'best business practices' are incorporated in an ERP
- Strategize pricing, production and sales in a competitive commodity market
- Analyze sales data in an ERP to dynamically respond to changing market conditions to maximize profits
- Expedite production planning and control using tools provided in an ERP (e.g. MRP)

Course content

SECTION A

Introduction of ERP: Concept of Enterprise, ERP Overview, Integrated information system, The role of Enterprise, Business Modelling, Myths about ERP, Basic ERP Concepts, Intangible benefits of ERP, Justifying ERP investment, Risks of ERP, Benefits of ERP

ERP and related Technology: Business Intelligence, Data ware housing, Data mining, OLAP, Business Process Reengineering, SCM, CRM, ERP Security.

Modules of ERP: Basic modules of ERP Package, Human Resources Management, Financial Management, Inventory Management, Quality Management, Sales and Distribution

SECTION B

ERP for Industries: ERP for manufacturing Industry: ERP for petroleum, GAS companies, ERP for Automobile Industry, ERP for Pharmacy, ERP for FMCG, ERP for Mining industry; ERP for Service Industry: ERP for retail, ERP for healthcare, ERP for Educational Institution, ERP for Telecom, ERP for banks, ERP for Insurance companies.

ERP Implementation: ERP Lifecycle implementation, Implementation Methodologies, ERP package selection, Reasons for failure and reasons for success of ERP implementation.

Pedagogy:

The Instructor is expected to use leading pedagogical approaches in the class room situation, research-based methodology, innovative instructional methods, extensive use of technology in the class room, online modules of MOOCS, and comprehensive assessment practices to strengthen teaching efforts and improve student learning outcomes.

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Class Participation:

Attendance will be taken at each class. Class participation is scored for each student for each class.

Text and Readings: Students should focus on material presented in lectures. The text should be used to provide further explanation and examples of concepts and techniques discussed in the course:

1. Alexis Leon, ERP Demystified, Tata McGraw-Hill.
2. Rajesh Ray, Enterprise Resource Planning - Text and Cases, Tata McGraw-Hill.
3. David L. Olson, Managerial Issues of Enterprise Resource Planning Systems, Tata McGraw Hill.
4. Ellen Monk and Bret Wagner, Concepts in Enterprise Resource Planning, Cengage Learning.
5. Ashim Raj Singla, Enterprise Resource Planning, Cengage Learning.

Scheme of Examination

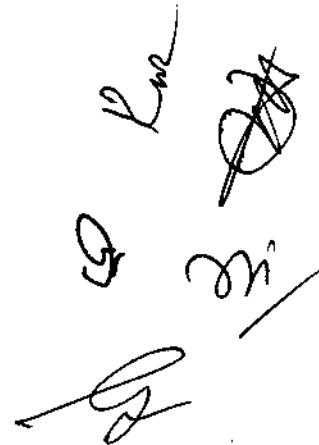
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Master of Computer Applications
Semester-II
Software Project Management (Subject Code: MCAAM 1205E5)

Maximum Marks: 50
Minimum Pass Marks: 40%

Maximum Time: 3 Hrs.
Lectures to be delivered: 45-55

Project Management is generally seen as a key component of successful software projects. Together with software techniques it can produce software of high quality. This course aims to cover the basics

- Deliver successful software projects that support organization's strategic goals
- Match organizational needs to the most effective software development model
- Plan and manage projects at each stage of the software development life cycle (SDLC)
- Create project plans that address real-world management challenges
- Develop the skills for tracking and controlling software deliverables

Course content

Section A

Introduction to Software Project Management: Introduction, Software, Difference between software and Program, Characteristics of Software, What is a Project? Why Software Project Management? Activities Covered by Software Project Manager, Structure of Software Project Management Document, Software Project Management Life Cycle, Role of Metrics and Measurement.

Project Size Measurement using KLOC and Function Point Metric, Cost Estimation Analysis, COCOMO Model, PERT, Gantt chart and Critical Math Management for Project Scheduling. Software Project Development Models: Waterfall Model, Prototype Model, Spiral Model and RAD Model, Merits and Demerits of different models.

Section B

Managing and Evaluating the Project: Managing the task: Project Monitoring and control, managing the plan, reviews, feedback and reporting mechanisms, configuration management, quality control and quality assurance, managing change, readjusting goals and milestones, risk management, testing phases, formalized support activities;

Managing the team: Team organizations, recruiting and staffing-picking the right people, technical leadership, avoiding obsolescence-training etc.

Risk Management: What is risk management and why it is important Risk Management Cycle, Risk Identification; Common Tools and Techniques, Risk quantification, Risk Monitoring, Risk mitigation.

PEDAGOGY:

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1. Walker Royce, Software Project Management, Pearson Education.
2. Pankaj Jalote, Software Project Management in Practice, Pearson Education Asia.
3. Tom Glib, Principles of Software Engineering Management, Addison-Wesley.
4. Joel Henry, Software Project Management, Pearson Education.

Scheme of Examination

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Instructions for candidates

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- Use of non-programmable scientific calculator is allowed.

