JAMIA HAMDARD

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CBCS ENABLED SYLLABUS MASTER OF COMPUTER APPLICATIONS (MCA)

SYLLABUS FOR MASTER OF COMPUTER APPLICATIONS (MCA)

Choice Based credit system (CBCS)

Approval Date: 26th June 2022

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

JAMIA HAMDARD

Deemed to be University

Accredited in 'A' Grade by NAAC

Declared to be designated as Institute of Eminence (IoE) by MHRD, GOI,

New Delhi -110062

www.Jamiahamdard.edu.in

PROGRAMME NAME: MASTER OF COMPUTER APPLICATIONS (MCA)
PROGRAME CODE: 501
ACADEMIC SESSION OF INTRODUCTION OF THE PROGRAMME: (2022-23)
SCHOOL NAME: SEST
DEPARTMENT NAME: COMPUTER SCIENCE & ENGINEERING

APPROVAL DATE OF THE BOARD OF STUDIES (BOS) MEETING FOR THE PRESENT SYLLABUS
26 JUNE 2022

APPROVAL DATE NUMBER OF ACADEMIC COUNCIL OF MEETING FOR THE PRESENT SYLLABUS

ADMISSION & EXAMINATION
BYE-LAWS

FOR

Master of Computer Applications (MCA)
Programme Code: 501

CHOICE BASED CREDIT SYSTEM (CBCS)
w.e.f (2022-23)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
School of Engineering Sciences& Technology
JAMIA HAMDARD
(DEEMED TO BE UNIVERSITY)
Hamdard Nagar, New Delhi-110 062
Ph. 011 26059688, Extn.-5858

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Date of approval of present syllabus: 18.1.2021

SCHOOL OF EGINEERING SCIENCES AND TECHNOLOGY

Vision Statement (School Level): To become the best institution in the national and international map in terms of quality of teaching and research, technical knowledge and academics in the field Computer Science & Engineering, Electronics & Communication Engineering, Bioinformatics with sincere honesty adding values in the core aspect of students' life.

Mission Statements (School Level):

MS1: To offer state-of-the-art undergraduate, postgraduate and doctoral programs in Computer Science & Engineering, Electronics and Communication Engineering & Engineering and Bioinformatics.

MS 2: To provide one of the best working environments to motivate faculty and students to work towards vision of the Department.

MS 3: To develop association with industry, other Universities/Institute/Research Laboratories and work in collaboration with them.

MS 4: To use our expertise in all the relevant disciplines for helping society in solving its real-life problem.

MS 5: To develop entrepreneurship skills in the students so that they can become problem solver and innovative developer and contribute to the society by providing employment to others.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Upon the completion of Academic Programme (MCA), students will be able -

PEO-1 : To establish technical and profesional foundation that yield the students to go for higher studies in the field of Computer Science application, especially concerning with the recent trends in technology.

PEO-2: To design software products required for many daily life solutions by utilizing their education in computer science and applications.

PEO-3: To work as a professionals in the capacity of team members / leaders in professional environment.

PEO-4: To analyze recent trends in innovation and technology and accordingly can apply their knowledge for providing related services.

Mapping Program Educational Objectives (PEOs)
with Mission Statements (MS)

	MS-1	MS-2	MS-3	MS-4	MS-5
PEO-1	3	2	2	2	2
PEO-2	2	2	3	3	3
PEO-3	2	2	2	3	3
PEO-4	2	2	3	2	3

Write ‘3’ in the box for ‘high-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low-level’ mapping.

Program Outcomes (PO):

PO1) Computational Knowledge: Apply knowledge of computing fundamentals and domain knowledge.

PO2) Problem Analysis: Identify, formulate, and solve complex computing problems reaching substantiated conclusions.

PO3) Development of Solutions: Design and evaluate solutions for complex computing problems with appropriate consideration.

PO4) Investigations of complex Computing problems: Use research-based knowledge and research methods for analysis and interpretation of data, and synthesis of the information to provide valid conclusions

PO5) Modern Tool Usage: Create, identify, and apply appropriate techniques, resources, and modern computing tools to complex computing activities.

PO6) Professional Ethics: Understand and commit to professional ethics and cyber regulations for professional computing practices.

PO7) Life-long Learning: Identify the need and have the ability, to engage in independent learning as a computing professional.

PO8) Project management and finance: Understand and apply computing, management principles to manage multidisciplinary projects

PO9) Communication Efficacy: Communicate effectively with the computing community, and with society.

PO10) Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues

PO11) Individual and Teamwork: Function effectively in diverse teams and in multidisciplinary environments.

PO12) Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity.

Program Specific Outcomes (PSO):

PSO1. To design software-oriented applications that may leverage the technical skills for social upliftment and ease of use for IT services.

PSO2. To apply the knowledge gained during the study to create new avenues for research and higher studies and to open the new opportunities for the challenging issues in the related domain.

PSO3. To serve as a responsible IT professionals and lead as an entrepreneur towards a better society with ethical values.

	PEO-1	PEO-2	PEO-3	PEO-4
PO-1	3	3	2	2
PO-2	3	3	1	2
PO-3	3	2	2	2
PO-4	2	3	2	3
PO-5	3	2	2	3
PO-6	2	3	3	1
PO-7	2	3	3	2
PO-8	2	3	2	3
PO-9	1	2	3	2
PO-10	2	2	1	2
PO-11	2	2	3	2
PO-12	1	2	2	3
PSO1	3	3	2	2
PSO2	2	2	3	3
PSO3	1	1	3	1

ADMISSION & EXAMINATION RULES
for
Master of Computer Applications

1. THE PROGRAM

Highlights of the course are described in the following table:

a.	*Name of the Program*	Master of Computer Applications
b.	*Nature*	Regular and Full Time
c.	*Duration*	Two years (4 Semesters)
d.	*Total number of credits*	100
e.	*Medium of Instruction and English Examinations*	English
f.	*Eligibility Criteria*	i. Passed BCA/ BSc/ B. Com/ BA with mathematics at 10 + 2 level or at graduation level examination from a recognized institution/university securing at least 50% marks (or equivalent CGPA) in the qualifying examination.
g.	*Selection procedure*	As per the merit of the qualifying examination.
h.	*Total Seats*	60
i.	*Period of Completion*	Not more than 04 years (8 Semesters)
j.	*Commencement of the Program*	July of the every academic session

2. PROGRAMME STRUCTURE

Semester-wise course structure, guidelines for teaching, practical and associated assessment of **MCA programme** is described in the following tables:

Course Type	Abbreviation	Credits
Program Core Course	PCC	44
Program Elective	PE	12
Open Elective	OE	04
Foundation Course	FC	04
Ability Enhancement Course	AEC	02
Skill Enhancement Elective	SEE	04
Laboratory	LAB	12
Dissertation	DISS	18
Total Credits		**100**

L-T-P stands for number of contact hours as Lecture-Tutorial-Practical in a week.

Semester – I

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MCA 101	Object oriented programming	PCC	40	60	100	3-1-0	4
MCA 102	Computer Organization and Architecture	PCC	40	60	100	3-1-0	4
MCA 103	Database Management Systems	PCC	40	60	100	3-1-0	4
MCA 104	Software Engineering	PCC	40	60	100	3-1-0	4
MCA 105	Data Communication and Computer Networks	PCC	40	60	100	3-1-0	4
MCA 106	Communication Skills	AEC	40	60	100	2-0-0	2
MCA 107	‘OO Programming Lab	LAB	40	60	100	0-0-4	2
MCA 108	Database Management Systems Lab	LAB	40	60	100	0-0-4	2
					Total	**17-5-8**	**26**

Semester – II

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MCA 201	Mathematical Foundations for Computer Applications	FC	40	60	100	3-1-0	4
MCA 202	Data Structures and algorithms	PCC	40	60	100	3-1-0	4
MCA 203	Java Programming	PCC	40	60	100	3-1-0	4
MCA 204	Operating Systems	PCC	40	60	100	3-1-0	4
	PE – 1	PE	40	60	100	3-1-0	4
	PE-2	PE	40	60	100	3-1-0	4
MCA 205	Data Structures Lab	LAB	40	60	100	0-0-4	2
MCA 206	Java Programming Lab	LAB	40	60	100	0-0-4	2
					Total	**18-6-8**	**28**

Semester – III

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Semester Exam	Total		
MCA 301	Formal languages and Compiler Design	PCC	40	60	100	3-1-0	4
MCA 302	Machine Learning	PCC	40	60	100	3-1-0	4
MCA 303	Data Warehousing and Data Mining	PCC	40	60	100	3-1-0	4
	PE – 3	PE	40	60	100	3-1-0	4
	SEE	SEE	40	60	100	3-1-0	4
	OE	OE	40	60	100	3-1-0	4
MCA 304	ML Lab	LAB	40	60	100	0-0-4	2
MCA 305	Lab based on SEE	LAB	40	60	100	0-0-4	2
					Total	**18-6-8**	**28**

Semester – IV

Course Code	Course Title	Course Type	Marks			L-T-P	Credits
			Internal Assessment	Viva Voce	Total		
MCA 401	Dissertation/Industrial Project	DISS	300	200	500	0-0-36	18

Grand Total of Credits = 100

PROGRAM ELECTIVES (PE)

PE – 1	
MCA PE111	Artificial Intelligence
MCA PE112	Web technology
MCA PE113	Software testing and Quality Assurance
PE – 2	
MCA PE221	Data Science and Analytics
MCA PE222	Soft Computing
MCA PE223	Neural Networks and Deep Learning
PE – 3	
MCA PE331	Distributed Systems
MCA PE332	Cloud Computing
MCA PE333	Cryptography and Network Security
MCA PE334	MOOCS*

*The list of online courses to be cleared through MOOCS shall be floated in the respective semester after the approval from Board of Studies with in-house examination being conducted.

Skill Enhancement Electives (SEE)

SEE	
MCA SEE311	Android Programming
MCA SEE312	Linux and Unix Programming
MCA SEE313	ASP.net Programming

OPEN ELECTIVES (OE)

OE	
MCA OE311	E-Governance and Smart City
MCA OE312	Cyber physical system and IoT
MCA OE313	Sustainable Development and Green Computing

3. MODE OF CURRICULUM DELIVERY

Mode of curriculum delivery includes classroom teaching, assignments, test, lab work, presentations, participation in relevant events and regularity.

4. ATTENDANCE

a. All students are supposed to attend every lecture and practical classes. However, the *attendance requirement for appearing in the examination shall be a minimum of 75% of the classes held.
b. Each one-period teaching shall account for one attendance unit.
c. The concerned teacher will take a roll call in every scheduled class, maintains and consolidate the attendance record, which would be submitted to the Head of the Department at the conclusion of the semester.

d. Attendance on account of participation (with prior permission from the Head of the Department) in the co-curricular/extra-curricular activities can be granted by the Dean on receipt of certificates or recommendations of the respective activity issued by the Head of the Department.

e. Attendance records displayed on the Notice Board from time to time, in respect of short attendance, shall be deemed to be a proper notification and no individual notice shall be sent to the students/local guardian.

f. In case a student is found to be continuously absent from the classes without information for a period of 30 days, the concerned teacher shall report it to the Head of the Department.

g. Head of the Department may recommend for striking off the name of a student from rolls, after ensuring '**one month continuous absence'**, from all the concerned teachers.

h. A student, whose name has been struck off on account of long absence may apply to the Dean for readmission within 15 days of the notice of striking off the name. The readmission shall be effected on payments of prescribed readmission fees.

i. A student with less than 75% attendance in a subject shall not be allowed to appear in that subject in the semester examination. The Head of the Department shall recommend all such cases to the Dean of the School.

j. The Dean, on the recommendation of the Head of the Department, may consider the relaxation of attendance up to 10% on account of sickness and /or any other valid reason. No application for relaxation of attendance (duly certified by a Registered Medical Practitioner/Public hospital or a competent authority) will be entertained after 15 days from the recovery from illness etc.

5. INTERNAL ASSESSMENT

a. Internal assessment, to be made by concerned teachers, will be based on minor tests, quizzes, presentation, programming test, demonstrations and assignments.

b. There will be two (2) Internal Assessment (Unit Tests) with a total of 30 marks (15 marks each). Other modes of assessment shall account for remaining 10 marks (assignments attendance, etc.).

c. Dates for unit test will be announced at the beginning of the semester, by the examination coordinator.

d. The teacher concerned shall maintain a regular record of the marks obtained by students in unit tests and display the same in due course.

e. The concerned teachers shall submit the compiled internal assessment marks to the Head of the Department, on the conclusion of teaching of the current semester.

f. The Head shall display a copy of the compiled sheet, of internal assessment marks of all the papers, before forwarding it to the Controller of Examination, i.e. at the conclusion of the semester.

g. A promoted candidate, who has to reappear in the examination of a paper, will retain internal assessment marks.

h. In the case of re-admission, the candidates shall have to go through the internal assessment process afresh and shall retain nothing of the previous year.

6. SEMESTER EXAMINATIONS

Prescriptions for conducting semester examinations of theory and lab papers, those shall be conducted after the conclusion of each of the semesters, are presented in the following table:

S.N.	Classification	Theory	Lab
1.	Mode	Written Only	Written, Demo, Programming and viva- voce etc.
2.	Duration	02 hours 30 minutes	03 Hours
3.	Total Marks	60 (sixty Only)	60 (Sixt Only)

7. DISSERTATION/INDUSTRIAL PROJECT

a. Each student of the final semester will have to go for a Dissertation/Industrial Project work either in the industry or in the Department under the guidance of one or two faculty members.

b. Period of completion of Dissertation/Industrial Project work shall be full one semester.

c. There shall normally be two supervisors-one internal and one *external (in the case of industry project form the place where the student is pursuing project-work).*

d. All the students, who are pursuing the Dissertation/Industrial project work, shall be continuously in touch with the internal supervisor.

e. ***There shall be a mid-term evaluation of the progress*** and the internal supervisors will conduct it. However, an internal supervisor may ask the student to submit a confidential progress-report from the external supervisor *(in the case of industry project).*

f. All the candidates shall submit ***Three (03***) hard copies of the project reports that are duly approved and signed by internal as well as external *(if applicable)* supervisors.

g. An external examiner, appointed for the purpose, shall evaluate the project report.

h. The Head of the Department shall fix a date and time for viva-voce examinations, on receipt of the evaluation-report of the project reports from the external examiner.

i. Head of the Department shall forward the compiled total marks (awarded in internal assessment, project Report and Viva-voce Examination), in the project-semester of each of the candidate, to the Controller of Examination.

8. EXAMINATION

a. The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/ tutorials, quizzes/ viva voce and attendance. The end semester examination shall be comprised of written papers, practical and viva voce, inspection of certified course work in classes and laboratories, project work, design reports or by means of any combination of these methods.

b. The marks obtained in a subject shall consist of marks allotted in end semester theory paper, practical examination and sessional work.

c. The minimum pass marks in each subject including sessional marks (Theory, Practical or Project etc.) shall be 50%.

9. PROMOTION SCHEME

a. A student will be required to clear minimum **40% of his/her papers** in a semester/annual examination to be eligible **for promotion to the next semester/year**. A student may appear in the supplementary examination after each semester/annual examination and can have a choice to appear in the backlog papers in the supplementary examination or in the subsequent regular semester/annual examination with a prescribed fee. A students detained due to shortage of attendance will repeat his/her paper in the subsequent semester concerned (even/odd).

b. A **detained** Student is not allowed to re-appear in the internal assessment (Unit test). His/her old internal assessment marks will remain same.

A student who cleared all the papers of a semester/annual examination of a programme/course will be eligible for improvement examination asper university rule.

10. THE GRADING SYSTEM

As per University Rule

11. CALCULATION OF SGPA AND CGPA OF A STUDENT IN A SEMESTER

As per University Rule

After having passed all the FOUR semesters, the students shall be eligible for the award of **Master of Computer Applications** degree of JAMIA HAMDARD.

12. CLASSIFICATION OF SUCCESSFUL CANDIDATES

The result of successful candidates, who fulfill the criteria for the award of **Master of Computer Applications**, shall be classified at the end of last semester, on the basis of his/her final CGPA (to be calculated as per university rule).

Detailed Syllabus

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: MCA-101 **Title of the Course:**Object Oriented Programming
L-T-P: 3-1-0 **Credits**: 4
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to …….
CO1: Understand the concept of OOPs and the characteristics of the C++ programming language. (Cognitive level: Understand)
CO2: Understand and apply the concepts of Classes & Objects, constructors, destructors and friend function in program design. (Cognitive level: Apply)
CO3: Design and implement various forms of inheritance, describe function overriding and constructor calls in different types of Inheritance. (Cognitive level: Create)
CO4: Analyse operator overloading, runtime polymorphism, Generic Programming. (Cognitive level: Analyze)
CO5: Analyze and explore various stream classes, I/O operations, and exception handling. Also Illustrate the process of data file manipulations**.** (Cognitive level: Analyze)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2			1	1	1	1	2	3	2	1
CO2	3		3	3	3	2					1	2	3	1	
CO3	3		3	3	3							2	3		
CO4	3		3	3	3							2	3		
CO5	3		3	3	3		1					2	3	1	

Detailed Syllabus:

Unit 1: (9 hours)

Introduction: Introducing Object-Oriented Approach Comparisons with Procedural Approach, Characteristics of Object-Oriented Languages. Basic terms and ideas: Abstraction, Encapsulation, Information hiding, Inheritance, Polymorphism, Review of C, Difference between C and C++, cin, cout, new, delete operators.

Unit 2: (12 hours)

Classes and Objects: Abstract data types, Object & classes, attributes, methods, Reference variable, C++ class declaration, State identity and behavior of an object, Constructors and destructors, copy Constructor, Static Class Data, inline function, default arguments, const arguments Friend Functions.

Unit 3: **(10 hours)**

Inheritance: Inheritance, Types of Inheritance, Class hierarchy, derivation – public, private & protected, Hybrid Inheritance and virtual base class Aggregation, composition vs classification hierarchies, function overriding and constructor calls in different types of Inheritance.

Unit 4: **(10 hours)**

Polymorphism: Type of Polymorphism – Compile time and runtime, Method polymorphism, Polymorphism by parameter, This Pointer, Operator overloading and Type Conversions, Parametric polymorphism, Virtual Functions, Virtual Destructors, Generic Programming – template function and Template Classes.

Unit 5: **(10 hours)**

Files and Exception Handling: Console I/O: Stream, stream classes, unformatted I/O operations, formatted I/O operations, manipulators. File I/O Basics of data files, creating/ opening & closing a file, reading data from file, writing data into file, error-handing functions, random access of data files, Namespaces and Exception handling.

Text Books and Reference Books:

[1]. Balagurusamy, "Object Oriented Programming with C++", TMH, 7th Edition, 2017.

[2]. Stephen Prata "C++ Primer Plus" Pearson Education, 6th Edition, 2015.

[3]. Schildt Herbert, "C++: The Complete Reference", Wiley DreamTech, 2005.

[4]. D. Parasons, "Object Oriented Programming with C++", BPB Publication, 2nd Edition.

[5]. A R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH, 1997

Teaching-Learning Strategies in brief

1. Build a positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting doubt classes.
4. By taking semester examination.
5. Internal assessment (40 marks), Semester Examination (60 marks), and Total Marks=100.

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code:-MCA 102
Course title: Computer Organization And Architecture

L-T-P: 3-1-0 **Credits: - 04**
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcomes:

CO1: The main objective of the syllabus is to make students remember the relevance Computer
Organization in the software-oriented course. (Cognitive level: Remember)
CO2: It aims at understanding basic digital concepts and then use them to explain details of computer organization. (Cognitive level: Understand)
CO3: To apply key skills of constructing cost-effective computer systems. (Cognitive level: Apply)
CO4: To analyse the basic CPU organization. (Cognitive level: Analyze)
CO5: To help students in evaluating various memory devices and to facilitate students in learning IO communication. (Cognitive level: Evaluate)

Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3		2	2	1	1	1	1	1	1
CO2	3	3	3	3	3	3	2	2	2	2	1	1	2	1	1
CO3	3	3	3	3	3				2	1		1	1		1
CO4	3	3	3		3	3	2	2			1	1		1	1
CO5	3	3		3	3	3	2	2	1			2			2

Unit – I **9 hours**
BASIC FUNCTIONAL BLOCKS OF A COMPUTER AND ITS REPRESENTATION: Functional units, Basic operational concepts, Bus structures, Performance and metrics, Instructions and instruction sequencing, Hardware–Software Interface, Instruction set architecture, Addressing modes, RISC, CISC, ALU design, Fixed point and floating point operations, Case study of a CPU (Intel Atom Board)
Unit – II **9 hours**
CPU CONTROL UNIT DESIGN: Execution of a complete instruction, Multiple bus organization, Hardwired control, Micro programmed control, Computer arithmetic, Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shiftand-add, Booth multiplier etc.
Unit – III **9 hours**
PIPELINE: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Performance considerations, Exception handling. Case Study of Intel Atom Board.
Unit – IV **9 hours**

MEMORY SYSTEM DESIGN: Basic concepts, Semiconductor RAM – ROM, Speed, Size and cost, Cache memories, Improving cache performance, Virtual memory, Memory management requirements, Associative memories, Secondary storage devices. Case study of Intel Atom Board.

Unit – V **9 hours**

I/O ORGANIZATION: Accessing I/O devices, Programmed Input/Output, Interrupts, Direct Memory Access, Buses, Interface circuits, Standard I/O Interfaces (PCI, SCSI, USB), I/O devices and processors.

TEXTBOOKS

1. John P. Hayes, Computer Architecture and Organization, MGH, 1998.
2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education, 2010.
3. M. Morris Mano, Computer System Architecture, 2nd Edition, PHI.

REFERENCE BOOKS

• David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Elsevier, 2012.
• Carl Hamachar, Zvonco Vranesic and Safwat Zaky, Computer Organization, MGH, 1990.
• Vincent P. Heuring and Harry F. Jordan, Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 1996.

TEACHING - LEARNING STRATEGIES

1. BLENDED LEARNING
2. BRAINSTORMING
3. CASE STUDY
4. COMPUTER AIDED PRESENTATION
5. COMPUTER LABS/LAPTOP INSTRUCTION
6. DEMONSTRATION
7. DIRECT INSTRUCTION
8. DISCOVERY LEARNING
9. DISCUSSION
10. DRILL AND PRACTICE
11. EXAMINATION
12. FLIPPED CLASS
13. FULLY ONLINE INSTRUCTION
14. GROUP ACTIVITIES
15. INQUIRY
16. LECTURE
17. MENTAL MODELING
18. MOOC ONLINE
19. PROJECT DEVELOPMENT
20. PROJECT PRESENTATION
21. QUESTION AND ANSWER
22. ROLE PLAY
23. SELF-LEARNING
24. SEMINAR
25. TUTORIAL
26. WEB-ENHANCED LEARNING

Assessment methods and weightages in brief

1. Internal Assessment: 40
2. Semester Exam: 75
   Assessments through Sessional, Assignments, Quizzes etc.

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: MCA 103 Title of the Course: Database Information Systems

L-T-P: 3-1-0 Credits: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES

After successful completion of the course, the learners would be able to

CO1: Define the terminology, features, classifications, and characteristics embodied in database systems. (Cognitive level: Understand)

CO2: Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary. (Cognitive level: Analyze)

CO3: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database. (Cognitive level: Understand)

CO4 Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database. (Cognitive level: Apply)

CO5 Understand where transactions are used, understand serializability and deadlocks. (Cognitive level: Understand)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	1	-	-	-	-	1	-	1	1	-	1
CO2	3	2	2	2	1	-	1	1	-	-	1	1	-	-	-
CO3	3	2	2	1	1	-	-	1	-	-	-	1	-	1	-
CO4	3	2	2	1	1	1	-	-	-	-	-	1	-	-	-
CO5	3	2	2	1	1	-	-	-	1	-	-	1	-	-	-

Unit –I **10 Hours**

Introduction to DBMS

Basics of File Processing Systems and Database Systems, Difference between traditional file system and DBMS, Responsibilities of Database Administrator, Three level Architecture of Database System, Physical and Logical data independence.

Unit– II **10 Hours**

Introduction to various Database Models Entity Relationship Model and its importance, Introduction to various Symbols used In ERD (Entity: Types of Entities, week Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of

relationship, Connectivity, Cardinality), Conversion of ER diagram to tables, Comparative study of Network, Hierarchical and Relational Models, Codd's 12 Rules, Comparison of Object Oriented Database and Object Relational Database.

Unit–III **10 Hours**

Normalization in DBMS

Normalization and its various forms (1NF, 2NF, 3NF and BCNF), Functional Dependencies, Multi-valued Dependencies, Study of various Database Integrity like Domain, Entity, Referential Integrity Constraints.

Unit – IV **10 Hours**

Normalization in DBMS

Categories of SQL Statements, The CREATE Statement, The DROP Command, The ALTERCommand,IntegrityConstraints,DMLStatements:TheSELECTStatement,TheINSERTStatement, The DELETE Statement, The UPDATE Statement, SQL Operators: Simple SelectsComparisonOperators,INandNOTINOperators,BETWEENOperator,TheLIKEOperatorLogical

Operators, IS NULLand IS NOT NULL, ANY, ALL, SQL FUNCTIONS, Joining Tables, SQLSubqueries,GROUPBYClause,HAVINGClause

Unit – V **10 Hours**

Transactions

Basic concepts, ACID Properties. Concurrency control techniques: Items, locks, Deadlocks, serializability, Locking and Two phase locking, Database recovery technique**:** Failure classification, recovery concepts, recovery techniques based on deferred and immediate update, Shadow paging.

TEXTBOOKS

R.Elmasri&S.B.Navathe,FundamentalsofDatabase Systems,PearsonEducation,6thedition,2010.

REFERENCEBOOKS

Silberschatz, H. Korth &S. Sudarshan, Database System Concepts, TMH, 5th Edition,2010.

R.Ramakrishnan &J.Gehrke,Database ManagementSystems,3rd edition,TMH,2007.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student’s everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.

- End semester examination.

Internal Assessment: 40 Marks, End Semester Examination: 60 marks &Total Marks: 100.

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: MCA 104

Title of the Course: Software Engineering

L-T-P: 3-1-0

Credits: 4

(L=Lecture Hours, T=Tutorial Hours, P=Practical Hours)

Course Outcomes:

On successful completion of this module, the student should:

CO 1. Understand the key concerns that are common to all software development processes. (Cognitive level: Understand)

CO 2. Be able to select appropriate process models, approaches and techniques to manage a given software development process. (Cognitive level: Analyze)

CO 3. Be able to elicit requirements for a software product and translate these into a documented design. (Cognitive level: Apply)

CO 4. Be able to identify dependability and security issues that affect a given software product creation. (Cognitive level: Create)

CO 5. Understand the role that testing and reuse play in the implementation phase and how these activities relate to the wider software process. (Cognitive level: Evaluate)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	1	1	1	1	2	1	1	3	2	1	3	3	3	1
CO 2	3	3	2	1	2	1	1	1	2	1	1	3	3	3	2
CO 3	3	2	3	3	3	1	1	1	1	1	1	3	3	3	2
CO 4	2	1	1	1	3	1	1	1	1	1	1	3	3	3	2
CO 5	3	3	3	2	3	1	1	1	1	1	1	3	3	3	3

UNIT-I 8 hours

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering-a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

UNIT–II 8 hours

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods.

UNIT–III 8hours

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

UNIT–IV 8 hours

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT–V 8 hours

Metrics for Process and Products: Software measurement, metrics for software quality. Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

Quality Management: Quality concepts, software quality assurance, software views, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000qualitystandards.

TEXTBOOKS:

1) Software Engineering, A practitioner’s Approach- Roger S. Pressman, 6th edition, McGrawHillInternationalEdition.
2) SoftwareEngineering-Sommerville,7thedition,PearsonEducation.
3) The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson,PearsonEducation.

REFERENCEBOOKS:

1) Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, JohnWiley.
2) Software Engineering principles and practice- Waman S Jawadekar, The Mc

Graw-HillCompanies.

3) FundamentalsofobjectorienteddesignusingUML Meilerpage-Jones:PearsonEducation.

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

Internal Assessment: 40 Marks, End Semester Examination: 60 marks &Total Marks: 100.

Name of the Academic Program: - Master of Computer Application (MCA)

Course Code: MCA-105 Title of the Course: Data Communication and Computer Networks
L-T-P: 3-1-0 Credits: - 04
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to:

CO1 Illustrate the overall functioning of layers of OSI model and TCP/IP Model. Create a Network architecture. (Cognitive Level: Create)
CO2 Design and implement Data Link protocols, Access Control, Examine IEEE 802.11 standards for LAN (Cognitive Level: Create)
CO3 Analyze and apply routing in Network layer with routing algorithms and IPV4 Schemes, Apply concepts of Subnets (Cognitive Level: Analyze)
CO4 Apply the elements and protocols of Transport & Application Layer, Illustrate Transport Layer- Connection Management (Cognitive Level: Apply)
CO5 Analyzing why networks need security and control, what errors might occur, and how to control network errors (Cognitive Level: Analyze)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	2	-	2	-	-	-	3	3	3
CO2	3	3	3	3	2	-	2	1	2	-	2	-	3	3	3
CO3	3	3	3	3	3	2	2	3	2	-	2	2	3	3	3
CO4	3	3	3	3	2	2	2	2	2	1	2	1	3	3	3
CO5	3	3	3	3	3	3	2	2	2	1	2	2	3	3	3

Detailed Syllabus:

Unit–I **(10 hours)**

Transmission Media: Twisted pair, Coaxial Cable, Fibre Optics, Wireless transmission, Bluetooth, Radio, Microwave, Infrared.
Network Classifications: Study of various Types of Networks (LAN, MAN, WAN, WLAN, PAN, etc.), Comparison of various enterprise network infrastructures (Internet, Intranet, and Extranet), Introduction to IEEE 802family.

Unit–II **(10 hours)**

IntroductoryConcepts-Networkhardware-Networksoftware-Physicallayer–Guided transmission media, OSI reference model
Data Link Layer–Error Detection and Correction, Data link control and protocol, Design issues

-Channel allocation problem-Multiple access protocols- Ethernet-Wireless LAN-802.11 architecture.

Unit–III **(10 hours)**

Network Layer – Addressing, Design issues, Routing algorithms, Congestion control algorithms Quality of Service, Internetworking.

Unit–IV **(10 hours)**

Transport Layer-Transport service-Elements of transport protocols-User Datagram Protocol-Transmission Control Protocol.

Unit–V **(10 hours)**

Application Layer-DNS-Electronic mail-World Wide Web-Multimedia –Network security.

TEXTBOOKS

- *A.S.TANENBAUM,"ComputerNetworks",PearsonEducation,IVEdition,2003*
- *W.STALLINGS,"DataandComputerCommunication", PearsonEducation,2001*
- *B.AForouzan"DataCommunicationandNetworking"TMH*

REFERENCEBOOKS

- *Shanmavgaon,K.S."DigitalandAnalogCommunicationSystem",JohnWileyandSons.*
- *Roden,M.S."AnalogandDigitalCommunicationSystem",P.H.I.*
- *Scheber,W.L."DataCommunication",MGH.*

Teaching-Learning Strategies in brief

1. Provide visuals, illustrations, explanations etc.
2. Adopt from basic to advance knowledge about the subject.
3. Use LMS for providing access to study materials.
4. Encourage students for participative learning.
5. Motivate students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. Assignments
2. Class tests
3. Sessional examination
4. Semester examination
5. **Internal assessment (40 Marks) & Semester Examination (60 marks) &Total Marks-100.**

Name of the Academic Program: - Master of Computer Application
Course Code: MCA-106
Title of the Course: Communication Skills
L-T-P: **2-0-0**
Credits: - 02
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to:

CO-1. Understand the basic rules of Grammar, avoid committing common mistakes (Cognitive level- Create)
CO-2. Read, comprehend, and pronounce correctly (Cognitive level- Analyse)
CO-3. Identity and use strategies for effective communication, including giving presentations (Cognitive level- Create)
CO-4. Know the pitfalls of General and Technical Writings (Cognitive level- Analyse)
CO-5. Demonstrate increased awareness of forms of communication and social behaviour (Cognitive level- Evaluate)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	PO 6	**PO 7**	PO 8	PO 9	PO1 0	PO1 1	PO1 2	**PSO 1**	**PSO 2**	**PSO 3**
CO1	-	-	-	-	-	-	1	-	2	1	3	3	2	3	3
CO2	-	-	-	-	-	-	1	-	2	2	3	3	2	3	3
CO3	-	-	-	-	-	-	1	1	3	3	3	3	3	3	3
CO4	-	-	-	-	1	-	1	-	1	1	3	3	3	3	3
CO5	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3

Detailed Syllabus:

Course Description:
Technical Communication is most essential for students and professionals. Thus, there is a drastic need for effective communication. Due to the various phenomenal changes in the business environment, recruiters are now looking for students with good computer knowledge as well as good communication skills. Thus, the objective of this course is to equip the students with the basics of communication skills and technical writing, so that they can put them into use in their day-to-day activities.

UNITS COURSE
Unit 1 Listening Skills: 6 hours
The Lynchpin of Communication, Hearing & Listening, Active Listening, Kinds of Listening,
Barriers to Good Listening, Barriers to Good Listening, Chinese Whisper, Good Listening, Role Play, Role Descriptions.
Unit 2 Writing Skills: 6 hours
The Basics of Writing, The Process of Writing, Paragraph, Instructional Writing, Precis Writing,

Abstract Writing, Note-Taking, Redundancy, Ambiguity, Cliché Words & Phrases, Formal & Informal Words, Intellectual & Emotional Words, Synonyms & Antonyms, Types of Writing, Difference between an Abstract & a Summary, Resume, CV, Statement of Purpose

Unit 3 Corporate Communication Public Speaking: 6 hours

Importance of Talk in a Team, Conflict Management, Communication in Teams, Group Discussions, Structuring the Group Discussion, Interviews, Problem Solving Skills, Decision making Process, Techniques in Interviewing, Preparation for an Interview, Kinds of Questions

Expected in Interviews, The Interview Process, Self-Confidence Tips, Presentation Skills

Unit 4 Non-Verbal Communication: 6 hours

The Communicating Body, Studying Body Language, Distance & Positioning, Body Orientation, KOPPACT factors, Mirror Imaging, Negative & Positive Cues, Cross-Cultural Communication, Barriers to Communication, Role Plays, Role Descriptions

Unit 5 Creativity & Mind-Mapping: 6 hours

Creativity, Times When Are Creative, Ways in Which You Can Be Creative, Developing Your

Creativity, Factors that Blocks Creativity, Mind-Mapping: The Networking of Ideas, Mind Mapping and the Learning Process, Mind-Mapping: Do's and Don'ts

Reference Books:

1. Business Communication, 2nd Edition, Meenakshi Raman, Prakash Singh, OXFORD
2. Technical Communication – Principles and Practice, 2nd Edition, Meenakshi Raman, Sangeeta Sharma, OXFORD
3. Managing Soft Skills for Personality Development –edited by B.N.Ghosh, McGraw Hill India, 2012.
4. Effective Communication and Soft Skills, Nitin Bhatnagar, Pearson Education India, 2011
5. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.
6. English for Practical Purposes. N. Patil, B. S. Valke, Ashok Thorat, Zeenat Merchant
7. Business Communication, Urmila Rai and S.M. Rai
8. Personality Development and Communicative English, Dr. S.R. Pandya and Dr. Pratima Dave Shastri
9. Better English Pronunciation, J D O'Connor,
10. Oxford Guide to Effective Writing and Speaking, John Seely
11. 7 Habits of Highly effective People, Stephen Covey
12. Think and Growth, Napoleon Hill

Teaching-Learning Strategies in brief:

1. Build positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief:

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting group discussions.

4. By taking speeches/short presentations.

By taking semester examination.

Name of the Academic Program: Master of Computer Applications (MCA)
Course Code: MCA-107 **Title of the Course:** Object Oriented Programming Lab

L-T-P: 0-0-4
Credits: 2
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (CO)

CO1: Able to understand the concept of classand objects (Cognitive level: understand).

CO2: Able to implement various forms of inheritance(Cognitive level: Apply).

CO3: Able to use the constructors (Cognitive level: Apply).

CO4: Able to understand the concept of operator overloading (Cognitive level: Analyze).

CO5: Able to understand and use the generic functions and generic classes (Cognitive level: Analyze).

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	3	2	3	2	2	1	1	1	1	1	1	2	3	1	2
CO2	3		3	2	2		1	2			1	2	3	2	2
CO3	3		3	2	1		1						3	2	1
CO4	3		3	2	1		1						2	1	2
CO5	3		3	2	2	1	1	2			1	1	2	2	2

List of experiments

1. Write a C++ program by using the concept of class and objects to perform the following operations:
   (i) Input a number into a data member (**num**)of the class
   (ii) Check whether **num** is prime or not?
   (iii) Print the reverse of **num**
   (iv) Print the sum and average of all the digits of **num**

2. Write a C++ program by using the concept of class and objects. Create an array **Ar** of size ten. Perform the following operations on **Ar**:
   (i) Insert the elements in **Ar**
   (ii) Search a particular element in **Ar**
   (iii) find the maximum and minimum values of **Ar**
   (iv) display the sum and average of the elements of **Ar**
   (v) sort the elements of **Ar** in ascending and descending orders respectively

3. Write a C++ program to implement a class **Student** to display names, roll numbers, and grades of three students who have appeared in the examination. Create an array of class objects. Read and display the contents of the array.

4. Consider the following four classes: **Student, Marks, Sports, and Result**. **Marks** derived from **Student** by single level inheritance. **Result** is derived from both **Marks** and **Sports** by multiple inheritance. Write a C++ program to demonstrate the concept of **hybrid inheritance** as per the above conditions.

5. Given that an EMPLOYEE class contains following members:
data members: Employee number, Employee name, Basic, DA, IT, and Net Salary. Write a C++ program to read the data of N employee and compute Net salary of each employee. (DA=50% of Basic and Income Tax (IT) =25% of the Net salary).

6. Create a class **Book** with data members book_no, book_name and member function getdata() andputdata(). Create a class **Author** with data members author_name, publisher and membersgetdata() and showdata(). Create an another class **Detail** with data members no_of_pages and year_of_publication. Derive **Detail** from **Book** and **Publisher.** Display all the information by using the array of objects of class **Detail**.

7. Create a class **Shape**with the following members:
Data members: length, breadth, height
Member functions: vol, comparison
Create two objects of **Shape** named **S1** and **S2**. Compare these objects by using ***this pointer***. Kindly assign the values to the data members through the constructor.

8. Write a C++ program to demonstrate the following concepts:
   (i) Binary operator overloading by using + and – operators
   (ii) Unary operator overloading by using - operator

9. Write a C++ program to access the overridden function of the derive class by using the pointer of the base class.

10. Write a C++ program to demonstrate the following concepts:
   (i) Generic function/function template
   (ii) Generic class/class template

Teaching-Learning Strategies in brief

1. Build positive environment in the Lab.
2. Provide concrete basic and advanced knowledge of the subject.
3. Encourage to the students to ask more & more questions.
4. Motivate to the students to develop critical & strategic thinking.

Assessment methods and weightages in brief

1. By giving assignments.
2. By conducting quizzes.
3. By conducting viva.
4. By taking semester examination.
5. Internal assessment (40 Marks) & Semester Examination (60 marks) &Total Marks-100.

Program: MCA (Database Management System lab)

Course Code: MCA 108 Title of the Course: (Database Management System lab)

L-T-P: 0-0-2

Credits: 1
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (CO)

After the completion of the course, student will be able to do the following

CO1 To understand and learn how to use DBMS/SQL resources and to use additional DBMS/SQL commands for various purposes.

CO2 To understand, learn and implement organizing and managing files within the DBMS/SQL lab system.

CO3 To learn how to use the tables and be able to add records, delete records, search records and arrange records.

CO4 To learn how to use the tables and be able to add keys to the database.

CO5 To understand, learn and implement the Front end and back end code using SQL and PL/SQL.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PS O 1**	**PS O2**	**PS O3**
CO1	1	1	-	-	-	-	2	1	2	1	2	1	1	1	2
CO2	-	1	3	-	2	-	2	1	-	1	2	1	2	2	2
CO3	1	1	3	1	-	1	-	2	1	2	-	1	3	2	3
CO4	-	1	-	-	1	-	1	-	-	-	1	-	1	1	2
CO5	1	-	3	-	-	1	1	1	1	2	-	1	1	2	3

List of experiments

1. Write SQL code to create a **Student**table and insert 8-10 records into the database.
2. Using the **Student**table**,** retrieve the records and display on the screen. Next display all the students from Delhi.

3. Using the **Student**table**, insert primary and foreign key** into the table**.** Insert new records and retrieve them for particular key elements.
4. Write SQL code to create**Employee**table and insert 8-10 records into the database.
5. Using the **Employee**table**,** retrieve the records and display on the screen. Next display all the employees from having salary greater than 75,000 rupees.
6. Using the **Employee** table**, insert primary and foreign key** into the table**.** Insert new records and retrieve them for particular key elements.
7. Using SQL, create a view of the **Student** table. Insert records into Student table using the view.
8. Using SQL, create a view of the **Employee** table. Insert records into the table using the view.
9. Write PL/SQL code to print a welcome message to the user.
10. Write PL/SQL code to create a table and enter records into the table.

Internal assessment (40 Marks) & Semester Examination (60 marks) &Total Marks-100.

Name of the Academic Program : MCA

Course Code: MCA 201

Title of the Course: Mathematical Foundations for Computer Applications

L-T-P:3-1-0(L=Lecture hours, T=Tutorial hours, P=Practical hours) **Credits**:-04

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to -

CO-1 Understand the matrix algebra in order to solve examples based on rank, different kinds of matrices and examples based on real world data.(Cognitive Level-Evaluate)

CO-2 Learn to describe and manipulate sets and to develop techniques for the construction of new sets from given sets. (Cognitive Level-Develop)

CO-3 Understand and solve examples based on countings . (Cognitive Level-Understand)

CO-4 Discuss and understand logic concepts that are useful in computer science. (Cognitive Level-Analyze)

CO-5 Understand topics of a graph theory which have wide application in mathematical situations. (Cognitive Level-Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	1	1	1	2	1	1	1	1	1		1	1
CO2	1	1	2	1	1	1	3	1	2	1	2	1	1	2	
CO3	1	1	1	1	3	1	1	1	2	1	2	1	2	1	2
CO4	1	1	1	2	1	1	1	1	1	3	1	1	1	2	1
CO5	3	1	1	1	1	1	3	1	2	1	1	1	1	1	

Detailed Syllabus:

UNIT 1: Matrix Algebra (10 Hours)

Rank of a Matrix, Solution of equations by Matrix Method, Symmetric, skew-symmetric and orthogonal matrices, Eigen values and Eigen vectors, Cayley Hamilton Theorem.

UNIT 2: Basic Set Theory (9 Hours)

Basic definitions, set operations, Venn Diagram, Cartesian Products, Domain and Range of Relation, Inverse Relation, Reflexive, Types of Relations: Symmetric, Asymmetric, Anti-symmetric,Transitive, Equivalence Relation, Partition, Types of functions, Inverse function, Composition of functions.

UNIT 3: Counting Techniques (9 Hours)

Inclusion and Exclusion Principal, Pigeon-hole Principle, Permutation and Combination.

UNIT 4: Mathematical Logic (9 Hours)

Propositions and Logical operators, Truth tables, Preposition generated by a set, Propositional Equivalence, Logical Equivalence, Algebra of Propositions, Predicates, Quantifiers.

UNIT 5:Graph Theory (11 Hours)

Basic definitions, Types of graph, Path, Simple Path, Trail, Closed Path, Cycle, Complementary Graph, Subgraphs, Spanning Subgraph, Isomorphism Graph, Homeomorphic Graph, Connected and Disconnected Graph, Complete Graph, Labeled Graph, Regular Graph ,Bipartite Graph, Eulerian and Hamiltonian Path ,Circuit and Graph, Planar and Non Planer Graph.

Reference books:

1.David Makinson,Sets, Logic and Maths for computing,Springer Indian Reprint 2011.
2. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.
3. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill,4th Edition 2002.
J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and Its Application to Computer Science", TMG Edition, Tata McGraw-Hill
4. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
5. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
6. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9 th Edition, Pearson, Reprint, 2002.

Teaching-Learning Strategies in brief

1. Build positive environment in the classroom.
2. Provide concrete basic and advanced knowledge of the subject.
3. Solve problems based on the basic & advanced concepts of the subject.
4. Encourage to the students to ask more & more questions.
5. Motivate to the students to develop critical & strategic thinking

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By conducting class tests.
4. By taking semester examination.

5. Internal assessment (40 Marks) & Semester Examination (60 marks) &Total Marks-100.

Name of the Academic Program: MCA

Course Code: MCA 202 Title of the Course: - Data Structures

L-T-P……3-0-0……. Credits……4……

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcomes (CO)

CO-1: Understand the basic Data Structure Concepts. (Cognitive level: Understand)
CO-2: To analyze the role of data structures in structuring and manipulating data and implementthem (Cognitive level: Analyze)
CO-3: Be acquainted with operations of Arrays, Linked List, Stacks, and Queues (Cognitive level: Apply)
CO-4: Implement the various Searching and Sorting Techniques (Cognitive level: Create)
CO-5: Be acquainted with operations of Trees and Graphs (Cognitive level: Evaluate)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	PO 6	**PO7**	PO 8	PO 9	PO 10	PO 11	PO 12	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	1	1	3	1	1	1	1	1	2	1	1
CO2	3	3	2	2	2	1	3	-	-	-	-	-	3	3	-
CO3	3	2	3	2	2	1	3	-	-	-	-	-	3	2	-
CO4	3	2	3	2	1	1	3	-	-	-	-	-	3	2	-
CO5	3	2	3	3	2	1	3	-	-	-	-	-	3	2	-

Detailed Syllabus:

Unit – I *9 hours*

Arrays and Linked Lists: Storage structures for arrays, matrix, row-major, column-major, Sparse matrices. Linked list, Doubly linked lists, Circular linked

Unit – II *9 hours*

Stack and Queue: Stacks and queues: insertion, deletion, Stack and queue using linked list, Circular queue, Prefix, postfix, infix notation and conversions.

Unit – III *11 hours*

Trees: Binary tree insertion, deletion, traversal (inorder, preorder and postorder), Binary Search Tree, Threaded binary tree, AVL tree, B-tree, B+-tree.

Unit – IV *9 hours*

Sorting and Searching: Selection sort, Insertion sort, Bubble sort, Merge Sort, Heap sort, and Quick sort, sorting in linear time, Hash Tables.

Unit – V *11 hours*

Graphs: Representation of Graphs, Breadth First Search, Depth First Search, Topological Sort, Strongly Connected Components, Algorithm for Kruskal's and Prim's for Finding Minimum cost Spanning Trees, Dijkstra's Algorithm for finding Single source shortest paths.

TEXT BOOKS·

1.Seymour Lipschutz, "Data Structures with C", Schaum's Outline Series,·LangsamYedidyah, Augenstein J Moshe, Tenenbaum M, "Data Structures using C and C++", PHI

REFERENCE BOOKS·

1.Horowitz, Sahni, Freed, "Fundamentals of Data Structures in C", Silicon Press· Kruse R., "Data Structures and Program Design in C", Pearson Education India

Teaching-Learning Strategies in brief

1. Learning by doing
2. Open ended questions by teacher
3. Open ended questions from students
4. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. Projects on various topics of subject;
2. Problem based assignments;
3. Practical assignment laboratory reports;
4. Observation of practical skills;
5. Time-constrained examinations;
6. Internal assessment (40 marks) & Semester Examination (60 marks) &Total Marks-100.

Name of the Academic Program : MCA

Course Code: MCA 203 **Title of the Course: JAVA PROGRAMMING**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

CO1. To identify and apply the scope and need of Java Programming (Cognitive level : Apply)
CO2. To develop ability to understand various algorithms based on Java Programming. (Cognitive level : Understand)
CO3. To apply the best coding effectively practices and to identify and use the language specific feature available us a library function. (Cognitive level : Apply)
CO4. To understand the design of Java applications based on Object Oriented Programming Principles. (Cognitive level : Create)
CO5.To learn why unit testing is part of developer role and apply it in java (Cognitive level : Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO12	PSO 1	PSO 2	PSO 3
CO 1					2		3			1		2		1
CO 2				1		1	2	2						
CO 3	3	2			2			1	2	1		3	2	1
CO 4			3			2					1			3
CO 5	2				2		3					1	2	2

Detailed Syllabus:

Unit – I Java Basics 10 Hours

Java and Internet, Difference between C++ and Java, Byte code and platform independence, Features of Java, Java Standard Edition (Java SE), Java Runtime Environment (JRE), Java Just In Time (JIT) Compiler, Installing JDK, Compiling and executing Java Application, Java Program Structure, Java Keywords, Data types, Variables, Arrays, Expressions, Operators, Control Statements, for each statement, Command Line Arguments.

Unit – II Object-Oriented Programming – I 10 Hours

Class and Encapsulation, Objects, Methods, Default and parameterized Constructors, Inheritance, super and this Keywords, Static Methods, Polymorphism, Overloading, Overriding, Dynamic Method Dispatch.

Unit – III Object-Oriented Programming – II 10 Hours

Abstract class, final Keyword, Interface and Multiple Inheritance, Package, Creating Package, Using Imports, static import, Access Controls, public, private, protected and default Control, Using Scanner Class for Formatted Input, Universal Superclass Object, toString() Method, Variable Argument List.

Unit – I String, Exception handling and Multithreading 10 Hours

String, Methods of String, StringBuffer and StringBuilder, Exception, try and catch Statement, Multiple catch Statements, Nested try Statement, throw, throws and finally Statements, Creating Exception Subclasses, Thread, Advantages of Thread, Creating Threads by Extending Thread Class and Implementing Runnable Interface, Creating Multiple Threads, Life Cycle of a Thread, Thread Priorities, Thread Synchronization.

Unit – V Unit Testing in Java 10 Hours

Introduction, Unit Testing meaning, Terminology, Why developers do unit testing Unit Testing with Junit, Installation of Junit and integration to the IDE, JUnit APIs,
Test Cases, Assert, TestRunner, TestSuite, Preparation, Create a Java class, Create a JUnit test for that class, Running your test cases.

TEXT BOOKS

- *Herbert Schildt, Java: The Complete Reference, Seventh Edition, DEC-06, ISBN: 9780072263855*
- *Joel Murach and Andrea Steelman, Murach's Java SE 6, ISBN-10: 1-890774-42-1; ISBN-13: 978-1-890774-42-4*

REFERENCE BOOKS

- *Katherine Sierra, Kathy Sierra, Bert Bates, SCJP Sun Certified Programmer for Java 6 Study Guide: Exam (310-065), McGraw-Hill Companies, June 2008, ISBN-13: 9780071591065*
- *Jeff Friesen, Beginning Java SE 6 Platform: From Novice to Professional, Apress*
- *Deital and Deital, Java How to Program, 8/e, Prentice Hall, 03/17/2009, ISBN: 0136123716*
- *Khalid Mughal, Rolf Rasmussen, A Programmer's Guide to Java SCJP Certification: A Comprehensive Primer, 3/e, ISBN: 0321556054*

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. With theoretical aspects explained for each topic, a live code demo is given in the class to make students understand the practical aspect of it in the class itself.
2. Demonstrate the common error that they might encounter while developing code on day-to-day basis. Revisit logical bugs with the demonstration and discussion through unit testing while teaching Unit V

3. The teaching strategy should also be intended to take the students to the next level of the best java coding conventions and practices.
4. Frequent interaction during classroom teaching to access understanding of students.

Assessment methods and weightages in brief (4 to 5 sentences)

1. Assessment will be carried out as internal assessment with weightage of 25 % based on sessional, assignment, quizzes and presentations.
2. External assessment will have weightage of 75 % based final exam.
3. Internal assessment (40 marks) & Semester Examination (60 marks) &Total Marks-100

Name of the Academic Program MCA

Course Code: MCA-204 Title of the Course: Operating System

L-T-P…4-0-0…….

Credits……4……

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to …….

CO1: Familiarize with the fundamental concepts of operating systems. (Remember)

CO2: Understand relation between various applications and operating system (Understand)

CO3: Understands the structure of directory and file systems.(Understand)

CO4: Understands how memory management among various memories occur in OS. (Analyse)

CO5: Understands the various terminologies and interaction of OS with other subjects of computers. (evaluate)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1				1	1		1				1	1	1
CO2				2	2			1			1	1			1
CO3			2		2		1			1				1	
CO4	3	3	2	2	2						1				2
CO5	2			1		1		2	2	1		3	2		

Detailed Syllabus:

Unit 1: Computer System Overview **8 Hours**

Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System, Layered Approach, Introduction to Virtual Machines.

Unit 2: Process **10 Hours**

State, Process Control Block, Process Scheduling, Operation on processes, Cooperating Processes, Threads.

Unit 3: Principles of Concurrency **10 Hours**

Mutual Exclusion, Semaphores, Monitors, Readers/Writers problem. Deadlocks-prevention-avoidance-detection, Scheduling- Basic Concepts of Scheduling, types of scheduling algorithms.

Unit 4: Memory management **10 Hours**

Requirements, swapping, memory allocation, Partitioning, Paging and Segmentation, Virtual memory - Demand Paging; Page Replacement algorithm.

Unit 5: I/O management and disk scheduling **10 Hours**

I/O devices, organization of I/O functions; OS design issues, I/O buffering, disk scheduling, Disk cache. File management – Organization, Directories, File sharing, and Record blocking, secondary storage management.

Reference Books:

1. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley
2. Andrew S. Tanenbaum, “Modern Operating System”, PHI Learning
3. Tanenbaum /Woodhaull “Operating System Design and Implementation”, Pearson Publication.
4. Harvey M Dietel, “ An Introduction to Operating System”, Pearson Education.
5. Achyut S Godbole, Atul kahate , “Operating System”, McGraw Hill.

Teaching-Learning Strategies in brief

1. Learning by doing
2. Open ended questions by teacher
3. Open ended questions from students
4. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. Projects on various topics of subject;
2. Problem based assignments;
3. Practical assignment laboratory reports;
4. Observation of practical skills;
5. Time-constrained examinations;
6. Internal assessment (40 marks) & Semester Examination (60 marks) &Total Marks-100.

Name of the Academic Program MCA

Course Code: MCA-205 Title of the Course: Data Structure Lab

L-T-P…0-0-4…….

Credits……2……

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

CO1: Able to design and implement All the basic linear and non-linear data structures. (Cognitive level: Create)
CO2: Searching and sorting are emphasised using all basic data structure. (Cognitive level: Apply)
CO3: Able to implement All Zig Zag Rotations in splay Tree Algorithms. (Cognitive level: Apply)
CO4: To learn efficient use of Hash Tables. (Cognitive level: Remember)
CO5: Able to implement all search related Algorithms. (Cognitive level: Apply)

MAPPING OF COURSE OUTCOME WITH PROGRAM OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	3	2	1	2	2	3	2	1	1		3
CO2	3	2	2	2	2	2	1	3	3	2	1	3		2	2
CO3	2	2	1	3	1	3	2	1	2	2	3	2	1	2	2
CO4	-	2	2	3	3	3	3	1	2	3	2	3	1		1
CO5	-	-	2	1	4	2	1	1	2	3	1	2	2	2	1

Program
1. Implementation of Traversal, Insertion, Deletion, Searching, Sorting in Linked list. 2. Implementation of stacks (PUSH, POP,SEARCH and SORT)

3. Implementation of Queues (Enque, Deque, Search and Sort)
4. Efficiently Updating, deletion and creation of a hash table.
5. Implement deletion and creation of a hash table.
6. Implementation of binary search Tree.
7. Implementation of Height Balanced Tree.
8. Calculation of balance factor in AVL Tree
9. Implementation of Red- Black Trees.
10. Implementation of Splay Tree.

TEACHING LEARNING STRATEGIES IN BRIEF

1. BUILT CONFORTABLE ENVIRONMENT FOR INTRACTION WITH TEACHER
2. BRIEF THE TOPIC OF THE LAB FOR PERTICULAR SESSION
3. To develop critical and strategical thinking.
4. Encourage mutual exchange of thought process and team work.

ASSESMENT METHOD AND WEIGHTAGES IN BRIEF

Ask questions while interaction.

Quiz

Puzzles

Internal Assessment (40)

External Assessment (60)

Name of the Academic Program : Masters of Computer Applications (MCA)

Course Code: MCA 206 **Title of the Course:** Java Programming Lab **L-T-P: 0-0-2** **Credits: 2**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

CO1. To identify and apply the scope and need of Java Programming (Cognitive level : Apply)
CO2. To develop ability to understand various algorithms based on Java Programming. (Cognitive level : Understand)
CO3. To apply the best coding effectively practices and to identify and use the language specific feature available us a library function. (Cognitive level : Apply)
CO4. To understand the design of Java applications based on Object Oriented Programming Principles. (Cognitive level : Create)
CO5. To learn why unit testing is part of developer role and apply it in java (Cognitive level : Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO12
CO1					2		3			1	
CO2			3			1	2	2			1
CO3	3	2			2			1	2	1	
CO4			3			2			3		
CO5	2	1			2		3				1

Mapping of Course Outcomes (COs) Program Specific Outcomes (PSOs)

	PSO1	PSO2	PSO3
CO1	1		1
CO2		3	
CO3	3	2	1
CO4		1	3
CO5	1	2	2

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write ‘3’ in the box for ‘High-level’mapping, 2 for ‘Medium-level’mapping, 1 for ‘Low’-level’mapping.

List of experiments

Q1. Write a program to implement final keyword in a class or a method.

Q2. Write a program to compare two strings by using equals() method .

Q 3. Write a program to to use toString() method.

Q 4. Write a program to implement the concept of multiple inheritance.

Q 5. Write a program to implement the concept of Abstract keyword within a class or method.

Q 6. Write a program of Interface and implement it on a child class.

Q 7. Write a program using Abstract class, Concrete classs and Super class.

Q 8. Write a program to make the object and class. Also use getter setter in it.

Q 9.Write a program to implement the concept of constructor with parameterise and default constructor.

Q 10. Write a program to implement OverRiding in java.

Q 11. Write a program to Overloading the Constructor in java.

Q 12. Write a program to implement the This() as well as Super() method.

Q 13. Write a program to follow the concept of Pure Dynamic Binding or Dynamic Method Dispatching.

Q 14. Write a program to implement the concept of Public and Private within some Methods and Classes.

Q 15. Write a program to create a class of “Shape,Triangle, Circle, and rectangle” then inherit all the property of “Triangle, Circle, and rectangle” in Shape Class and Execute in Main class to find their AREA and Radius of circle.

Q 16. Write a program to create a Class 3D and define the default Coordinate

(X1,Y1

,Z1

)=0, and set another Coordinate (X2,Y2 Z2

)= 6,5,3.

And execute Class 3D in Main class.

Q17. Code a class called **circle** which should contain:
Two private instance variables: radius (of the type double) and color (of the type String), with default value of 1.0 and "red", respectively.
Two *overloaded* constructors - a *default* constructor with no argument, and a constructor which takes a double argument for radius.
Two public methods: getRadius() and getArea(), which return the radius and area of this instance, respectively.
write a *test program* called `TestCircle.`
`Q18. Code a` class called Author to model a book's author. It should contain:
Three private instance variables: name (String), email (String), and gender (char);
public getters/setters
A toString() method that returns "Author[name=?,email=?,gender=?]". Note - ? to be replaced with values.
Write the Author class. Also write a *test driver* called TestAuthor to test all the public methods

Teaching-Learning Strategies in brief

1. Build positive environment in the Lab.
2. Provide concrete basic and advanced knowledge of the subject.
3. Encourage to the students to ask more & more questions.
4. Motivate to the students to develop critical & strategic thinking.

Assessment methods and weight ages in brief

1. By giving assignments.
2. By conducting quizzes.
3. By conducting viva.
4. By taking semester examination.

Internal assessment (40 marks) & Semester Examination (60 marks) &Total Marks-100

Name of the Academic Program : MCA

Course Code: MCA PE111 **Title of the Course: Artificial Intelligence**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcomes

CO1: To help students understand historical perspective of AI and its foundations. (Cognitive level: Understand)

CO2: To help students apply Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning. (Cognitive level: Apply)

CO3: Analyze applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models. (Cognitive level: Analyze)

CO4: Evaluate and Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis. (Cognitive level: Evaluate)

CO5: Create and Explore the current scope, potential, limitations, and implications of intelligent systems. (Cognitive level: Apply)

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3		2	2	1	1	1	1	1	1
CO2	3	3	3	3	3	3	2	2	2	2	1	1	2	1	1
CO3	3	3	3	3	3	3			2	1		1	1		1
CO4	3	3	3	3	3	3	2	2			1	1		1	1
CO5	3	3	3	3	3	3	2	2	1			2			2

UNIT-I: Introduction to artificial intelligence: 9 hours

Introduction , history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI, Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction.

UNIT-II: Problem reduction and game playing: 9 hours

Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games, Logic concepts: Introduction, propositional calculus, proportional logic,

natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.

UNIT-III: Knowledge representation: 9 hours

Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames, advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web, Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.

UNIT-IV: Uncertainty measure: Probability theory: 9 hours

Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory, Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

UNIT-V: Machine learning paradigms: 9 hours

Introduction, machine learning systems, supervised and unsupervised learnings, inductive learning, deductive learning, clustering, support vector machines, case based reasoning and learning, Artificial neural networks: Introduction, artificial networks, single layer feed forward networks, multi layered forward networks, design issues of artificial neural networks.

Readings

1. A.M. Andrew, Artificial Intelligence. Kent: Abacus Press, 1983.

2. R., Grishman, Computational Linguistics, Cambridge: Cambridge University Press, 1986.

3. G. Keith, and M. Glover, Primary Language Learning with Microcomputers. London: Croom Helm, 1987. 23

4. S. Nirenburg, (ed) Machine Translation: I Theoretical and Methodological Issues. Cambridge, Cambridge University Press, 1987.

5. W.A. Sedlow, and S.Y. Sedlow, (eds.) Computer in Language Research, Hillsdale: N.S. Lawrence Erlbawn, 1979.

TEACHING - LEARNING STRATEGIES
1. BLENDED LEARNING
2. BRAINSTORMING
3. CASE STUDY
4. COMPUTER AIDED PRESENTATION
5. COMPUTER LABS/LAPTOP INSTRUCTION
6. DEMONSTRATION
7. DIRECT INSTRUCTION
8. DISCOVERY LEARNING
9. DISCUSSION
10. DRILL AND PRACTICE

11. EXAMINATION
12. FLIPPED CLASS
13. FULLY ONLINE INSTRUCTION
14. GROUP ACTIVITIES
15. INQUIRY
16. LECTURE
17. MENTAL MODELING
18. MOOC ONLINE
19. PROJECT DEVELOPMENT
20. PROJECT PRESENTATION
21. QUESTION AND ANSWER
22. ROLE PLAY
23. SELF-LEARNING
24. SEMINAR
25. TUTORIAL
26. WEB-ENHANCED LEARNING

Assessment methods and weightages in brief

1. Internal Assessment: 40
2. Semester Exam: 60
   Assessments through Sessional, Assignments, Quizzes etc.

Name of the Academic Program : MCA

Course Code: MCA PE112 **Title of the Course: Web Technology**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES:

Upon completion of this course, students will be able to:
CO 1. Create web pages using PHP (Cognitive level: create)
CO 2. Design web application using MVC architecture (Cognitive level: create)
CO 3. Identify the engineering structural design of XML and parse tree (Cognitive level: apply)
CO 4. Analyze the difference between and PHP and XML. (Cognitive level: Analyze)
CO 5. Understand the concept of JAVA SCRIPTS. (Cognitive level: Understand)
CO 6. Identify the difference between the JSP and Servlet. (Cognitive level: apply)
CO 7. Apply JDBC and ODBC technologies to create database connectivity (Cognitive level: apply)

Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	2	-	3	1	-	-	-	3	-	-	1
CO 2	3	3	3	3	2	-	3	1	-	1	-	3	1	-	-
CO 3	3	3	3	3	2	-	3	1	-	-	1	3	-	1	-
CO 4	3	3	3	3	2	-	3	1	-	-	-	3	-	-	-
CO 5	3	3	3	3	2	-	3	1	-	-	-	3	-	-	-

Unit – I 9 hours

INTRODUCTION: Introduction to Multimedia, Multimedia Information, Multimedia Objects, Multimedia in business and work. Convergence of Computer, Communication and Entertainment Products ,Stages of Multimedia Projects: Multimedia hardware, Memory & storage devices, Communication devices, Multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Unit – II 9 hours

MULTIMEDIA BUILDING BLOCKS: Text, Sound MIDI, Digital Audio, audio file formats, MIDI under windows environment Audio & Video Capture.

Unit – III 10 hours

EMERGENCE OF THE INTERNET: Terminology, Accessibility: Language & Connectivity, Services of the Internet: E-Mail, World Wide Web (WWW), Remote Access, Collaboration, File Sharing, Internet Telephony; Use & Culture: Usenet, From gopher to WWW, Search Engines: Wais, Archie, Web Search Engine.

Unit – IV 10 hours

INTRODUCTION AND WEB DEVELOPMENT STRATEGIES: History of Web, Protocols governing Web, Creating Websites for individual and Corporate World, Cyber Laws, Web Applications, Writing Web Projects, Identification of Objects, Target Users, Web Team, Planning and Process Development.

Unit – V 10 hours

CONCEPTS OF WEB PROGRAMMING: Developing Web using HTML, DHTML, CSS, XML, Using Scripting Languages such as JavaScript.

TEXTBOOKS

- *Tay Vaughan, Multimedia, Making IT Work, MGH*
- *Rajkamal, Web Technology, TMH, 2001*..

REFERENCE BOOKS

1. *David Hillman, Multimedia technology and Applications, Galgotia Publications.*
2. *Rosch, Multimedia Bible, Sams Publishing.*
3. *Stephen Holzner, HTML Black Book , Wiley Dreamtech.*
4. *Deitel & Deitel, Goldberg, Internet and world wide web – How to Program, Pearson Education.*

Teaching-Learning Strategies in brief

1. Learning by doing
2. Open ended questions by teacher
3. Open ended questions from students
4. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. Projects on various topics of subject;
2. Problem based assignments;
3. Practical assignment laboratory reports;
4. Observation of practical skills;
5. Time-constrained examinations;
6. Internal assessment (40 marks) & Semester Examination (60 marks) &Total Marks-100.

Name of the Academic Program - Master of Computer Applications (MCA)

Course Code: MCA PE 113 **Title of the Course: Software testing and Quality Assurance**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to-

CO-1: Understand and demonstrate knowledge related to the basic concepts of security in networking and data transmission. *(Cognitive level: Understand)*

CO-2: Apply different mathematical concepts related to cryptography. *(Cognitive level: Apply)*

CO-3: Apply and evaluate different cryptographic techniques. *(Cognitive level: Evaluate)*

CO-4: Apply and evaluate different network security protocols. *(Cognitive level: Evaluate)*

CO-5: Demonstrate knowledge and apply mechanisms related to network security, internet security and information security. *(Cognitive level: Create)*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	3	-	-	-	1	1	3	3	1
CO2	3	3	3	3	3	-	3	-	-	-	1	1	2	3	2
CO3	3	3	3	3	3	-	3	1	-	-	1	1	2	3	2
CO4	3	3	3	3	3	-	3	1	-	-	1	1	3	3	3
CO5	3	3	3	3	3	1	3	1	1	1	1	2	3	3	3

Detailed Syllabus:

Unit 1: *9 hours*

Security Objectives, Security Mechanisms, Security Services, Network security model, Threats, Vulnerabilities, Attacks, Foundations of Cryptography, Steganography, Classical Cryptographic Techniques, Substitution Ciphers and Transposition Ciphers, Simple XOR, One-Time Pads, Block Ciphers and DES.

Unit 2: 10 *hours*

Mathematical Background, Random Numbers, Random Number Generators Types and Properties, Information Theory, Groups, Rings, Fields, Modular arithmetic, Euclid's algorithm, Finite fields, Polynomial, Prime numbers, Fermat's and Euler's theorem, Testing for primality, Chinese Remainder theorem, Discrete logarithms .

Unit 3: *9 hours*

Advance Encryption Standard (AES), Triple DES, Blowfish, RC5 algorithm, Message authentication functions, Hash functions, Hash Algorithms, MD5, Secure Hash Algorithm (SHA), Principles of Public-Key cryptosystems, RSA algorithm, Diffie -Hellman, Elgamal Cryptosystem, Public-Key Digital Signature Algorithm Standard.

Unit 4: *9 hours*

Key Exchange, Key Management and Distribution Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure, User Authentication Protocols Remote User Authentication Principles, Remote User Authentication Using Symmetric & Asymmetric Encryption, Kerberos.

Unit 5: 11 *hours*

Network & Internet Security, IP Security, Electronic Mail Security, Privacy Enhanced Mail (PEM), Pretty Good Privacy (PGP), Public-Key Cryptography Standards (PKCS), Web Security, System Security, Firewalls, IDS, IPS, Standards and Governing Bodies (National Security Agency (NSA), National Institute of Standards and Technology (NIST).

Reference Books:

1. William Stallings, "Cryptography and Network Security", Prentice Hall, 4th Edition
2. Alfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone, "Handbook Of Applied Cryptography" , CRC Press, 5th Edition
3. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a Public World, Pearson, 2nd Edition

Teaching-Learning Strategies in brief

1. Providing examples, real life scenarios etc through online references, animation, slide show and video
2. Making groups for peer to peer learning and enabling discussions for motivating coordination and team-player skills
3. Giving them tutorials and topic based presentations for gaining more insights
4. Motivating them for research and product based learning

Assessment methods and weightages in brief

1. Assessing different groups through presentation and oral questionnaires
2. Assessing through quizzes for better objective evaluation
3. Assessing through sessionals and assignment submission apart from semester examination
4. Weightage is given on sincerety, punctuality, timely submissions, improvisations etc.
5. Internal assessment (40 marks) & Semester Examination (60 marks) &Total Marks-100.

Name of the Academic Program - Master of Computer Applications (MCA)

Course Code: MCA PE221 **Title of the Course: Data Science and Analytics**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcome

CO1: Understand the fundamental concepts of data science. (Cognitive level: Understand)
CO2: Evaluate the data analysis techniques for applications handling large data. (Cognitive level: Evaluate)
CO3: Demonstrate the various machine learning algorithms used in data science process. (Cognitive level: Apply)
CO4: Understand the ethical practices of data science. (Cognitive level: Understand)
CO4: Apply and Visualize and present the inference using various tools. (Cognitive level: Apply)
CO5: Create and Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making. (Cognitive level: create)

Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	3	3	3		2	2	1	1	1	1	1	1
CO 2	3	3	3	3	3	3	2	2	2	2	1	1	2	1	1
CO 3	3	3	3	3	3				2	1		1	1		3
CO 4	3	3	3		3	3	2	2			1	1		1	1
CO 5	3	3		3	3	3	2	2	1			2			2

Unit-1 INTRODUCTION TO DATA SCIENCE

Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Data Scientist - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation.

Unit-2 BIG DATA AND ANALYTICS

Problems when handling large data – General techniques for handling large data through data analytics – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study.

Unit-3 MACHINE LEARNING

Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms.

Unit-4 DEEP LEARNING

Introduction – Deep Feedforward Networks – Regularization – Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning.

Unit-5 DATA VISUALIZATIONETHICS AND RECENT TRENDS

Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js-summary. Data Science Ethics – Doing good data science – Owners of the data - Valuing different aspects of privacy - Getting informed consent - The Five Cs – Diversity – Inclusion – Future Trends.

Text Books and Reference Books:

[1]. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016

[2]. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013

[3]. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 1st edition, 2016

[4]. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018

Essential Reading / Recommended Reading

[1]. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 1st edition, 2015

[2]. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013

[3]. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014.

TEACHING - LEARNING STRATEGIES
1. BLENDED LEARNING
2. BRAINSTORMING
3. CASE STUDY
4. COMPUTER AIDED PRESENTATION
5. COMPUTER LABS/LAPTOP INSTRUCTION
6. DEMONSTRATION
7. DIRECT INSTRUCTION
8. DISCOVERY LEARNING
9. DISCUSSION
10. DRILL AND PRACTICE

11. EXAMINATION
12. FLIPPED CLASS
13. FULLY ONLINE INSTRUCTION
14. GROUP ACTIVITIES
15. INQUIRY
16. LECTURE
17. MENTAL MODELING
18. MOOC ONLINE
19. PROJECT DEVELOPMENT
20. PROJECT PRESENTATION
21. QUESTION AND ANSWER
22. ROLE PLAY
23. SELF-LEARNING
24. SEMINAR
25. TUTORIAL
26. WEB-ENHANCED LEARNING

Assessment methods and weightages in brief

1. Internal Assessment: 40
2. Semester Exam: 60
   Assessments through Sessional, Assignments, Quizzes etc.

Name of the Academic Program - Master of Computer Applications (MCA)

Course Code: MCA PE222 **Title of the Course: Soft Computing**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcomes:

CO1. To Understand the concepts of Neural Networks. (Cognitive level: Understand)
CO2. Discuss the various neural network architectures.(Cognitive level: Analyze)
CO3. To Understand the concept of fuzzy logic.(Cognitive level: Understand)
CO4. To Discuss the concept of fuzzification and defuzzification.(Cognitive level: Evaluate)
CO5. Describe and understand the concept of Genetic algorithm.(Cognitive level: Understand)

CO-PO & PSO Mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	3	2	-	3	1	1	-	-	3	-	-	3
CO 2	3	3	3	3	2	-	3	1	-	-	-	3	-	-	3
CO 3	3	3	3	3	2	1	3	1	-	-	-	3	-	-	3
CO 4	3	3	3	3	2	-	3	1	-	-	1	3	-	1	3
CO 5	3	3	3	3	2	-	3	1	-	1	-	3	1	-	3

Unit-I: Introduction to Neural Networks 9 hours

Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

Unit-II: Neural Network Architectures 9 hours

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient; back propagation algorithm, factors affecting backpropagation training, applications.

Unit-III: Introduction to Fuzzy logic 9 hours

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV: Fuzzy Inference System 9 hours

Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications & Defuzzification, Fuzzy Controller, Industrial applications.

Unit-V: Genetic Algorithm (GA) 9 hours

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Text Books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.

Reference Books:

1. Siman Haykin,"Neural Netowrks"Prentice Hall of India
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
3. Kumar Satish, "Neural Networks" Tata Mc Graw Hill

Teaching-Learning Strategies in brief:

- Learning by doing
- Learning through discussion among the peer group
- Open ended questions by teacher
- Open ended questions from students
- Reflective Learning
- Provide relevant study material

Assessment methods and weightages in brief:

- time-constrained examinations
- closed-book class tests
- quiz
- problem based assignments
- sessional examinations
- semester examination
- practical assignments
- viva voce

Total Marks-100

- Internal assessment (40 marks)
- Semester Examination (60 marks)

Name of the Academic Program - Master of Computer Applications (MCA)

Course Code: MCA PE223 **Title of the Course:** Neural network and deep learning

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course outcomes:

CO1. Students must be aware of Artificial Intelligence and Neural Networks. (Cognitive level: Understand)
CO2. Student will have a broad understanding of Machine Learning. (Cognitive level: Understand)
CO3. Student will be capable of working with neural networks. (Cognitive level: Apply)
CO4. Student will have a broad understanding of Machine Learning. (Cognitive level: Understand)
CO5. The student will be able to work on the various deep learning tools and programming platforms to meet the market and research trending demands. (Cognitive level: create)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	3	3	3		2	2	1	1	1	1	1	-
CO 2	3	3	3	3	3	3	2	2	2	2	1	1	2	1	-
CO 3	3	3	3	3	3				2	1		1	1		-
CO 4	3	3	3		3	3	2	2			1	1		1	2
CO 5	3	3		3	3	3	2	2	1			2			2

UNIT - I: Introduction to Neural Network: 10 hours

Introduction to Artificial Intelligence & Neural Network: Definition, Biological Neuron, Analogy of Biological Neural Network and Artificial Neural Network, Mathematical definition of Neural Network, Model of ANN, Advantages and Benefits of ANN, Features of ANN, Types of activation function, Learning Rate, Synaptic Weights.

Neural Network Architecture: Single Layer Feed Forward NN, Multiple layer Feed Forward NN, Recurrent Neural Network.

UNIT – II: Introduction to Machine Learning: 10 hours

Machine Learning: Definition, types- supervised, unsupervised and reinforcement learning, and Learning process. Learning in ANN: Error Correction Learning, Hebbian Learning, Competitive Learning.

Introduction to Programming with R and python, Data preprocessing

Descending the Right Curve: Interpreting Learning as Optimization, Cost Functions.

Validating Machine Learning: Depicting Learning Curves, Training, testing and validation.

UNIT - III: Types of Neural Networks 10 hours

Single layer perceptron: Least Mean Square Algorithm, Multilayer perceptron: Backpropagation Algorithm, Radial-basis function network, Support Vector Machine, Principal Components Analysis, Self-Organized Maps.

UNIT - IV: Introduction to Deep Learning: 10 hours

Introducing Deep Learning, Machine learning principles, Basics of Deep Learning.

Moving towards Deep Learninsg: Benefits, Improving Processing Speed, Deep Learning vs other forms of AI, Find Smarter solutions, end to end learning.

Deep learning & Neural Network: Convolution Neural Networks, Recurrent Neural Networks

UNIT – V: Applications of Deep Learning 10 hours

Applications and fields requiring Deep Learning, Deep Learning tools.

Interacting with Deep Learning: Image Classification, Advanced CNN, Language Processing, Playing with Reinforcement Learning.

Reference Books:

1. Simon Haykins, Neural Networks – A comprehensive foundation, Prentice Hall, Pearson Education, 1999.

2. Jaun Paul Mueller, Luca Massaron, Machine Learning for Dummies(With R and python), John Wiley & Sons, 2016.

3. Jaun Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons, 2019.

4. S. N. Deepa, S.N. Sivanandam, Principles of Soft Computing, John Wiley & Sons, 2007

Teaching-Learning Strategies in brief:

- Learning by doing
- Learning through discussion among the peer group

- Open ended questions by teacher
- Open ended questions from students
- Reflective Learning
- Provide relevant study material

Assessment methods and weightages in brief:

- time-constrained examinations
- closed-book class tests
- quiz
- problem based assignments
- sessional examinations
- semester examination
- practical assignments
- viva voce

Total Marks-100

- Internal assessment (40 marks)
- Semester Examination (60 marks)

Name of the Academic Program: Master of Computer Applications

Course Code: MCA 301

Title of the Course: Formal Languages & Compiler Design

L-T-P: 3-1-0 **Credits**: 4

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to:

CO-1: Evaluate the basic concepts of formal languages and their application to Compiler Design.

(Cognitive level: Analyse)

CO-2: Develop a familiarity with fundamental principles of compiler design.
(Cognitive level: Understand)

CO-3: Demonstrate the process of translating a high-level language to executable code.
(Cognitive level: Apply)

CO-4: Analyze different parsing techniques and algorithms. (Cognitive level: Analyse)

CO-5: Generate intermediate code for statements in the high-level languages. (Cognitive level: Apply)

CO-6: Apply techniques for code optimization. (Cognitive level: Apply)

CO-7: Implement a complete compiler for a small programming language. (Cognitive level: Create)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3									1			2	2	
CO2		3											2		
CO3	3	2	2		2			1	1		1		3	3	
CO4	2													2	
CO5	2										1		2		
CO6	2	2	2						1				2		3
		3	3		3	1	2	1		1	1	3	3	3	3

CO7															

Detailed Syllabus:

Unit–I **10 Hours**

INTRODUCTION: Introduction to Translators (interpreter, compiler & cross-compiler), Phasesofcompilation andoverview,IntroductiontoGCC.

LEXICAL ANALYSIS (SCANNER): Regular language, finite automata, regular expression andtheir applications to lexical analysis, from regular expression to finite automata, Implementationoflexicalanalyzers,lexical-analyzergenerator,LEX-compiler,Formalgrammarsandtheirapplicationto syntaxanalysis,ambiguity,YACC.

Unit–II **10 Hours**

SYNTAXANALYSIS(PARSER): Context-freelanguageandgrammar

BASIC PARSING TECHNIQUES: Parsers, Top-down parsing, Shift reduce parsing, operatorgrammar,operatorprecedenceparsing,predictiveparsers.LL(1)grammar,LR(0),SLR(1),LR(1), LALR(1) grammars and Bottom-up parsing, ambiguity and LR parsing, LALR(1) parsergenerator(yacc,bison).

Unit–III **10 Hours**

SYNTAX-DIRECTED TRANSLATION: Syntax-directed Translation schemes, Implementation ofSyntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees,threeaddresscode,quadruple&triples,translationofassignmentstatements,Boolean expressions, statements that alter the flow of control, postfix translation, translation with a topdown parser.

Unit–IV **10 Hours**

SEMANTIC ANALYSIS: Attribute grammar, syntax directed definition, evaluation and flow ofattributein asyntaxtree.

SYMBOL TABLE: Data structure for symbols tables, representing scope information, symbolattributes and management. Run-time environment: Procedure activation, parameter passing,value return, memory allocation, and scope. Error Detection & Recovery: Lexical Phase errors,syntactic phaseerrorssemanticerrors.

Unit–V **10 Hours**

INTERMEDIATE CODE GENERATION: Translation of different language features, differenttypes ofintermediatecodes.

CODE IMPROVEMENT (OPTIMIZATION): Analysis: control-flow, data-flow dependence etc.,Codeimprovementlocaloptimization,globaloptimization,loopoptimization,peep-holeoptimization

TEXTBOOKS

- *Alfred V. Aho, Monica S. Lam, Ravi Sethi & Jeffrey D. Ullman, Compilers:*

Principles,Techniques, andTools,2nd edition,PrenticeHall,2006.

REFERENCEBOOKS

- *AllenI.Holub,CompilerDesigninC,PHI,2003.*
- *C. N.FischerandR. J. LeBlanc, CraftingacompilerwithC, BenjaminCummings,2003.*
- *J.P.Bennet,IntroductiontoCompilerTechniques,2nd Edition, TMH, 2003.*
- *Henk Alblas and Albert Nymeyer, Practice and Principles of Compiler Building with C,PHI,2001.*

Teaching-Learning Strategies in brief:

- Learning by doing
- Learning through discussion among the peer group
- Open ended questions by teacher
- Open ended questions from students
- Reflective Learning
- Provide relevant study material

Assessment methods and weightages in brief:

- time-constrained examinations
- closed-book class tests
- quiz
- problem based assignments
- sessional examinations
- semester examination
- practical assignments
- viva voce

Total Marks-100

- Internal assessment (40 marks)
- Semester Examination (60 marks)

Name of the Academic Program: Master of Computer Applications

Course Code: MCA 302 **Title of the Course:** Machine Learning

L-T-P: 3-1-0 **Credits**: 4

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcomes:

CO1. To learn the concept of how to identify patterns and concepts from data without being explicitly programmed in various IoT nodes. (Cognitive level: Analyze)
CO2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances. (Cognitive level: Analyze)
CO3. Explore supervised and unsupervised learning paradigms of machine learning. (Cognitive level: Evaluate)
CO4. To explore Deep learning technique and various feature extraction strategies. (Cognitive level: Understand)
CO5. To extend machine learning for higher understanding and implementation of neural network etc. (Cognitive level: Create)

Mapping CO-PO and PSO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	3	3	3		2	2	1	1	1	1	1	1
CO 2	3	3	3	3	3	3	2	2	2	2	1	1	2	1	1
CO 3	3	3	3	3	3				2	1		1	1		1
CO 4	3	3	3		3	3	2	2			1	1		1	1
CO 5	3	3		3	3	3	2	2	1			2			2

Unit wise Syllabus

Unit – I: Supervised Learning **10 hours**

Supervised Learning (Regression/Classification) - Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes - Linear models: Linear Regression, Logistic Regression, Generalized Linear Models; Support Vector Machines, Nonlinearity and Kernel Methods; Beyond Binary Classification: Multi-class/Structured Outputs, Ranking.

Unit – II: Clustering **10 hours**

Clustering: K-means/Kernel K-means; Dimensionality Reduction: PCA and kernel PCA; Matrix Factorization and Matrix Completion; Generative Models (mixture models and latent factor models).

Unit – III: Evaluating Machine Learning 10 hours
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests).

Unit – IV: Sparse Modelling & Estimation 9 hours
Sparse Modelling and Estimation, Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

Unit – V: Scalable Machine Learning 9 hours
Scalable Machine Learning (Online and Distributed Learning A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference. Recent trends in various learning techniques of machine learning and classification methods for IOT applications

Reference Books:

 Tom M. Michell, Machine Learning, McGraw Hills
 AurÈlien GÈron, Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems, Orielly Publications
 Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
 Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
 Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

Teaching-Learning Strategies in brief:
- Learning by doing
- Learning through discussion among the peer group
- Open ended questions by teacher
- Open ended questions from students
- Reflective Learning
- Provide relevant study material

Assessment methods and weightages in brief:
- time-constrained examinations
- closed-book class tests
- quiz
- problem based assignments
- sessional examinations
- semester examination
- practical assignments
- viva voce

Total Marks-100

- Internal assessment (40 marks)
- Semester Examination (60 marks)

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: MCA-303 **Title of the Course:**Data Warehousing and Data Mining
L-T-P: 3-1-0 **Credits**: 4
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to …….
CO1: To develop an understanding of the basic concepts of data warehousing, design, architecture, OLAP in Data Warehousing (Cognitive Level: Understand)
CO2: To understand with the Data Mining Primitives, Architecture of Data Mining System (Cognitive Level: Understand)
CO3: To understand the concept of Association Rule Mining in Large Databases (Cognitive Level: Apply)
CO4: To Understand with the Classification by Decision Tree Induction, Bayesian Classification, Classification by back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction (Cognitive Level: Analyze)
CO5: To understand the concept of Cluster Analysis in Data, Types of Data in Cluster of Analysis. A Categorization of Major Clustering Methods, Mining Complex Types Data (Cognitive Level: Analyze)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	3	3		2	2	1	1	1	1	3	2
CO 2	3	3	3	3	3	3	2	2	2	2	1	1	1	3	
CO 3	3	3	3	3	3				2	1		1	1	1	
CO 4	3	3	3		3	3	2	2			1	1	1	3	2
CO 5	3	3		3	3	3	2	2	1			2	1	3	2

Detailed Syllabus:

Unit-I **(8 hours)**
DATA WAREHOUSING: Basic concepts in data warehousing, Collecting the requirements of data warehouse, Data Warehouse Architecture, Design, Implementation & Maintenance, OLAP in data warehouse, Data warehousing and the web, Data Cube Technology, From Data Warehousing to Data Mining.

Unit-II **(8 hours)**
DATA MINING CONCEPTS: Data mining primitives, Basics of data mining, Query language, Architectures of data mining system

Unit-III **(11 hours)**

MINING ASSOCIATION RULES IN LARGE DATABASES: Association Rule Mining, Mining Single Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint Based Association Mining.

Unit-IV **(11 hours)**

CLASSIFICATION AND PREDICTION: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, Classifier Accuracy.

Unit-V **(10 hours)**

CLUSTER ANALYSIS IN DATA MINING: Types of Data in Cluster Analysis. A Categorization of Major Clustering Methods, Partitioning Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Outlier Analysis.

MINING COMPLEX TYPES OF DATA: Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time Series and Sequence Data, Mining Text Databases.

TEXTBOOKS

- Alex Berson & Stephen J. Smith, *Data Warehousing, Data Mining & OLAP*, Tenth Reprint, TMH, 2007.
- Jiawei Han & Micheline Kamber, *Data Mining Concepts and Techniques*, 2nd Edition, Elsevier, 2007.

REFERENCE BOOKS

- Pang-Ning Tan, Michael Steinbach & Vipin Kumar, *Introduction To Data Mining*, Pearson Education, 2007.
- G. K. Gupta, *Introduction to Data Mining with Case Studies*, Easter Economy Edition, PHI, 2006.
- Daniel T. Larose, *Data Mining Methods and Models*, Wile-Interscience, 2006.

Teaching-Learning Strategies in brief

1. Build a positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By taking semester examination.
4. Internal assessment (40 marks), Semester Examination (60 marks), and Total Marks=100.

Program: Master of Computer Applications (MCA)

Course Code: MCA 304 **Title of the Course: Machine Learning Lab**

L-T-P: 0-0-2
Credits: 1
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (CO)

CO1: Familiarize with PythonProgramming language (Cognitive level: understand).

CO2: Able to generate, analyze and interpret data using Python(Cognitive level: Apply and analyze).

CO3: Able to design and implement classifiers for machine learning applicationsusing Python (Cognitive level: Apply and analyze).

CO4: Able to implement clustering techniques for machine learning applications(Cognitive level: Apply).

CO5: Able to implement an end to end Machine Learning System(Cognitive level: create).

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	3	3	3	-	2	-	-	-	-	2	2	2	1
CO2	2	2	3	3	2	-	2	-	-	-	-	2	2	2	3
CO3	-	3	3	2	3	1	2	-	1	-	1	-	1	2	2
CO4	-	3	3	2	3	-	2	-	-	1	2	-	2	1	1
CO5	2	2	2	2	3	1	2	2	-	-	2	3	2	2	3

List of Experiments

1. Write a python program to compute- Central Tendency Measures: Mean, Median, Mode and Measure of Dispersion: Variance, Standard Deviation.
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
3. Write a program to implement the concept of linear regression.
4. Write a program to implement the concept of multiple regressions.
5. Write a program to demonstrate the working of the decision tree algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
6. Write a program to implement support vector machines classifier.

7. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
8. Write a program to implement k-Means clustering algorithm.
9. Write a program to implement k-Nearest Neighbor algorithm to classify the data set. Print both correct and wrong predictions.
10. Write a program to implement the concept of fuzzy logic by considering the tipping problem.

Teaching-Learning Strategies in brief

1. Build positive environment in the Lab.
2. Provide concrete basic and advanced knowledge of the subject.
3. Encourage to the students to ask more & more questions.
4. Motivate to the students to develop critical & strategic thinking.

Assessment methods and weightages in brief

- By giving assignments.
- By conducting quizzes.
- By conducting viva.
- By taking semester examination.
- Internal assessment (40 marks) & Semester Examination (60 marks) &Total Marks-100.

Program: Master of Computer Applications (**MCA) (Linux and Unix Programming)**

Course Code: MCA 305 Title of the Course: Linux and Unix Programming

L-T-P: 0-0-2
Credits: 1
(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (CO)

After the completion of the course, student will be able to do the following

CO1 To understand and learn how to use UNIX/Linux resources and to use additional UNIX/Linux commands for various purposes.

CO2 To understand, learn and implement organizing and managing files within the UNIX/Linux file system.

CO3 To learn organizing and managing various processes within UNIX/Linux

CO4 To understand, learn and implementthe concept of Shell scripting and design scripts to do basic tasks.

CO5 To understand, learn and implement the C Unix Linux Interface and do the programing for processes and files.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O2	PS O3
CO1	1	1	-	-	-	-	1	1	2	1	2	1	1	1	2
CO2	-	1	3	-	1	-	2	1	-	1	2	1	2	2	2
CO3	1	1	3	1	-	1	-	2	1	2	-	1	3	2	3
CO4	-	1	-	-	1	-	1	-	-	-	1	-	1	1	2
CO5	1	-	3	-	-	1	1	1	1	2	-	1	1	2	3

List of experiments

1. Write a shell script to enter two numbers. Add these two numbers and print the result of it. (Show the use of expr and grave accent character `).
2. Write a shell script to design a calculator. Perform addition, subtraction, multiplication and division of numbers.

3. Write a shell script to design a KBC type question. (Which of the following the capital of India… a) Bombay b) Calcutta c) Madras d) Delhi).

   The user will prompt the answer and the system should say Correct answer or Incorrect answer.
4. Write a shell script to file out the type of Input file.(Whether the file is ordinary or system or device file).
5. Write a shell script to generate the mark sheet for five subjects for a particular name.
6. Write a C program to calculate the factorial of a number using C under Ubuntu.
7. Write a C program to create a process and find out the PID and PPID of a process.
8. Write a C program to demonstrate process synchronization in C language.
9. Write a C program to demonstrate the use of IPC(Inter process communication) by using semaphores.
10. Write a C program to demonstrate the use of IPC(Inter process communication) by using Message queues.

Teaching-Learning Strategies in brief

1. Build positive environment in the Lab.
2. Provide concrete basic and advanced knowledge of the subject.
3. Encourage to the students to ask more & more questions.
4. Motivate to the students to develop critical & strategic thinking.

Assessment methods and weightages in brief

- By giving assignments.
- By conducting quizzes.
- By conducting viva.
- By taking semester examination.
- Internal assessment (40 marks) & Semester Examination (60 marks) &Total Marks-100.

Name of the Academic Program: MCA
Course Code: MCA PE331 Title of the Course: Distributed Systems

L-T-P: 3-0-0 Credits: **04**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (CO)

After completing this Course, the students should be able to

CO-1: Understand the basic elements and concepts related to distributed system technologies. (Cognitive level: Understand)
CO-2: Apply the knowledge of the synchronization and consistency aspects of distributed systems in real world applications. (Cognitive level: Apply)
CO-3: Illustrate the underlying components of distributed systems (such as RPC, security and file systems. (Cognitive level: Analyze)
CO-4: Design and implement distributed transactions and gain knowledge of replication models. (Cognitive level: Create)
CO-5: Evaluate distributed computing models and implement typical algorithms used in distributed systems and distributed applications in cloud infrastructure. Cognitive level: Evaluate)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specificoutcomes(PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	2	2	-	-	-	-	-	-	2	1	1	-
CO2	2	3	3	3	2	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	3	-	2	-	-	2	-	-	3	3	-
CO4	2	3	2	3	3	2	-	2	2	-	-	-	3	2	2
CO5	2	2	3	2	2	-	2	-	-	-	-	2	2	2	-

Detailed Syllabus:

Unit – I: Characterization of Distributed Systems- Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges.
SYSTEM MODELS: Architectural models, Fundamental Models
Theoretical Foundation for Distributed System- Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection.
Distributed Mutual Exclusion- Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non-token-based algorithms, performance

metric for distributed mutual exclusion algorithms. 9 hours

Unit – II: Distributed Deadlock Detection- System model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.
Agreement Protocols- Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system. 9 hours

Unit – III: Distributed Objects and Remote Invocation - Communication between distributed objects, Remote procedure call, Events and notifications.
Security - Overview of security techniques, Cryptographic algorithms, Digital signatures.
Distributed File Systems - File service architecture. 9 hours

Unit – IV: Transactions and Concurrency Control - Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control.
Distributed Transactions - Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.
Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data. 9 hours

Unit – V: Distributed Algorithms - Introduction to communication protocols, Balanced sliding window protocol, Routing algorithms, Destination based routing, Deadlock free Packet switching, Election algorithm. 9 hours

Reference Books:

1. Singhal & Shivaratri, Advanced Concept in Operating Systems, McGraw Hill.
2. Coulouris, Dollimore, & Kindberg, Distributed System: Concepts and Design, Pearson.
3. Gerald Tel, Distributed Algorithms, Cambridge University Press.

Teaching-Learning Strategies in brief

1. Learning by doing
2. Open ended questions by teacher
3. Open ended questions from students
4. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief

1. Two Sessional Tests- 10 marks each
2. Assignments, quizzes etc.- 5 marks
3. Semester examination – 60 marks

Name of the Academic Program: MCA

Course Code: MCA PE332 Title of the Course: Cloud Computing

L-T-P: 3-1-0 Credits: **04**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcomes:

CO1: Gained an overview of the concepts, processes and keywords associated with Cloud computing. (cognitive level: Analyze)
CO2: Learnt the cloud types and deployment models and understanding the key drivers of cloud like the concept of virtualization and the barriers associated with its implementation. (cognitive level: Understand)
CO3: understood the constraints associated with security aspect of Cloud. (cognitive level: Understand)
CO4: Understood the best practices that can be adopted for ensuring a secure cloud and how the audit of a cloud works. (cognitive level: Understand)
CO5: Identified the risks, compliance, and governance responsibilities and challenges associated with cloud types and services. (cognitive level: Apply)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	2	2	-	-	-	-	-	-	2	1	1	1
CO2	2	3	3	3	2	-	-	-	-	-	-	-	2	1	1
CO3	3	2	2	2	3	-	2	-	-	2	-	-	1		1
CO4	2	3	2	3	3	2	-	2	2	-	-	-		1	1
CO5	2	2	3	2	2	-	2	-	-	-	-	2			2
CO6	3	3	2	2	3	-	-	2	2	2	2	-			

Detailed Syllabus:

Unit-I: Introduction to cloud computing
Cloud introduction and overview, applications of cloud computing. **10 hours**

Unit-II: cloud computing architecture
Requirements, introduction to architecture, on demand computing virtualization, types of virtualizations, hypervisors, SPI framework, cloud service delivery model **10 hours**

Unit-III: deployment model
Key drivers to adopting model, impact on users, governance in the cloud, types of models: private, public, hybrid, VPN, Barriers in cloud adoption **10 hours**

Unit-IV: Security Management
Trust boundaries, IAM, standards and protocols, security issues, solutions, IAM practices**,** Recent advancements in cloud and its applications. **10 hours**

Unit-V: audit and compliance

Journal policy, compliance, governance, risks, GRC, Cloud security alliance, auditing the cloud, **10 hours**

Text/Reference Books:

1. William Stallings, "Cryptography and Network Security"

2. Alfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone, "Handbook Of AppliedCryptography"

3. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: PrivateCommunication in a Public World

Teaching-Learning Strategies in brief (4 to 5 sentences)

1. Learning by doing
2. Open ended questions by teacher
3. Open ended questions from students
4. Preparation of question bank by students at various cognitive level

Assessment methods and weightages in brief (4 to 5 sentences)

1. Two Sessional Tests- 10 marks each
2. Assignments, quizzes etc.- 5 marks
3. Semester examination – 60 marks

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: MCA OE312 **Title of the Course: Cyber physical system and IoT**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to-

CO-1: Understand and apply the basic concepts related to evolution of distributed computing over the Web. *(Cognitive level: Understand)*

CO-2: Describe and illustrate the core architectural aspects of IoT network. *(Cognitive level: Understand)*

CO-3: Demonstrate and apply the knowledge of Cloud Computing, Internet of Everything and their distributed applications. *(Cognitive level: Apply)*

CO-4: Evaluate the basic concepts and layered architecture of Cyber Physical Systems. *(Cognitive level: Evaluate)*

CO-5: Create and apply framework for security and privacy in IoT, CPS and Industry 4.0 and different CPS applications in real world. *(Cognitive level: Create)*

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	2	-	1	-	3	3	1	2	1
CO2	3	3	3	3	3	1	2	-	-	-	3	3	2	3	1
CO3	3	3	3	3	3	1	2	-	-	-	3	3	3	3	2
CO4	3	3	3	3	3	1	2	-	-	1	3	3	3	3	2
CO5	3	3	3	3	3	1	2	1	-	2	3	3	3	3	3

Detailed Syllabus:

Unit 1:

Introduction to IoT. Definition of IoT. Why use IoT. Evolution and Importance of IoT. Web 3.0. Ubiquitous Computing and IoT. Applications of IoT. Privacy and Security issues. Pillars of IoT - Horizontal, Verticals, and Four Pillars, The internet of devices, objects, transducers, and controllers.

10 *hours*

Unit 2:

Web of Things vs. Internet of Things. IoT Standardization. Standardization protocols. Issues with IoT Standardization. Cloud Computing. Cloud of Things. IoT vs Cloud Computing. Middleware for IoT.

10 *hours*

Unit 3: Introduction to CPS – Definition of CPS. Key features of cyber physical systems. Requirements of CPS. Models of CPS. CPS Architecture and CPS Ecosystem.

10 hours

Unit 4:

Platform components, CPS implementation issues, Intelligent CPS, Secure Deployment of CPS. Security objectives in CPS. Privacy issues and challenges in CPS. 10 *hours*

Unit 5:

CPS in the real world. CPS in real world and its applications. Case study of CPS applications, Smart City, Power grid control, monitoring applications etc.

10 *hours*

Reference Books:

1. Honbo Zhou, "The Internet of Things in the Cloud", CRC Press, 1st Edition
2. Rajeev Alur, "Principles of Cyber Physical Systems", MIT Press, 1st Edition
3. Sheng-Lung Peng, Souvik Pal, Lianfen Huang, "Principles of Internet of Things (IoT) Ecosystem: Insight Paradigm", Springer, 1st Edition

Teaching-Learning Strategies in brief

1. Build a positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By taking semester examination.
4. Internal assessment (40 marks), Semester Examination (60 marks), and Total Marks=100.

Name of the Academic Program: Master of Computer Applications (MCA)

Course Code: MCA SEE311 **Title of the Course: Android Programming**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcomes:

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

CO1: Identify various concepts of Android programming, (cognitive level: Analyze)

CO2: Critique Android applications on their design pros and cons, (cognitive level: Evaluate)

CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces for Android operating system, (cognitive level: Apply)

CO4: Program Android applications with the knowledge of Java programming concepts that use basic and advanced phone features, (cognitive level: create)

CO5: Test and deploy applications to the marketplace for distribution. (cognitive level: Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	3	3	3		2	2	1	1	1	1	1	1
CO 2	3	3	3	3	3	3	2	2	2	2	1	1	2	1	1
CO 3	3	3	3	3	3				2	1		1	1		1
CO 4	3	3	3		3	3	2	2			1	1		1	1
CO 5	3	3		3	3	3	2	2	1			2			2

Unit 1: **10 Hours**

Basics of Object-Oriented Programming: Encapsulation, Abstraction, Polymorphism and Inheritance; Basics of Java Programming: Using Variables, Flow Controls, Loops, Arrays and Matrices, Working with Strings, Exceptions in Java, ArrayList and Collections, Enums, Static Variables and Methods, Inner Classes, Basic Threading, Timers, UI, Working with SWT, UI Events.

Unit 2: **10 Hours**

Basics of XML: Introduction, Tree, Syntax, Elements, Attributes, Namespaces, Display, HttpRequest, Parser, DOM, XPath, XSLT, XQuery, XLink, Validator, DTD, Schema, and Server; Setting up Android IDE, Android SDK, Basics of Android Studio: Project Configuration, Screens & Basic Layouts, First Android App: How to Run and Debug with Emulator.

Unit 3: **10 Hours**

Basic concepts of Android: Activities, Menus, Fragments, Intents, Widgets, Contexts, UI Components: View and ViewGroup, Toast, TextView, Buttons, Radio Buttons etc., User Interaction & Screen Navigation, Dialogs, Permissions, Working with Files, Working with the Network, Debugging Android apps.

Unit 4: **10 Hours**

Advanced Concepts of Android: Providing feedback to the user with Sensors: Vibration, Sounds, Flash; Raw camera usage, Touch gestures; Location and Maps, Status Bar Notifications, WebView, Localization, Services.

Unit 5: **10 Hours**

Animations, 2D graphics, 3D graphics and OpenGL, SOAP and REST Overview, Working with SOAP, Working with REST, Google Maps, Monetizing Apps, Ads, Publishing and Uploading App to Google Play

Reference Books:

1. John Horton, "Android Programming for Beginners", PACKT Publishing
2. Ian Darwin, "Android Cookbook: Problems and Solutions for Android Developers", O'Reilly Media, Inc.
3. David Griffiths and Dawn Griffiths, "Head First Android Development: A Brain-Friendly Guide", O'Reilly Media, Inc.**:**
4. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
5. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
6. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
7. Android Application Development All in one for Dummies by Barry Burd, Edition: I

Teaching-Learning Strategies in brief

1. Build a positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By taking semester examination.
4. Internal assessment (40 marks), Semester Examination (60 marks), and Total Marks=100.

Name of the Academic Program: MCA
Course Code: MCA SEE312 Title of the Course: Linux and Unix Programming

L-T-P: 3-1-0 Credits: **04**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES:

After successful completion of the course, the learners would be able to

CO1 To learn how to use UNIX/Linux resources and to find additional information about UNIX/Linux commands. (Cognitive Level: Understand)
CO2 To learn organizing and managing files within the UNIX/Linux file system.(Cognitive Level: Remember)
CO3 To learn organizing and managing various processes within UNIX/Linux. (Cognitive Level: Analyze)
CO4 Learn the concept of Shell scripting and design scripts to do basic tasks.(Cognitive Level: Apply)
CO5 Learn the C Unix Linux Interface and do the programing for processes and files.(Cognitive Level: Create)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	3	3	1	-	-	-	-	-	-	1	1	-	-
CO 2	3	2	2	2	1	-	-	1	-	-	-	1	1	-	1
CO 3	3	2	2	1	1	1	-	1	-	1	1	1	1	-	-
CO 4	3	2	2	1	1	-	1	-	1	-	-	1	1	1	-
CO 5	3	2	2	1	1	-	-	-	-	-	-	1	1	-	-

Unit I **10 Hours**

A brief history of LINUX. Architecture of LINUX. Features of LINUX. Introduction to vi editor. Commands like Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, grep, etc.

Unit II **10 Hours**

Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.

Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files. Input/output redirection.

Unit III **10 Hours**

Shell programming: read and echo, Variables, keywords, logical operations, expressions.
Control statements: Taking decisions: if-then-fi, if-then-else-fi, test, case…esac. Loops: while, for, until, break. Nested statements.

Unit IV **10 Hours**

Process and Signals: Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets. File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.

Unit V **10 Hours**

Inter Process Communication: Pipe, process pipes, the pipe call, parent and child processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.

Introduction to Sockets: Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications.

REFERENCES

1. UNIX SHELL PROGRAMMING (1996) by Yashavant Kanetkar
2. W. Richard. Stevens (2005), Advanced Programming in the UNIX Environment, 3 rd edition, Pearson Education, New Delhi, India.
3. Unix and shell Programming Behrouz A. Forouzan, Richard F. Gilberg. Thomson
4. Linux System Programming, Robert Love, O'Reilly, SPD.
5. UNIX Network Programming, W.R. Stevens, PHI. UNIX for Programmers and Users, 3rd Edition, Graham Glass, King Ables, Pearson Education

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

Internal Assessment: 40 marks, End Semester Examination: 60 marks &Total Marks: 100.

Name of the Academic Program: MCA

Course Code: MCA SEE313 Title of the Course: Asp .net Programming

L-T-P: 3-1-0 Credits: **04**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course outcomes:

Upon successful completion of this course, students will be able to
CO1. Develop applications using ASP.NET IDE (cognitive level: Create)
CO2. Develop simple web page using built in Objects (cognitive level: Apply)

CO3. Use controls available with the IDE platform of ASP.NET for given purpose (cognitive level: Analyze)

CO4. Apply Styles, themes and Master pages in ASP.NET Web applications (cognitive level: Apply)

CO5. Develop programs using session management and user's preference in ASP.NET

Describe Objects of ADO.NET. (Cognitive level: Apply)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	2	-	1	-	3	3	-	2	2
CO2	3	3	3	3	3	1	2	-	-	-	3	3	-	-	-
CO3	3	3	3	3	3	1	2	1	-	-	3	3	-	-	-
CO4	3	3	3	3	3	1	2	-	-	1	3	3	1	-	1
CO5	3	3	3	3	3	1	2	-	-	-	3	3	-	-	-

Detailed Syllabus

Unit – I **10 Hours**

Introduction to .NET Framework and ASP.NET: State the components of Framework and describe CLR, Microsoft .NET framework Overview, .Net framework Architecture, .Net Framework components,Client-Server architecture, Basics of ASP.NET , Differences between ASP.NET and Classic ASP 1.2.3 Web Applications, Develop applications using ASP.NET IDE, Introduction to Visual Studio, Creating a New Web Project (ASP.NET),Building Web Sites, Set up of work environment, start page, the menu system, toolbars, the new project dialog box, graphical designer, code designer.

Unit – II **10 Hours**

ASP.NET Web Forms 2: Develop simple web page using built in Objects, Adding Controls to the Web Page, Types of ASP.NET , Page Life Cycle , ASP.Net In-Built Objects (Response, Request, Server, Trace Objects)

Use controls available with the IDE platform of ASP.NET for given purpose, Web Server Controls (Button, Check Box, Check Box List, Drop Down List, HyperLink, Image, Controls Image Button, Label, Link Button, List Box, List Item, Panel, Place Holder, Radio Button, Radio Button List, Text Box)
Working with Control Properties and Events, Validation Controls

Unit – III **10 Hours**

Styles, Themes and Master pages: Apply Styles, themes and Master pages in ASP.NET Web applications, How Themes Work, Creating Multiple Skins for the Same Control, How Master page and Content pages are connected

Unit - IV **10 Hours**

ASP.NET State Management: Session management and user's preference in ASP.NET, State Management, View State, The Query String, Cross-Page Posting and Validation, Cookies , Session State, Application State,Application Events, ASP.NET Configuration, The Web.config File

Unit – V **10 Hours**

Connecting Database Using ADO.NET: Describe Objects of ADO.NET, Describe the use of Data Binding to bind different, ADO.NET Architecture, DataProvider, Connection Object, Command Object,DataReader,Differentiate between single value and repeated value types of data binding, DataAdapter Object, DataSet, DataView, Data Binding, Types of data binding, SQL Data Source, Selecting, Updating and Deleting Records

REFERENCE BOOKS

1. ASP.NET: The Complete Reference Books Matthew Macdonald McGraw Hill education
2. Programming in Visual Basic. NET Julia Case Bradley, Anita C. Millspaugh McGraw Hill, latest edition

Teaching-Learning Strategies in brief:

- Encourage participation of students in learning.
- Connect the subject matter with the student's everyday life.
- Encourage the spirit of questioning by the students.
- Arrange student friendly study material and other learning resources.
- Create friendly environment conducive for learning.

Assessment methods and weightages in brief:

- Two sessional examinations.
- Assignments.
- End semester examination.

Internal Assessment: 40 marks, End Semester Examination: 60 marks &Total Marks: 100.

Name of the Academic Program: MCA

Course Code: MCA OE 311 Title of the Course: E-Governance And Smart Cities

L-T-P: 3-1-0 Credits: **04**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES:

After studying this subject student will be able to:

CO1. Acquaint knowledge on smart cities planning and development. (Cognitive level: Understand)
CO2. Develop work break down structure, scheduling and project management of smart cities (cognitive level: Apply)
CO3. Work out the most energy efficient technique (cognitive level: Create)
CO4. Student will be able to understand technologies, infrastructure, and concept of planning and latest methodology. (Cognitive level: Understand)
CO5. Evaluate govt. web sites as per the state-of-the-art practices. (Cognitive level: Evaluate)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	3	-	2	-	1	-	3	3	-	1	-
CO 2	3	3	3	2	3	1	2	-	-	-	3	3	-	-	2
CO 3	3	3	2	3	3	1	2	1	-	-	3	3	-	-	-
CO 4	3	3	2	2	3	1	2	-	-	1	3	3	1	-	-
CO 5	3	3	3	3	3	1	2	-	-	-	3	3	-	-	-

3-High Level, 2-Medium Level, 1-Low Level

Detailed Syllabus

Unit – I **10 Hours**

Introduction to Smart cities and E-Governance

Understanding smart cities, Principal stakeholders, key trends in smart cities developments, Introduction to E-Governance, Difference between Smart cities and E-Governance; Benefits of Smart cities; Evolution, Scope and Content of E-Governance; Present Global Trends of Growth in E-Governance,

Unit – II **10 Hours**

Models of E-Governance
Introduction; Model of Digital Governance: Broadcasting / Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive – Service Model / Government-to-Citizen-to-Government Model (G2C2G)

Unit – III **10 Hours**
Green building in smart cities
Introduction to green buildings, Rating system, Energy saving system, Dimension of smart cities, Global Standards and performance benchmarks, Smart city planning and development , Financing smart cities development , Governance of smart cities

Unit – IV **10 Hours**
Project management in Smart Cities
Stages of project and work break down Structure , Project organization structure, Planning, Scheduling and CPM ,Project cost analysis, resource allocation & leveling, Line of balancing technique ,Project monitoring and control, Project risk management.

Unit – V **10 Hours**
Practical's/ Tutorials
Smart material associated with smart building, Technology involved in different construction of smart building, Model preparation on smart city, Case study on ITS, Case study on smart city

REFERENCE BOOKS

1. *Richard Heeks, Implementing and managing e-Government*
2. *C.S. R Prabhu, e-Governance: Concepts and Case studies, prentice hall of India Pvt. Ltd.*
3. *J. Satyanarayana, e-Government, , prentice hall of India Pvt. Ltd*
4. *Backus, Michiel, e-Governance in Developing Countries, IICD Research Brief, No. 1, March 2001*
5. *Smart Cities in Canada: Digital Dreams, Corporate Design.by Mariana Valverde (Author), Alexandra Flynn (Editor) Format: Kindle Edition*
6. *E-Governance Policy for Modernizing Government through Digital Democracy in India*
7. *SHAPE UP For SMART CITIES by SURYA JEEDIGUNT.*
8. *Design and Construction of Smart Cities: Toward Sustainable Community (Sustainable Civil Infrastructures), 1st ed. 2021*

Teaching-Learning Strategies in brief
1. Build a positive and peaceful environment in the classroom.
2. Provide testing pathway for the knowledge of the subject.
3. Provide subject materials to develop and explore different perspectives.
4. Encourage students for reasoning when solving problems.
5. Motivate the students to develop learning and thinking process.

Assessment methods and weightages in brief

1. By taking two sessional examinations.
2. By giving assignments.
3. By taking semester examination.
4. Internal assessment (40 marks), Semester Examination (60 marks), and Total Marks=100.

Name of the Academic Program - Master of Computer Applications (MCA)

Course Code: MCA OE312 **Title of the Course: Cyber physical system and IoT**

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

COURSE OUTCOMES (COs)

After completing this Course, the students should be able to-

CO-1: Understand and apply the basic concepts related to evolution of distributed computing over the Web. (Cognitive level: Understand)

CO-2: Describe and illustrate the core architectural aspects of IoT network. (Cognitive level: Analyze)

CO-3: Demonstrate and apply the knowledge of Cloud Computing, Internet of Everything and their distributed applications. (Cognitive level: Apply)

CO-4: Evaluate the basic concepts and layered architecture of Cyber Physical Systems. (Cognitive level: Evaluate)

CO-5: Create and apply framework for security and privacy in IoT, CPS and Industry 4.0 and different CPS applications in real world. (Cognitive level: Create)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	2	-	1	-	3	3	-	-	-
CO2	3	3	3	3	3	1	2	-	-	-	3	3	-	1	-
CO3	3	3	3	3	3	1	2	1	-	-	3	3	-	-	-
CO4	3	3	3	3	3	1	2	-	-	1	3	3	1	-	1
CO5	3	3	3	3	3	1	2	-	-	-	3	3	-	-	-

Detailed Syllabus:

Unit 1: **10 hours**

Introduction to IoT. Definition of IoT. Why use IoT. Evolution and Importance of IoT. Web 3.0. Ubiquitous Computing and IoT. Applications of IoT. Privacy and Security issues. Pillars of IoT - Horizontal, Verticals, and Four Pillars, The internet of devices, objects, transducers, and controllersUnit 2:

10 hours

Web of Things vs. Internet of Things. IoT Standardization. Standardization protocols. Issues with IoT Standardization. Cloud Computing. Cloud of Things. IoT vs Cloud Computing. Middleware for IoT

Unit 3: Introduction to CPS – Definition of CPS. Key features of cyber physical systems. Requirements of CPS. Models of CPS. CPS Architecture and CPS Ecosystem.

Unit 4: **10 hours**

Platform components, CPS implementation issues, Intelligent CPS, Secure Deployment of CPS. Security objectives in CPS. Privacy issues and challenges in CPS.

Unit 5: **10 hours**

CPS in the real world. CPS in real world and its applications. Case study of CPS applications, Smart City, Power grid control, monitoring applications etc.

Reference Books:

1. Honbo Zhou, "The Internet of Things in the Cloud", CRC Press
2. Rajeev Alur, "Principles of Cyber Physical Systems
3. Sheng-Lung Peng, Souvik Pal, Lianfen Huang, "Principles of Internet of Things (IoT) Ecosystem: Insight Paradigm", Springer

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Name of the Academic Program - Master of Computer Applications (MCA)

Course Code: MCA OE313

Title of the Course: Sustainable Development and Green Computing

L-T-P: 3-1-0 **Credits: 4**

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Course Outcomes:

Students would have –

CO1. Understood need of sustainable development. (Cognitive level: Understand)

CO2. Understood what are sustainable development goals and how these goals can be achieved. (Cognitive level: Understand)

CO3. acquired knowledge to adopt green computing practices to minimize negative impacts on the environment. (Cognitive level: Analyze)

CO4. Acquired knowledge about the issues related to green compliance. (Cognitive level: Apply)

CO5. Evaluated technology tools that can reduce paper waste and carbon footprint by the stakeholders. (Cognitive level: Evaluate)

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	2	-	1	-	3	3	-	-	1
CO2	3	3	3	3	3	1	2	-	-	-	3	3	-	-	-
CO3	3	2	2	3	3	1	2	1	-	-	3	3	-	-	-
CO4	3	3	2	3	3	1	2	-	-	1	3	3	1	-	-
CO5	3	2	3	3	3	1	2	-	-	-	3	3	-	2	-

Detailed Syllabus:

Unit I: **10 Hours**

Sustainability: definition, mission and motives. Need of the sustainability. Issues in achieving sustainable environment.

Unit II: **10 Hours**

UNESCO sustainable goals (SG). Policies and technological approaches for achieving SG1 to SG 17.

Unit III: **10 Hours**

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

Unit IV: **10 Hours**

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

Unit V: **10 Hours**

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

Reference Books:

1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence‖, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies‖, August 2012.
REFERENCES
1. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey‖, Shroff/IBM rebook, 2011.
2. John Lamb, ―The Greening of IT‖, Pearson Education, 2009.
3. Jason Harris, ―Green Computing and Green IT- Best Practices on regulations & industry‖, Lulu.com, 2008
4. Carl speshocky, ―Empowering Green Initiatives with IT‖, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency‖, CRC Press.

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