

22/2/20

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PUNJABI UNIVERSITY, PATIALA

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

**FOR**

**MASTER OF COMPUTER APPLICATIONS (MCA)**

**SECOND YEAR (SEMESTER III&IV)**

Programme Code : MCA M 2 P 4 P ~~④~~

(Session 2022-23 & 2023-24)

**CHOICE-BASED CREDIT SYSTEM**

(As per RUSA Guidelines)



**PUNJABI UNIVERSITY,  
PATIALA 147002**

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

Session 2022-23 & 2023-24 Programme Code - MCAM2 PU.

Paper Code	Title of Paper	L	T	P	C	Internal Marks		External Marks	
						Max	Pass	Max	Pass
MCAM2101T	Artificial Intelligence	4	0	0	4	50	20	50	20
MCAM2102T	Theory of Computation	4	0	0	4	50	20	50	20
MCAM2103T	Business Intelligence	4	0	0	4	50	20	50	20
MCAM2104T	Computer Graphics	4	0	0	4	50	20	50	20
MCAM2105E	Elective-III	4	0	0	4	50	20	50	20
MCAM2106L	Programming Lab-V (Computer Graphics)	0	0	4	2	60	24	40	16
MCAM2107L	Programming Lab-VI (Minor Project)	0	0	4	2	0	0	100	40
<b>Total</b>		<b>20</b>	<b>0</b>	<b>8</b>	<b>24</b>	<b>310</b>		<b>390</b>	

\*Elective: Any one of the following papers:

Paper Code	Title of Paper
MCAM2105E1	Mobile Application Development
MCAM2105E2	Machine Learning
MCAM2105E3	Big Data Analytics
MCAM2106E4	Cloud Computing
MCAM2106E5	Cryptography and Network Security

\*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)

SECOND YEAR –FOURTH SEMESTER EXAMINATIONS

Session 2022-23 & 2023-24 Programme Code - MCAH2 PUP

CODE	TITLE OF PAPER	MAXIMUM MARKS	TOTAL CREDITS
MCAH2301V	PROJECT	400	24

**Project Guidelines:**

1. The students are required to undergo full-semester software development project training during the fourth semester of MCA and should work on a software development project during the training period.
2. The students must prefer doing Industrial Training and try to avoid the training in computer institutes/centres where there is no software development work and mere training is provided. In case students are not able to find training in any industry, they may opt for doing this project training in the Department on some live project related to the automation of any University Department functionality or any Project given by the concerned teacher of the Department.
3. Joint projects will be allowed and joint project reports will also be accepted. However, the students should highlight their individual contributions in a joint project. The quantum of individual contribution of particular students in joint projects should be such which can be accepted as equivalent to full-semester project. The same must also be reflected in joint reports.
4. On the completion of the fourth semester, the students are required to submit three copies (including one personal copy of the student) of their project reports to the Department, as per the format decided by the Department. The personal copy of the student, duly signed by the Head of the Department, will be returned to the student after the conduct of the viva-voce.
5. The Department will schedule the presentations and viva-voce of the students. Each student is required to give a detailed presentation (using some presentation software) about the work done and software developed by him/her during the period of project training. The viva-voce will also be conducted by the Project Evaluation Committee of the Department during the presentation by the student.
6. The Project Evaluation Committee of the Department will comprise of the following members:
  - i. Head of the Department
  - ii. Internal Guide of the student
  - iii. One or two nominee(s) of Dean, Academic Affairs
  - iv. External Examiner appointed by the Head of the DepartmentThe quorum of the Project Evaluation Committee will be of any three members.
7. The Project Evaluation Committee will evaluate the student cumulatively on the basis of the Presentation, Viva-voce and Project Report (hard copy) and marks out of 400 will be awarded to each student. The Letter Grade and Grade Point will be awarded to the student according to marks obtained by him/her out of total 400 marks as per the following scheme:

Marks Obtained	Letter Grade	Performance	Grade Point
361 – 400	O	Outstanding	10
321 – 360	A+	Excellent	9
281 – 320	A	Very Good	8
241 – 280	B+	Good	7
201 – 240	B	Above Average	6
161 – 200	C	Average	5
160	P	Fair	4
Less than 160	F	Fail	0

**Master of Computer Applications**  
**Semester-III**  
**Artificial Intelligence (Subject Code: MCAM 210 | T)**

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

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

This course will introduce the basic principles in artificial intelligence research. It will cover simple representation schemes, problem solving paradigms, constraint propagation, and search strategies. Areas of application such as knowledge representation, natural language processing, expert systems, vision and robotics will be explored. Upon successful completion of this course student will:

- be able to design a knowledge based system,
- be familiar with terminology used in this topical area,
- have read and analyzed important historical and current trends addressing artificial intelligence.

**Course content**

**SECTION A**

**Introduction to AI:** What is AI? Different approaches of AI: Turing test approach, cognitive modeling approach, laws of thought approach, rational agent approach. Brief history of Artificial Intelligence, State of the art, Risks and benefits of AI.

**Intelligent Agents:** Agents and environments, Concept of Rationality, Specifying the task environment through PEAS, A general model of an intelligent agent.

**Solving Problems by Searching:** Problem-solving agents, Standardized problems, Real-world problems, Search Algorithms: Best-first search, Uninformed search strategies: Breadth-first search, Dijkstra's algorithm or uniform-cost search, Depth-first search, Depth-limited search. Informed (Heuristic) Search Strategies: Greedy best-first search, A\* search strategy.

**Knowledge-Based Agents:** Knowledge base, Propositional logic, Syntax and semantics of Propositional logic. First-Order Logic, Syntax and semantics of First-order logic, Models for first-order logic, Symbols and interpretations, Terms, Atomic sentences, Complex sentences, Quantifiers: Universal quantification, Existential quantification, Nested quantifiers, Connections between  $\forall$  and  $\exists$ , Equality. The knowledge engineering process in First-order logic. Inference in first-order logic: Propositional versus First-order inference, Unification, Resolution, Conjunctive normal form.

**SECTION B**

**Machine Learning:** Learning from Examples, Forms of Learning, Supervised learning versus Unsupervised learning, Learning Decision Trees, Linear Regression and Classification, Univariate linear regression versus Multivariable linear regression, Gradient descent, Linear classification with logistic regression, Nonparametric Models: Nearest-neighbor models, Support vector machines, Concept of Ensemble Learning. Introduction to Statistical Learning, Naive Bayes models.

**Neural networks:** Units in neural networks, Activation function, Network structures, Perceptrons, Multilayer feed-forward neural networks. A brief introduction to Deep Learning, Convolutional Networks, Recurrent Neural Networks, Reinforcement Learning.

**Natural Language Processing:** Natural Language Understanding versus Natural Language Generation, Challenges in NLP, Phases in NLP, Syntactic analysis (Parsing), Concept of Grammars.

**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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**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. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Pearson Education.
2. Elaine Rich, Kevin Knight, B. Nair, Artificial Intelligence, McGraw Hill Education.
3. Artificial Intelligence - A Modern Approach, Stuart Russell, Peter Norvig, Fourth Edition, Pearson.
4. E. Charniak and D. McDermott, Introduction to artificial Intelligence, Addison-Wesley Publishing.
5. Nils J. Nilsson, Principles of Artificial Intelligence, Springer-Verlag.
6. Patrick Henry Winston, Artificial Intelligence, Pearson Education.
7. N.P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press.

**Scheme of Examination**

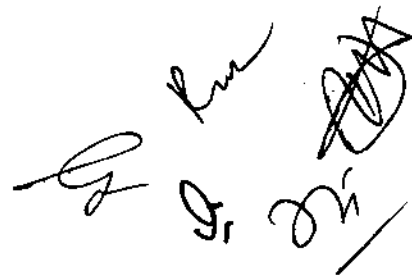
- English will be the medium of instruction and examination.
- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks 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-III**  
**Theory of Computation (Subject Code: MCAMD102T)**

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

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

In this course, students will learn several formal mathematical models of computation along with their relationships with formal languages. In particular, they will learn regular languages and context free languages which are crucial to understand how compilers and programming languages are built. Also students will learn that not all problems are solvable by computers, and some problems do not admit efficient algorithms. At the end of this course, students will be able to do the following:

- Acquire a full understanding and mentality of Automata Theory as the basis of all computer science languages design
- Have a clear understanding of the Automata theory concepts such as RE's, DFA's, NFA's, Stack's, Turing machines, and Grammars
- Be able to design FAs, NFAs, Grammars, languages modeling, small compilers basics
- Be able to design sample automata
- Be able to minimize FA's and Grammars of Context Free Languages

**Course content**

**SECTION A**

**Finite Automata:** Deterministic Finite Automata, Non Deterministic Finite Automata, Equivalence of NFA and DFA, Finite Automata with Epsilon-moves. 2-Way Finite Automata, Crossing sequences, Moore and Mealy Machine, Applications of Finite Automata i.e. Lexical Analyzers, text editors.

**Regular Expression and Languages:** Regular expression, Equivalence of finite Automata and Regular expressions, Conversion between Regular Expressions and Finite Automata. Application of Regular Expressions: Regular Expression in UNIX, Lexical analysis, Finding pattern in text.

**Regular Languages and Regular sets:** Pumping lemma for regular sets, Applications of pumping lemma. Closure properties of Regular Language, The Myhill-Nerode Theorem, Minimization of Finite Automata.

**SECTION B**

**Context Free Grammar and Languages:** Context free Grammars, Derivation Trees, Leftmost and rightmost derivations, Ambiguity, Properties of Context free Languages- Normal forms for context free grammars - CNF and GNF, The Pumping Lemma for context free Languages; Closure properties of context free languages.

**Push Down Automata(PDA):** Deterministic Push Down Automata; Non Deterministic Push Down Automata, Equivalence of Push Down Automata and Context free grammar.

**Linear Bounded Automata (LBA):** Power of LBA, Closure Properties.

**Turning Machine (TM):** One Tape, multitape.

The notions of time and space complexity in terms of T.M.

Construction of simple problems. Computational complexity.

**Chomsky Hierarchy of Languages:** Recursive and recursively-enumerable languages.

**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. John E. Hopcroft, Rajeev Motwani and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, Pearson Education.
2. Daniel I. A. Cohen, Introduction to Computer Theory, Wiley.
3. B. M. Moret, The Theory of Computation, Pearson Education Asia.
4. H. R. Lewis and C.H. Papadimitriou, Elements of the theory of Computation, Pearson Education Asia.

**Scheme of Examination**

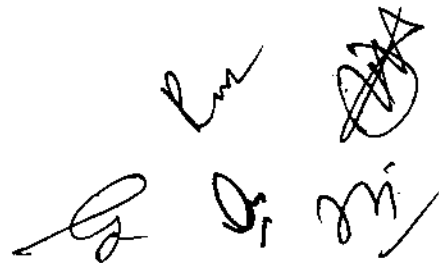
- English will be the medium of instruction and examination.
- Written Examinations will be conducted at the end of each Semester as per the Academic Calendar notified in advance
- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks 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-III**  
**Business Intelligence (Subject Code: ~~MCA412103T~~)**

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

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

The objectives of this course are to provide comprehensive and in-depth knowledge of Business Intelligence (BI) principles and techniques by introducing the relationship between managerial and technological perspectives. The course will cover general concepts in the BI field (report authoring, ETL). The focus will be on how the techniques are to be used, and the details of the methodologies will be covered to the extent necessary to understand when and how each technique can be used. On successful completion of this course student will be able to:

- Appraise and apply evidence practice (EBP) to formulate effective solutions to deal with contemporary performance problems and issues associated with the delivery of business information systems.
- Create a consultant report that critically evaluates important design principles and operations involving business intelligence and that offers effective recommendations aimed at enhancing business outcomes.
- Devise a framework to assess company/industry performance and to apply it to produce a performance report about a nominated entity.
- Evaluate the importance and implementation of learning theory to construct and apply practices that facilitate aspects of personal and institutional change.
- Demonstrate competence in oral, written, and visual communication in business reports and presentations.

**Course content**

**SECTION A**

Digital data and its types, Structured data: characteristics and sources of structured data, advantages of structured data, Unstructured data: characteristics and sources, Managing and storing unstructured data, Problems of unstructured data, Semi-structured data: characteristics and sources of semi-structured data, Extracting information from semi-structured data. Introduction to Online Transaction Processing (OLTP), Advantages and challenges of OLTP system, Online Analytical Processing (OLAP), Advantages of OLAP system. Different OLAP architectures: ROLAP, MOLAP, HOLAP, Comparison of OLTP and OLAP. Introduction to Business Intelligence, BI Definitions and benefits of Business Intelligence, BI Capabilities, BI Components, BI Tools. Data Warehouse: Definition, characteristics and goals of a data warehouse. Problems of operational databases and need for data warehouse. Data Warehouse Architecture, What constitutes a data warehouse, Metadata repository, Data Mart, Introduction to Extraction-Transformation-Loading (ETL), Ralph Kimball approach versus W.H. Inmon's approach. Data integration, need and advantages of using data integration, Introduction to common data integration approaches.

**SECTION B**

Introduction to Data Quality, Why data quality matters, factors defining data quality, Data Profiling concepts and types. Multi-Dimensional Data Modelling, Data modelling techniques, Introduction to data and dimension modelling, Multi-dimensional data model, ER Modelling versus Multi-dimensional modelling, Concepts of dimensions, facts, cubes, attribute, hierarchies, fact table, Dimension table, Typical Dimensional models – Star schema, Snowflake schema and Fact constellation schema. Dimensional modelling life cycle. OLAP operations on multidimensional data: Slice, Dice, Roll-up, Drill-down, Pivot operations.

Basics of Enterprise Reporting: Features of good reporting, Common report layout types, Report delivery formats, Report standardization and presentation practices, Brief introduction to Balanced scorecard, and Enterprise dashboards, Balanced scorecards versus Enterprise dashboards.

**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. R.N. Prasad, Seema Acharya, Fundamentals of Business Analytics, Wiley India Pvt. Ltd.
2. Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional.
3. David Taniar, Progressive methods in Data Warehousing and Business Intelligence: Concepts and competitive analytics, Idea Group Inc.

**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-III**  
**Computer Graphics (Subject Code: MCAAM 2104T)**

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

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

The main objective of this module is to introduce to the students the concepts of computer graphics. It starts with an overview of interactive computer graphics, two dimensional system and mapping, then it presents the most important drawing algorithm, two-dimensional transformation; Clipping, filling and an introduction to 3-D graphics. After completing this course, students will be able to:

- Identify and explain the core concepts of computer graphics.
- Apply graphics programming techniques to design, and create computer graphics scenes.
- Understand the basic principles of implementing computer graphics primitives
- Familiarity with key algorithms for modeling and rendering graphical data
- Develop design and problem solving skills with application to computer graphics

**Course content**

**SECTION A**

**Introduction to Computer Graphics:** Applications areas, Components of Interactive Computer Graphics System.  
**Video Display Devices:** Refresh cathode ray tube systems – raster scan CRT displays, random scan CRT displays, colour CRT-monitors, direct view storage tube. Flat panel displays – emissive vs non emissive displays, LCD displays, plasma panel displays, 3-D viewing devices, virtual reality.  
**Scan conversion:** Scan converting a Point, Line (Direct, DDA and Bresenham line algorithms), Circle (Direct, Polar, Bresenham and Mid-point circle algorithms), Ellipse (Direct, Polar and Midpoint ellipse algorithms), Area filling techniques (Boundary fill, Flood fill, scan line area fill algorithm), Limitations of scan conversion.  
**2-dimensional Graphics:** 2D Cartesian and Homogeneous co-ordinate system, Geometric transformations (Translation, Scaling, Rotation, Reflection and Shearing), Composite transformations, 2D dimensional viewing transformation and clipping (Cohen –Sutherland, Liang-Barsky, Sutherland-Hodge man algorithms).

**SECTION B**

**3-dimensional Graphics:** 3D Cartesian and Homogeneous co-ordinate system, Geometric transformations (Translation, Scaling, Rotation, Reflection), Composite transformations.  
**Mathematics of Projections:** Perspective Projections - Mathematical Description and Anomalies of perspective projections. Parallel Projections – Taxonomy of Parallel Projections and their Mathematical Description. Introduction to 3D viewing pipeline and 3D clipping.  
**Hidden surface elimination algorithms:** z-buffer, scan-line, sub-division, Painter's algorithm.  
**Illumination Models:** Diffuse reflection, Specular reflection, refracted light, texture surface patterns, Halftoning, Dithering.  
**Surface Rendering Methods:** Constant Intensity method, Gouraud Shading, Phong Shading.

**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. R.A. Plastock and G. Kalley, Computer Graphics, McGraw Hill.
2. Donald Hearn and M. Pauline Baker, Computer Graphics, Pearson Education.
3. J.D. Foley, A.V. Dam, S.K. Feiner, J.F. Hughes, R.L Phillips, Introduction to Computer Graphics, Addison-Wesley Publishing.

**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.



Programming Lab -V (Computer Graphics Lab) (Subject Code: *MCA2106L*)

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 based on paper MCA-214: Computer Graphics

\*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.

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**Master of Computer Applications  
Semester-III**

**Programming Lab -VI (Minor Project) (Subject Code: MCA42107L)**

**Maximum Marks: 100\***  
**Minimum Pass Marks: 40%**

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

This course will mainly comprise of developing a minor project using any of the different technologies learnt during the course.

\* There will not be any marks for internal assessment of the student.

**Guidelines for the Minor Project:**

1. The students are required to undertake a minor software development project during the third semester of MCA Course along with the regular classes. The project should be done preferably using the programming languages taught in the three semesters of the MCA course.
2. The students will complete systems analysis, design, coding and testing of the software project assigned to them by the teacher. The students are required to complete the minor project in the Department given by the concerned teacher of the Department. No outside training/ project work will be allowed.
3. Joint projects may be allowed and joint project reports will also be accepted, with the permission of the teacher concerned. However, the students should highlight their individual contributions in a joint project. The quantum of individual contribution of particular students in joint projects should be such which can be accepted as equivalent to individual minor project. The same must also be reflected in joint reports.
4. Each student should submit one project report of his/her project to the teacher concerned, as per the format decided by the Department.
5. The students are required to give live demo of the software developed by them and there will be viva-voce of the students during the end-semester practical examination.
6. There will not be any marks for internal assessment of the student. The external teacher along with the internal teacher will evaluate the student and marks out of 100 will be awarded to each student.

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**Masters in Computer Applications  
Semester-III**

**Mobile Application Development (Subject Code: ~~MCAM2105 E1~~ MCAM2105 E1)**

**Maximum Marks: 50**

**Minimum Pass Marks: 40%**

**Maximum Time: 3 Hrs.**

**Lectures to be delivered: 45-55**

In this course, students will learn about mobile application development. In particular, they will learn about Android operating system and understand how to build apps for mobile devices running Android. Also students will learn the complete cycle from planning and developing an application to deploying the same on Google Play Store. On completion of this course, the students will be able to:

- Apply knowledge into an interactive environment where they are shown how to develop, test and deploy Android Apps
- Learn the various aspects of Android Apps building blocks and Development.
- Understand how inter and intra process communication can be implemented.
- Learn to use GUI based controls for developing highly interactive and user friendly Apps.
- Learn to use different types of sensors available in the devices
- Learn to test and publish the Apps on Google Play Store.

**Course content**

**SECTION A**

**Introduction to Android and Apps:** Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User.

**Platforms:** Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing

**App Building Blocks:** Activities, Intents and Intent Filters, Services, Broadcast Receivers, Content Providers, Menus, Lists and Notifications.

**Testing:** Doing Test Driven Development (TDD), Setting AVD, Cloud based testing, troubleshooting application crashes, using BugSense, using StrictMode,

**Intents and Services:** Android Intents and Services, Characteristics of Mobile Applications, Successful Mobile Development

**Inter/intra process communication:** Opening webpages, sending email, background services, broadcast messages, using threads, Activity Thread Queue and Handler.

**Storing and Retrieving Data:** Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider

**Content Providers:** Retrieving data from content provider, writing a content provider, Android Remote Service

**SECTION B**

**Graphics:** OpenGL ES, Taking pictures using intent/camera, Chart and Graphs using Android Plot, InkSpace, Android RGraph, Simple Raster Animation, Pinch to Zoom. Performance and Multithreading, Graphics and UI Performance

**GUI:** Using controls, handling long-press events, detecting gestures.

**GUI Alerts:** Menu, Submenu, Pop-up, Timepicker, Tabbed dialog, Progress dialog, Custom dialog, Toasts, Status bar.

**Data Persistence:** Introduction, Getting file information, listing directory.

**SQLite Database:** Loading values from existing database, Working with Dates, JSON and JSONObject, Parsing XML with DOM API, XMLPullParser, Adding Contact, Reading Contact data

**Telephony:** Deciding Scope of an App, Processing outgoing call, dialing the phone, Sending Single or Multi part SMS messages, receiving SMS message.

**Communications Via Network and the Web:** Wireless Connectivity and Mobile Apps, State Machine, Correct Communications Model, Android Networking and Web, using RESTful web service, using WebView.

**Location:** Location Aware Apps, Getting location information, Accessing GPS information, mocking GPS coordinates on device, using Google Maps with MapView, Location search on Google Maps,

**Sensors:** Checking presence or absence of a sensor, Using Accelerometer, Using Orientation sensor, Using Temperature sensor.

**Bluetooth:** Introduction, Enabling Bluetooth and making device discoverable, connecting to other devices, Handling Bluetooth requests, implementing Device Discovery.

**Publishing Apps:** Packaging and Deploying, Performance Best Practices, Android Field Service App

#### **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. Ian F. Darwin, Android Cookbook, O'Reilly.
2. Dawn Griffiths, David Griffiths, Head First Android Development, Shroff Publishing and Distributors.
3. Rick Rogers, John Lombardo, ZigurdMednieks and Blake Meike, Android Application Development, O'Reilly.
4. Kyle Mew, Mastering Android Studio 3, Packt.

#### **Scheme of Examination**

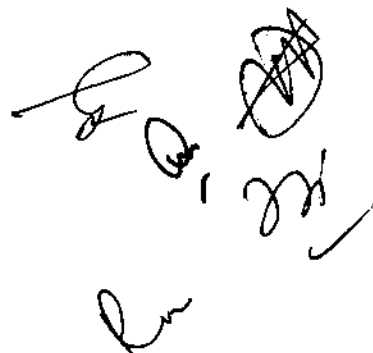
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- Each course will carry 100 marks of which 50 marks shall be reserved for internal assessment and the remaining 50 marks for written examination to be held at the end of each semester.
- The duration of written examination for each paper shall be 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-III**  
**Machine Learning (Subject Code: MCAM 2105 E2)**

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

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

This main objective of this course is to provide students with an in-depth introduction to two main areas of Machine Learning: supervised and unsupervised. We will cover some of the main models and algorithms for regression, classification, and clustering. Topics will include simple linear regression and multiple linear regression, Decision tree, kNN, and dimensionality reduction. After completing this class, student will be able to:

- Analyze methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.
- Apply decision tree learning, Instance based learning and feature selection in real world problems.
- Understand the use of clustering and clustering techniques.
- Apply inductive and analytical learning with perfect domain theories.
- Critically evaluate and compare different learning models and learning algorithms and be able to evaluate the performance of learning algorithms.

**Course content**

**SECTION A**

**Machine Learning:** Meaning, definition and applications of machine learning, History of machine learning, Steps involved in a machine learning project, Building a machine learning model: representing training examples, target function, representation of target function, learning algorithms, Basic terminology: features, feature vector, instance space, target function, training data, hypothesis space, inductive bias and Occam's razor principle. Bias versus variance, overfitting and underfitting.

**Types of machine learning:** supervised learning (classification and regression), unsupervised learning (clustering), reinforcement learning. **Classification:** binary versus multi-class classification, ZeroR classifier.

**Generalization of performance of the learning system, Evaluating the performance of learning algorithms:** confusion matrix, sensitivity and specificity, accuracy, precision and recall, k-folds cross validation.

**SECTION B**

**Simple linear regression model, multiple linear regression model, Gradient descent method:** incremental gradient descent, batch gradient descent, stochastic gradient descent.

**Decision Tree Learning:** Decision tree representation, appropriate problems for decision tree learning, building decision trees, principles of information gain and entropy.

**Instance based learning and feature selection, k-nearest neighbour algorithm.** Curse of dimensionality and the need for feature reduction.

**Clustering:** meaning and applications of clustering, requirements of a good clustering algorithm, Brief introduction to clustering approaches (partition based, hierarchical, model based, density based, graph theoretic clustering), similarity measures (Euclidean, Manhattan, Minkowski), evaluating the quality of clustering algorithm (Rand index, f-measure). K-means clustering technique.

**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. Tom M. Mitchell, Machine Learning, McGraw Hill Education.
2. Ethem Alpaydin, Introduction to Machine Learning, PHI.
3. Shai Shalev-Shwartz, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press.
4. Trevor Hastie,,Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer.

**Scheme of Examination**

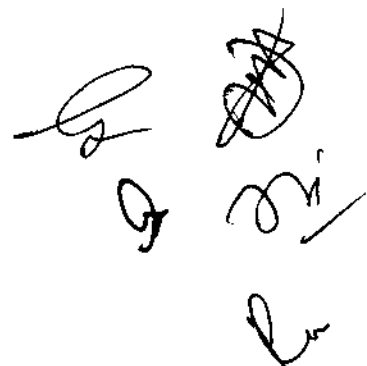
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- The minimum marks for passing the examination for each semester shall be 40% in aggregate as well as a minimum of 40% marks in the semester-end examination in each paper.
- A minimum of 75% of classroom attendance is required in each subject.

**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-III**  
**Big Data Analytics (Subject Code: MCA M. 2105 E3)**

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

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

The objectives of this subject are to introduce students the concept and challenge of big data and teach students in applying skills and tools to manage and analyze the big data. Upon completion of the subject, students will be able to:

- understand the concept and challenge of big data and why
- existing technology is inadequate to analyze the big data;
- collect, manage, store, query, and analyze various form of big data
- gain hands-on experience on large-scale analytics tools to solve some open big data problems
- understand the impact of big data for business decisions and strategy

**Course content**

**Section A**

Introduction to Data Analytics: Data and Relations, Data Visualization, Correlation, Regression, Forecasting, Classification, Clustering. Big Data Technology Landscape: Fundamentals of Big Data Types, Big data Technology Components, Big Data Architecture, Big Data Warehouses, Functional vs. Procedural Programming Models for Big Data. Introduction to Business Intelligence: Business View of IT Applications, Digital Data, OLTP vs. OLAP, Why, What and How BI? , BI Framework and components, BI Project Life Cycle, Business Intelligence vs. Business Analytics. Big Data Analytics: Big Data Analytics, Framework for Big Data Analysis, Approaches for Analysis of Big Data, ETL in Big Data, Introduction to Hadoop Ecosystem, HDFS, Map-Reduce Programming, Understanding Text Analytics and Big Data, Predictive analysis on Big Data, Role of Data analyst.

**Section B**

Business implementation of Big Data: Big Data Implementation, Big Data workflow, Operational Databases, Graph Databases in a Big Data Environment, Real-Time Data Streams and Complex Event Processing, Applying Big Data in a business scenario, Security and Governance for Big Data, Big Data on Cloud, Best practices in Big Data implementation, Latest trends in Big Data, Latest trends in Big Data, Big Data Computation, More on Big Data Storage, Big Data Computational Limitations.

Introduction to most recent advancements in Big Data technology along with their usage and implementation with relevant tools and technologies.

**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. Michael Minelli, Michele Chambers, Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley CIO Series.

#### Reference Books:

1. R.N. Prasad, Fundamentals of Business Analytics, Wiley.
2. Anil Maheshwari, Data Analytics, McGraw Hill Education.
3. Seema Acharya and Subhashini Chellappan, Big Data and Analytics, Wiley.
4. Tom White, Hadoop – the Definitive Guide, O'Reilly.

#### Scheme of Examination

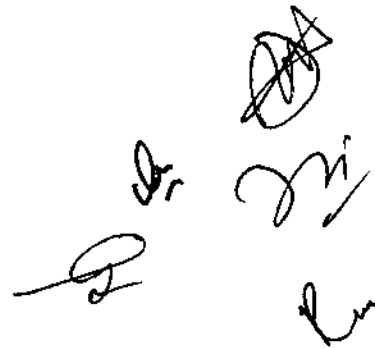
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Handwritten signatures and initials in black ink. There are three distinct signatures: one on the left, one in the middle, and one on the right. The rightmost signature is the most prominent and appears to be 'Dr. M. K. S.' with a large 'M' and 'K'.

**Master of Computer Applications**  
**Semester-III**  
**Cloud Computing (Subject Code: MCAM 2105 E4)**

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

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

Cloud Computing is a large-scale distributed computing paradigm which has become a driving force for information technology over the past several years. In this course, the student will learn about the cloud environment, building software systems and components that scale to millions of users in modern internet, cloud concepts capabilities across the various cloud service models including IaaS, PaaS, SaaS, and developing cloud based software applications on top of cloud platforms. Upon successful completion of this course you should be able to:

- Develop and deploy cloud application using popular cloud platforms,
- Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud and building private cloud.
- Explain and identify the techniques of big data analysis in cloud.
- Compare, contrast, and evaluate the key trade-offs between multiple approaches to cloud system design, and Identify appropriate design choices when solving real-world cloud computing problems.
- Write comprehensive case studies analyzing and contrasting different cloud computing solutions.
- Make recommendations on cloud computing solutions for an enterprise.

**Course content**

**Section A**

**Introduction:** Definition of Cloud, Basics of Cloud Computing, Characteristics of Cloud, Benefits of Cloud, Driving factors towards the use of Cloud Computing, Comparing Cloud with Grid Computing Systems, Workload Patterns for the Cloud, Selection criteria for migrating into Cloud, Application of Cloud Computing.

**Basic Concepts and Virtualization:** Cloud Computing Evolution, Big Data Concept, Elasticity and scalability, Virtualization: characteristics of virtualization, Benefits of virtualization, Forms of CPU virtualization, Hypervisors, VMware, Multitenancy, Application programming interfaces (API), Billing and metering of Cloud services, Economies of scale, Management, Tooling, and automation in Cloud Computing, SLA in Cloud Computing.

**Cloud Computing Service Delivery Models:** Cloud service delivery models, Cloud Reference Model, Infrastructure as a service (IaaS) architecture, details, examples and applications, Platform as a service (PaaS) architecture, details, examples and applications, Software as a service (SaaS) architecture, details, examples and applications, NIST architecture.

**Section B**

**Cloud Deployment Models:** Cloud deployment models, Private Clouds, Public Clouds, Hybrid Clouds, Community, Virtual private Clouds, Heterogeneous and Homogenous Clouds, Vertical and special purpose Clouds, Migration paths for Cloud, Selection criteria for Cloud deployment.

**Cloud Security:** Cloud Security challenges and risks, Principal Characteristics of Cloud Computing security, Cloud Computing Security Reference Model, How security gets integrated, Principal security dangers to Cloud Computing, Virtualization and Multitenancy, Internal security breaches, Data corruption or loss, User account and service hijacking, Steps to reduce Cloud Security breaches, Identity and access management, Cloud forensics, Digital signature, SSL.

**Case Studies:** Google Cloud platform, Windows Azure platform.

**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. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley.
2. Barrie Sosinsky, Cloud Computing Bible, Wiley.
3. Michael Miller, Cloud Computing, QUE Publications.
4. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley.

**Scheme of Examination**


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**Master of Computer Applications**  
**Semester-III**  
**Cryptography and Network Security (Subject Code: MCAM 2105 ES)**

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

This course is meant to provide a broad overview of the field of computer security. Students will learn the basic concepts in computer security including software vulnerability analysis and defence, networking and wireless security, applied cryptography, as well as ethical, legal, social and economic facets of security. Students will also learn the fundamental methodology for how to design and analyze security critical systems. After studying this course, student should be able to:

- identify some of the factors driving the need for network security
- identify and classify particular examples of attacks
- define the terms vulnerability, threat and attack
- identify physical points of vulnerability in simple networks
- compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.

**Course content**

**Section A**

**Basic Encryption And Decryption:** Attackers and Types of threats, challenges for information security, Encryption Techniques, Classical Cryptographic Algorithms: Mono-alphabetic Substitutions such as the Caesar Cipher, Cryptanalysis of Mono-alphabetic ciphers, Polyalphabetic Ciphers such as Vigenere, Vernam Cipher, Stream and Block Ciphers.

**Secret Key Systems:** The Data encryption Standard (DES), Analyzing and Strengthening of DES, Introduction to Advance Encryption Standard (AES)

**Public Key Encryption Systems:** Concept and Characteristics of Public Key Encryption system, Introduction to Merkle-Hellman Knapsacks, Rivets – Shamir-Adlman (RSA) Encryption.

**Section B**

**Hash Algorithms:** Hash Algorithms, Message Digest Algorithms such as MD4 and MD5, Secure Hash Algorithms such as SHA1 and SHA2.

**Network Security:** Network Security Issues such as Impersonation, Message Confidentiality, Message Integrity, Code Integrity, Denial of Service, Firewalls, DMZs, Virtual Private Networks, Network Monitoring and Diagnostic Devices.

**Web Security:** Web Servers, Secure Electronic Mail, Enhanced Email, Pretty Good Privacy, Public Key Cryptography Standards

**Ethical Hacking:** Introduction to Ethical Hacking, Terminology, Hackers, Crackers, and Other Related Terms, Hactivism, Threats, Hacking History, Ethical Hacking Objectives and Motivations.

**PEDAGOGY:**

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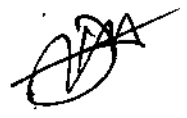
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 22









**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. AtulKahate, Cryptography & Network Security, McGraw Hill Education.
2. William Stallings, Cryptography and Network Security - Principles and Practice, Pearson.
3. Forouzan, Cryptography and Network Security, McGraw Hill India.

**Scheme of Examination**

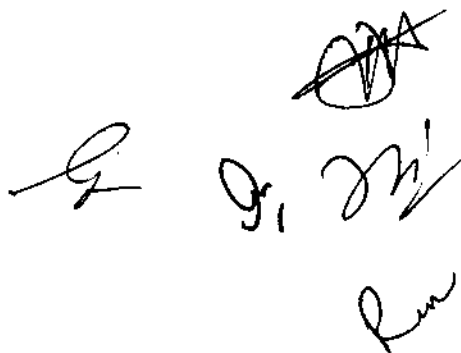
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