Masters of Computer Applications
Semester System

Learning Outcome-based Curriculum Framework (LOCF)

for

MCA

Session 2023-24
Exam 2024 and 2025

Department of Computer Science
Maharaja Ganga Singh University, Bikaner

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Background

Considering the curricular reforms as instrumental for desired learning outcomes, all the academic departments of Maharaja Ganga Singh University Bikaner, made a rigorous attempt to revise the curriculum of postgraduate programs in alignment with National Education Policy-2020 and UGC Quality Mandate for Higher Education Institutions-2021. The process of revising the curriculum could be prompted with the adoption of the "Comprehensive Roadmap for Implementation of NEP-2020". The Roadmap identified the key features of the Policy and elucidated the Action Plan with well-defined responsibilities and an indicative timeline for major academic reforms.

The process of revamping the curriculum started with a series of webinars and discussions conducted by the University to orient the teachers about the key features of the Policy, enabling them to revise the curriculum in sync with the Policy. Proper orientation of the faculty about the vision and provisions of NEP-2020 made it easier for them to appreciate and incorporate the vital aspects of the Policy in the revised curriculum focused on creating holistic thoughtful, creative, and well-rounded individuals equipped with the key 21st-century skills 'for the development of an enlightened, socially conscious, knowledgeable, and skilled nation'.

With NEP-2020 in the background, the revised curricula articulate the spirit of the Policy by emphasising upon - an integrated approach to learning; innovative pedagogies and assessment strategies; multidisciplinary and cross-disciplinary education; creative and critical thinking; ethical and Constitutional values through value-based courses; 21st century capabilities across the range of disciplines through life skills, entrepreneurial and professional skills; community and constructive public engagement; social, moral, and environmental awareness; Organic Living and Global Citizenship Education (GCED); holistic, inquiry-based, discovery-based , discussion-based and analysis-based learning; exposure to Indian knowledge system, cultural traditions and literature through relevant courses offering "Knowledge of India, fine blend of modern pedagogies with indigenous and traditional ways of learning; flexibility in course choices, student-centric participatory learning; imaginative and flexible curricular structures to enable creative combinations of disciplines for study; offering multiple entry and exit points, alignment of Vocational courses with the International Standard Classification of Occupations maintained by the International Labor Organization; breaking the silos of disciplines; integration of extra-curricular and curricular aspects, exploring internships with local industry, businesses and artists and craft persons; closer collaboration between industry and higher education institutions for technical, vocational, and science programs, and formative assessment tools to be aligned with the learning outcomes, capabilities, and dispositions as specified for each course. The university has also developed a consensus on Blended Learning with 10% component of online teaching and 60% face-to-face classes for each program.

The revised curricula of various programs could be devised with concerted efforts of the faculty, Heads of the Departments, and the Deans of Schools of Study. The draft prepared by each department was discussed in a series of discussion sessions conducted at the Department, School, and University level. The leadership of the University has been a driving force behind the entire exercise of developing the uniform template and structure for the revised curriculum. The Vice-Chancellor of the University conducted series of meetings with Heads and Deans to deliberate upon the vital parameters of the revised curriculum to formulate a uniform template featuring Background, Programme Outcomes, Programme

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Specific Outcomes, Postgraduate Attributes, Structure of Masters Course, Learning Outcome Index, Semester-wise Courses and Credit Distribution, Course-level Learning Outcomes, Teaching-Learning Process, Blended Learning, Assessment and Evaluation, Keywords, References, and Appendices. The experts of various Board of Studies and School Boards contributed to a large extent in giving the final shape to the revised curriculum of each program.

To ensure the implementation of curricular reforms envisioned in NEP-2020, the University has decided to implement various provisions in a phased manner. Therefore, the curriculum may be reviewed annually so as to gradually include all relevant provisions of NEP-2020.

Program Outcomes

On completing Masters in the Faculty of Science, the students shall be able to realize the following outcomes:

PO	Description
PO1	Acquired knowledge with facts and figures related to various subjects in pure sciences such as Physics, Chemistry, Botany, Zoology, Mathematics, etc.
PO2	Understood the basic concepts, fundamental principles, and scientific theories related to various scientific phenomena and their relevance in day-to-day life.
PO3	Acquired the skills in handling scientific instruments, planning, and performing laboratory experiments The skills of observations and drawing logical inferences from the scientific experiments.
PO4	Analyzed the given scientific data critically and systematically and the ability to draw objective conclusions.
PO5	Been able to think creatively (divergent and convergent) to propose novel ideas in explaining facts and figures or providing new solutions to problems.
PO6	Realized how developments in any science subject help develop other science subjects and vice-versa and how interdisciplinary approach helps provide better solutions and new ideas for sustainable outcomes.
PO7	Developed a scientific outlook concerning science subjects and all aspects related to life.
PO8	Realized that knowledge of subjects in other faculties such as humanities, performing arts, social sciences, etc., can have greatly and effectively influence, which inspires in evolving new scientific theories and inventions.
PO9	Imbibed ethical, moral, and social values in personal and social life, leading to a highly cultured and civilized personality.
PO10	Developed various communication skills such as reading, listening, speaking, etc., which will help express ideas and views clearly and effectively.
PO11	Realized that pursuit of knowledge is a lifelong activity and in combination with untiring efforts and positive attitude and other necessary qualities leads towards a successful life.

Program Specific Outcomes (PSO)

On completing Masters in Computer Applications, the students shall be able to realize the following outcomes:

PSO	Description
PSO1	Communicate computer science concepts, designs, and solutions effectively and professionally
PSO2	Apply knowledge of computing to produce effective designs and solutions for specific problems
PSO3	Use software development tools, software systems, and modern computing platforms
PSO4	To have the knowledge and the ability to develop creative solutions
PSO5	To develop skills to learn new technology
PSO6	To develop critical reasoning
PSO7	To apply computer science theory and software development concepts to construct computing-based solutions
PSO8	To design and develop computer programs/computer-based systems in the area related to algorithms, networking, web design, cloud computing, Artificial Intelligence, Mobile applications
PSO9	The ability to understand, analyse and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity
PSO10	The ability to understand the evolutionary changes in computing, apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success, real-world problems, and meet the challenges of the future
PSO11	The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, lifelong learning and a zest for higher studies and also to act as a good citizen by inculcating in them moral values & ethics

Postgraduate Attributes

- Disciplinary Knowledge
- Creative & Critical Thinking
- Reasoning and Analytical abilities
- Logic/Discrete Mathematics knowledge
- Logical Thinking
- Problem analysis and solving abilities
- Life Skills
- Moral & Ethical Values
- Research Skills

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Structure of Masters' Programme

Bridge Course
for students admitted directly to MCA part II through Lateral Entry and do not have BTech(CS/IT)/B.Sc.(CS/IT)/BCA degree

MCA (Semester I)
Session 2023-24

Semester I											
	Course Code	Course Title	Exam Hours	Max. Marks		Min. passing Marks	Agg. Passing Marks	L	T	P	Credits
				Int. marks	Ext. marks						
Core Courses											
1	FS-COMP-MCA-BC- 001	Bridge course paper-I	3	10	40	13 (25%)	20 (40%)	1	0	0	1
2	FS-COMP-MCA-BC- 002	Bridge course Lab-I	3	10	40	13 (25%)	20 (40%)	0	0	1	1

Semester I										
	Course Code	Course Title	Exam Hours	Max. Marks		Min. Marks	L	T	P*	Credits
				Int. Marks	Ext. Marks					
Core Courses										
1	FS-COMP-MCA-CC-101	Mathematics for Computer Science	3	10	40	13 (25%)	3	1	1	5
2	FS-COMP-MCA-CC-102	Internet Programming	3	10	40	13 (25%)	3	1	1	5
3	FS-COMP-MCA-CC-103	Computer Organization	3	10	40	13 (25%)	3	1	1	5
4	FS-COMP-MCA-CC-104	C++ Programming	3	10	40	13 (25%)	3	1	1	5
5	FS-COMP-MCA-CC-105	Combined Practical	6	25	75	26 (25%)	*combined practical of above subjects			
Core Foundation Course										
1	FS-COMP-MCA-CC-106	Computer Fundamentals	3	10	40	13 (25%)	4	2	2	5

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Scheme for
MCA (Semester II)
Session 2023-24

Semester II										
	Course Code	**Course Title**	**Exam Hours**	**Max. Marks**		**Min. Marks**	**L**	**T**	**P***	**Credits**
				Int. Marks	**Ext. Marks**					
Core Courses										
1	FS-COMP-MCA-CC-201	Database Management System	3	10	40	13 (25%)	3	1	1	5
2	FS-COMP-MCA-CC-202	Data Communication and Networking	3	10	40	13 (25%)	3	1	1	5
3	FS-COMP-MCA-CC-203	Operating System	3	10	40	13 (25%)	3	1	1	5
4	FS-COMP-MCA-CC-204	Python	3	10	40	13 (25%)	3	1	1	5
5	FS-COMP-MCA-CC-205	Combined Practical	6	75	25	26 (25%)	*combined practical of above subjects			
Core Foundation Course										
1	FS-COMP-MCA-CC-206	Course on Moral Values	3	10	40	13 (25%)	4	2	2	5

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Scheme for
MCA (Semester III)
Examination 2024
Session 2024-25

Semester III										
	Course Code	**Course Title**	**Exam Hours**	**Max. Marks**		**Min. Marks**	**L**	**T**	**P***	**Credits**
				Int. Marks	**Ext. Marks**					
Core Courses										
1	FS-COMP-MCA-CC-301	Data Structures	3	10	40	13 (25%)	3	1	1	5
2	FS-COMP-MCA-CC-302	Java	3	10	40	13 (25%)	3	1	1	5
Core Elective Courses										
3	FS-COMP-MCA-CEC-303	a) PHP b) Cloud Computing c) Machine Learning d) Internet of Things e) Big Data & Data Mining	3	10	40	13 (25%)	3	1	1	5
4	FS-COMP-MCA-CEC-305	Combined Practical	6	25	75	26 (25%)	*combined practical of above subjects			
Open Elective Course										
1	FS-COMP-MCA-OEC-306	a) Data Analysis Using R b) Introduction to LaTeX	3	10	40	13 (25%)	2	2	1	5

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Scheme for
MCA (Semester IV)
Examination 2024
Session 2024-25

Semester IV										
	Course Code	**Course Title**	**Exam Hours**	**Max. Marks**		**Min. Marks**	**L**	**T**	**P***	**Credits**
				Int. Marks	**Ext. Marks**					
Core Courses										
1	FS-COMP-MCA-CC-401	Natural Language Processing	3	10	40	13 (25%)	3	1	1	5
2	FS-COMP-MCA-CC-402	Android Programming	3	10	40	13 (25%)	3	1	1	5
Core Elective Courses										
3	FS-COMP-MCA-CEC-403	a) Industrial Training b) Project c) Dissertation	6	25	75	26 (25%)	0	0	10	10
4	FS-COMP-MCA-CEC-404	Combined Practical	3	10	40	13 (25%)	*combined practical of above subjects			

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Learning Outcome Index

Learning Outcomes are statements of knowledge, skills, and abilities a student should possess and demonstrate upon completion of learning experiences.

I. Programme Outcomes(PO) and Programme Specific Outcomes (PSO)

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11
PO1	x	x	x	x	x	x	x	x		x	x
PO2	x		x		x	x	x	x	x	x	x
PO3	x	x	x		x	x	x	x	x	x	x
PO4	x	x	x	x	x	x		x	x	x	x
PO5	x	x	x	x	x	x	x	x	x	x	x
PO6	x	x	x	x	x	x	x			x	x
PO7				x	x		x		x	x	x
PO8		x		x		x	x	x			x
PO9	x	x		x	x		x	x			x
PO10	x	x	x		x				x		x
PO11	x	x	x		x	x	x	x	x	x	x

II. Programme Specific Outcomes (PSO) and Core Courses (CC)

	MCS 101	MCS102	MCS 103	MCS 104	MCS 201	MCS 202	MCS 203	MCS 204	MCS 301	MCS 302	MCS 401	MCS 402
PSO1	x	x	x	x	x	x	x	x	x	x	x	x
PSO2	x	x	x	x	x	x	x	x	x	x	x	x
PSO3		x		x	x			x	x	x		x
PSO4	x	x	x	x	x	x	x	x	x	x	x	x
PSO5	x	x	x	x	x	x	x	x	x	x	x	x
PSO6	x		x		x	x	x				x	
PSO7	x	x	x	x	x	x	x	x	x	x	x	x
PSO8		x		x	x			x	x	x		x
PSO9		x	x	x	x			x	x	x	x	x
PSO10	x	x	x	x	x	x	x	x	x	x	x	x
PSO11	x	x	x	x	x	x	x	x	x	x	x	x

III. Programme Specific Outcomes (PSO) and Core Elective Courses (CEC)

	MCS 303a	MCS 303b	MCS 303c	MCS 303d	MCS 403a	MCS 403b	MCS 403c	MCS 403d
PSO1	x	x	x	x	x	x	x	x
PSO2	x	x	x	x	x	x	x	x
PSO3	x		x		x		x	
PSO4	x	x	x	x	x	x	x	x
PSO5	x	x	x	x	x	x	x	x
PSO6		x		x		x		x
PSO7	x	x	x	x	x	x	x	x
PSO8	x		x		x		x	
PSO9	x	x	x	x	x	x	x	x
PSO 10	x	x	x	x	x	x	x	x
PSO 11	x	x	x	x	x	x	x	x

IV. Programme Specific Outcomes (PSO) and Open Elective Courses (OEC)

	MCS 305a	MCS 305b	MCS 405a	MCS 405b
PSO1	x	x	x	x
PSO2	x	x	x	x
PSO3	x		x	
PSO4	x	x	x	x
PSO5	x	x	x	x
PSO6		x		x
PSO7	x	x	x	x
PSO8	x		x	
PSO9	x	x	x	x
PSO 10	x	x	x	x
PSO 11	x	x	x	x

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Objectives, Course-level Learning Outcomes, Contents, and Suggested Readings

Semester I

Paper Code:MCA-001
Paper Name: Bridge course paper-I

Scheme of Examination

1. This bridge course shall be completed by the student as prescribed by university authorities.
2. MCA degree shall not be awarded unless the student successfully completes the Bridge Course.
3. Examination will be conducted by the University Department.
4. The student has to secure 40% marks in both theory and practical Examination in order to pass the bridge course. These marks however will not be added to the final score of the semester / programme.
5. For the Bridge course, only Satisfactory or Not Satisfactory will be mentioned in the mark sheet. No separate certificate will be issued.
6. The University department shall arrange for the contact sessions (10 contact sessions per paper) for completing the Bridge Course. However the College/Department shall not charge any fee for the conduct of Bridge Course.

Unit – I

The Number System:Decimal, Binary, Octal, and Hexadecimal number system, Conversion from one to other number system, 1's,2's, 9's and 10's Complements, Signed and unsigned number representations, Fixed-point and Floating-point representation of numbers.Computer Networking: Type of networks, LAN, MAN and WAN, Concept of topology.

Unit – II

Introduction to Programming: Concept of OOP's: Decision Making and looping controls, Functions, Introduction to RDBMS : Basic Queries (Insert, Update, Delete), Concept of Primary Key, candidate key, and Foreign Key.

Unit – III

Computer Organization: Logic Gate, Flip Flop, Combinational and Sequential Circuits – Multiplexer, De multiplexer, Encoders. Computer Architecture: CPU organization – Register Organization, Stack Organization, Instruction Format, Memory Organization – Memory Hierarchy and Virtual Memory, Cache Memory.

Recommended Readings

1. Introduction to algorithms, Third Edition. By Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Clifford Stein, PHI
2. Fundamental of Computer – P.K.Sinha
3. Let Us C – Yashwant Kanetkar.

Suggested Readings

4. Object Oriented Programming Through CPP – Balguru Swamy.
5. SQL and PL/SQL programming by Ivan Bay Ross
6. A.Doerr, Discrete Mathematics for Computer Science.
7. Computer System Architecture – M.Morris Mano.

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Paper Code:MCA-101
Paper Name: Mathematics for Computer Science

Course Objectives:

CO1. To learn to evaluate mathematical arguments revolving around computation
CO2. To understand the basics of Combinations and Permutations
CO3. To acquire the ability to represent relations matrices and digraphs
CO4. To acquire and apply the knowledge on Graphs and Trees to real-world applications
CO5. To have the ability to Demonstrate the working of Grammars and Languages

Learning Outcomes:

After completion of this course the student will be able to-
LO1. Comprehend and evaluate mathematical arguments revolving around computation.
LO2. Understand the basics of Combinations and Permutations.
LO3. Represent relations matrices and digraphs.
LO4. Apply the knowledge on Graphs and Trees to real-world applications.
LO5. Demonstrate the working of Grammars and Languages.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of the syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of parts A, B, and C are 50, 200, and 500 respectively

Note: Non-Scientific Calculator may be allowed in the end-semester examination.

Unit – I

Sets: different types of sets, set operations; Basic Counting Principles, Pigeonhole Principle, Binomial Coefficients, Binomial Theorem, Permutations, Combinations; Matrices: addition, multiplication; Vectors: Position vector, addition, subtraction and products of vectors.

Unit - II

Mathematical Induction; **Logic**: Propositions and logical operations, Conditional statements, Tautologies and Contradictions, Logical Equivalence, quantifiers. Basic computability theory: Chomsky Hierarchy, concept of models of computation, concept of types of languages and grammars.

Unit - III

Relations: Representation of Relations, Properties of relations, transitive closure; Ordered Sets: poset, Properties, Hasse Diagram, Extremal elements of posets; **Functions**: Types of Functions, Asymptotic notations; Coordinate Systems: representation of points, straight lines, standard equation of circles.

Recommended Readings

1. Discrete Mathematics and its applications by K.H. Rosen, seventh edition
2. Discrete Mathematical Structures by Kolman, Busby and Ross, Sixth Edition, PHI.

Suggested Readings

3.Schaum'sOutline Of Theory and Problems of DiscreteMathematics, Third Edition. SEYMOUR LIPSCHUTZ
4. NCERT Mathematics textbook for class XI and XII
5. Elements of Discrete Mathematics, TMH, C L Liu
6.Foundation Mathematics for Computer Science: A Visual Approach,John Vince, Springer
7. Calculus and Analytic Geometry, George B. Thomas and Ross L. Finney, Addison Wesley
8. J. Ullman and J. Hopcroft (2006), Introduction to Automata Theory, Languages, and Computation, Pearson Education
9. "Introduction to Computer Theory" by Daniel I.A. Cohen , 2ed , Wiley.
10. An Introduction to Formal Languages and Automata, Peter Linz, Sixth edition.

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Paper Code:MCA-102
Paper Name : Internet Programming

Course Objectives -

CO1. To gain knowledge of how the client-server model of Internet programming works
CO2. To learn designing and development of interactive, client-side, executable web applications
CO3. To acquire the ability to demonstrate how Internet programming tasks are accomplished
CO3: To know how to build tools that assist in automating data transfer over the Internet.
CO4: To understand the advantages and disadvantages of the core Internet protocols

Learning Outcomes:

After completion of this course the student will be able to-
LO1: Explain how the client-server model of Internet programming works
LO2: Design and develop interactive, client-side, executable web applications
LO3: Demonstrate how Internet programming tasks are accomplished
LO3: Build tools that assist in automating data transfer over the Internet
LO4: Compare the advantages and disadvantages of the core Internet protocols

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Internet Basics: Evolution of Internet, Basic internet terms and applications. ISP, Anatomy of an e-mail Message, basics of sending and receiving, E-mail Protocol; Mailing List-Subscribing, Unsubscribing. Introduction to World Wide Web and its work, Web Browsers, Search Engine, Downloading, HyperText Transfer Protocol (HTTP), URL, Web Servers, FTP, Web publishing- Domain Name Registration, Space on Host Server for Web Site,Maintain and Updating.

Unit - II

HTML: Elements of HTML & Syntax, Comments, Headings, Paragraph, Span, Pre Tags, Backgrounds, Formatting tags, Images, Hyperlinks, div tag, List Type and its Tags, Table Layout, Use of Forms in Web Pages. CSS**:**Introduction to Cascading Style Sheets, Types of Style Sheets (Inline, Internal and External), using Id andClasses, CSS properties: Background Properties, Box Model Properties, Margin, Padding, List Properties, Border Properties, Positioning Properties.

Unit - III

Java Script: Introduction to Client Side Scripting, Introduction to JavaScript, Comments, Variables in JS, Global Variables, Data types, Operators in JS, Conditions Statements (If, If Else, Switch), JavaScript Loops (For Loop, While Loop, Do While Loop), JS Popup Boxes (Alert, Prompt, Confirm), JS Events, Onload, Onunload, Onsubmit, OnFocus, Onchange

Event, Onblur Event, Onmouseover, Onclick, Ondbclick Events, JS Arrays, Working with Arrays, JS Objects, Window object, Document object, JS Functions, getElementById, innerHTML property, inner Text property, form validation, email validation.

Recommended Readings

1. Thomas A. Powell , “HTML: The Complete Reference”, Osborne/McGraw-Hill
2. Deitel, Deitel and Nieto : Internet & WWW. How to program, 2nd Edition, Pearson Education Asia.

Suggested Readings

3. E Stephen Mack, Janan Platt : HTML 4.0 , No Experience Required, 1998, BPB Publications.
4. "HTML Complete" by Sybex, BPB Publications, 2001.
5. Internet and Web Page Designing By V.K Jain (BPB)
6. Web Enabled Commercial Application Development Using HTML, DHTML , java script, Perl CGI By Ivan Bayross (BPB)

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Paper Code:MCA-103
Paper Name : Computer Organization

Course Objectives:

CO1: To understand the structure, function, and characteristics of computer systems.
CO2: To understand the design of the various functional units and components of computers.
CO3: To Identify the elements of modern instruction sets and their impact on processor design.
CO4: To acquire the ability to explain the function of each element of a memory hierarchy,
CO5: To identify and compare different methods for computer I/O

Learning Outcomes:

After completion of this course the student will be able to-
LO1: Understand the structure, function, and characteristics of computer systems.
LO2: Understand the design of the various functional units and components of computers.
LO3: Identify the elements of modern instruction sets and their impact on processor design.
LO4: Explain the function of each element of a memory hierarchy,
LO5: Identify and compare different methods for computer I/O.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Note: Non-Scientific Calculator may be allowed in end-semester examination.

Unit I

Components of a Computer: Processor, Memory, Input-Output Unit, Difference between Organization and Architecture, Hardware Software Interaction. **Number System:** Concept of Bit and Byte, types and conversion. **Complements:** 1's complement, 2's complement. **Binary Arithmetic:** Addition, overflow, subtraction, multiplication (booth's algorithm) and division algorithm. **Logic gates:** Boolean Algebra, Map Simplification.

Unit II

Combinational circuits: Half Adder, Full Adder, Decoders, Multiplexers. **Sequential circuits:** Flip Flops- SR, JK, D, T Flip-Flop, Excitation Tables, State Diagram, State Table,, Registers, Counters.
Input Output Organization: Peripheral devices, I/O Interface, Asynchronous Data Transfer, Modes of Data Transfer, Priority Interrupt, Direct Memory Access, I/O Processor.
Memory Organization: Types and capacity of Memory, Memory Hierarchy, Associative Memory, Buffer, Cache Memory, Virtual Memory.

Unit III

Intel 8085 Microprocessor: Introduction, ALU, Timing and Control Unit, Register Set, Data and Address Bus, Addressing modes, Complete Intel 8085 Instruction set, Instruction format, Opcode and Operand, Word Size, Instruction Cycle, Pin Configuration, Intel 8085 programs.

Recommended Readings

1. Computer System Architecture, By M. Morris Mano (Pearson, Prentice Hall)
2. J.P. Hayes, "Computer Architecture & Organization", Tata McGraw Hill

Suggested Readings

3. Digital Computer Electronics By Malvino Leach, Jerald A. Brown(McGraw Hill)
4. Microprocessor Architecture, Programming, and Application With the 8085 By Ramesh Gaonkar (PENRAM)
5. Fundamentals of Microprocessor and Microcomputers By B.Ram (Danpat Rai Publications)

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Paper Code:MCA-104
Paper Name : C++ Programming

Course Objectives:

CO1. To declare, initialize and process variables, constants, and arrays
CO2. To read and print values from the keyboard using Scanner and Dialog boxes
CO3. To create statements for decisions and loops
CO4. To define functions and return values
CO5. To create classes, objects, and constructors
CO6. To understand and apply OO design concepts
CO7. To create, open, manipulate and close files using Streams
CO8. To create applets for drawing shapes and playing audio clips

Learning Outcomes:

After completion of this course the student will be able to-
LO1. Declare, initialize and process variables, constants, and arrays
LO2. Read and print values from the keyboard using Scanner and Dialog boxes
LO3. Create statements for decisions and loops
LO4. Define functions and return values.
LO5. Create classes, objects, and constructors.
LO6. Understand and apply OO design concepts.
LO7. Create, open, manipulate and close files using Streams.
LO8. Create applets for drawing shapes and playing audio clips.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Object Oriented System Object Oriented Paradigm: need, characteristics, applications. Basics of C++, branching, looping and jump statements. **Functions** : need, types, passing arguments by value and reference, recursive function, pointers and functions. **Arrays**: need, types, array and function, array and pointers.

Unit II

Class: Basics, static data members, Inline Function, Constructors and Destructors: need, types, usage, **Inheritance** - need, usage, types, compile time and run time polymorphism, overloading and overriding, virtual function, friend function, abstract class. **Operator overloading**: need, rules, through member function and through friend function.

Unit III

String handling, String class, Templates,Additional Features for C++ 11, C++14 and C++17 Searching and Sorting: **Searching**: Linear Search, Binary Search. **Sorting:** Insertion Sort, Selection Sort, Quick Sort, Bubble Sort, Heap Sort, Shell Sort, Merge sort, Radix Sort, Counting Sort, Bucket Sort.

Recommended Readings

6. Object Oriented Programming With C++ By E. Balagurusamy (Tata Mcgraw Hill)
7. C++ The Complete Reference By Herbert Schildt (Tata Mcgraw Hill)

Suggested Readings

8. Object Oriented Programming With C++ By Schaum Series (Tata Mcgraw Hill)
9. C++11 for Programmers (Deitel Developer) by Paul J. Deitel (Author), Harvey M. Deitel, Prentice Hall; 2nd edition
10. Professional C++ by Marc Gregoire, Nicholas A. Solter and Scott J.Kleper (Goodreads Publications)
11. A Tour of C++ by Bjarne Stroustrup, 2018
12. C++17 in Detail by Bartłomiej Filipek

Masters of Computer Applications
Semester System

Paper Code:MCA-105
Paper Name : Computer Fundamentals

Course Objectives:

CO1. To understand the characteristics of computers
CO2. To know about the generations of computers
CO3. To have knowledge about computer languages
CO4. To understand the basics of operating system
CO5. To be acquaint with with word processor, spreadsheet and presentation
CO6. To understand and apply the concept of algorithms and algorithm analysis
CO7. To know about some unsolved problems of computer science

Learning Outcomes:

After completion of this course the student will be able to-
LO1. Understanding of the characteristics of computers
LO2. Know about the generations of computers
LO3. Having knowledge of computer languages
LO4. Understanding of the basics of operating system
LO5. Acquaintance with with word processor, spreadsheet and presentation
LO6. Understanding and ability to design algorithms
LO7. Know about some unsolved problems of computer science

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Basics: Block Diagram, characteristics, generations of computers, classification of computers; Binary number system, Limitations of Computers, Primary and secondary memory, Input and output devices; Computer languages: Machine language, assembly language, higher level language, 4GL. Introduction to Compiler, Interpreter, Assembler, System Softwares, Application Softwares.Operating System: Features of Windows, Linux, Macintosh, Android. Open source softwares: concept and examples.

Unit II

Word Processing software: different formats for saving a word document, creating, editing documents and related operations, formatting features and related operations, spelling and grammar checker, headers and footers, creating and managing tables; printing, macros, mail merge, equation editor. Spreadsheet Software: Workbook, worksheets, datatypes, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references.

Unit III

Presentation Graphics Software: Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows. Computer Problem Solving:

Algorithms, Efficiency and analysis of algorithms, Writing algorithms for simple problems like factorial computation, generation of Fibonacci sequence and checking for prime number; Examples of unsolved problems in Computer Science.

Recommended Readings

1. P.K Sinha, "Computer Fundamentals", 2004
2. Rajaraman, Fundamentals of Computers, Fourth edition, Prentice Hall India Pvt. Limited, 2006

Suggested Readings

3. Peter Norton, "Introduction to Computers",4th Edition, TMH Ltd, New Delhi, 2017.
4. R.G. Dromey,"How to solve it by Computers", Pearson Publishers, New Delhi, 2007.

5. Dorothy House, "Microsoft Word, Excel, and PowerPoint: Just for Beginners, 2015

Web resources:

1. https://documentation.libreoffice.org/en/english-documentation/getting-started-guide/
2. https://www.coursera.org/learn/creative-problem-solving
3. http://web.mit.edu/rsi/www/pdfs/new-latex.pdf
4. https://www.latex-project.org/help/books/
5. https://support.google.com/docs/?hl=en#topic=1382883
6. https://en.wikipedia.org/wiki/List_of_unsolved_problems_in_computer_science
7. https://www.claymath.org/millennium-problems

Semester II

Paper Code:MCA-201
Paper Name : Database Management System

Course Objectives:

CO1: To understand the need for a DB approach and understand the components and roles of DBMS
CO2: To know how to write SQL queries for the given problem statement
CO3: To apply DB system development life cycle to business problems
CO4. To develop ER diagram for representing the conceptual data model
CO5: To convert ER diagram into a set of relations representing the logical data model
CO6: To implement a collection of ties in the chosen DBMS product, such as ORACLE
CO7: To have a broad understanding of database concepts and database management system software
CO8: To have a high-level experience of major DBMS components and their function
CO9: To be able to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.
CO10: To be able to write SQL commands to create tables and indexes, insert/update/delete data, and query data in a relational DBMS.
CO11: To understand detailed architecture, define objects, load data, query data, and performance tune SQL databases.
CO12: To be able to handle large volumes of structured, semi-structured, and unstructured data using database technologies.

Learning Outcomes:

After completion of this course, the student will be able to-

LO1: Appreciate the need for a DB approach and understand the components and roles of DBMS
LO2: Write SQL queries for the given problem statement
LO3: Apply DB system development life cycle to business problems
LO4. Develop ER diagram for representing the conceptual data model
LO5: Convert ER diagram into a set of relations representing the logical data model
LO6: Implement a collection of ties in the chosen DBMS product, such as ORACLE
LO7: Have a broad understanding of database concepts and database management system software
LO8: have a high-level experience of major DBMS components and their function
LO9: be able to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.

LO10: be able to write SQL commands to create tables and indexes, insert/update/delete data, and query data in a relational DBMS.

LO11: To understand detailed architecture, define objects, load data, query data, and performance tune SQL databases.

LO12: Able to handle large volumes of structured, semi-structured, and unstructured data using database technologies.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of the syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section C** will consist of 6 questions (2 questions from each unit). The word limit of parts A, B, and C are 50, 200, and 500 respectively

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Unit I

Introduction: Characteristics of database approach, Advantages, Database system architecture, Overview of different types of Data Models and data independence, Schemas and instances, Database languages and interfaces; **E-R Model**: Entities, Attributes,keys, Relationships, Roles, Dependencies, E-R Diagram; Normalization: Definition, Functional dependencies and inference rules, 1NF, 2NF, 3NF, and BCNF.

Unit II

Introduction to Relational model, Constraints: Domain, Key, Entity integrity, Referential integrity; Keys: Primary, Super, Candidate, Foreign; **Relational algebra**: select, project, union, intersection, minus, cross product, different types of join, division operations; aggregate functions and grouping**; SQL**: Data Types, statements: select, insert, update, delete, create, alter, drop; views, SQL algebraic operations, nested queries; Stored procedures: Advantages, Variables, creating and calling procedures, if and case statements, loops, Cursors, Functions, Triggers.

Unit III

Transactions processing: Definition, desirable properties of transactions, serial and non-serial schedules, the concept of serializability, conflict-serializable schedules; **Concurrency Control:** Two-phase locking techniques, dealing with Deadlock and starvation, deadlock prevention protocols, basic timestamp ordering algorithm; Overview of database recovery techniques; the concept of data warehousing.

Recommended Readings

1. Fundamentals of Database Systems,Ramez A. Elmasri, Shamkant Navathe,5th Ed(Pearson)
2. Database System Concepts By Korth, Silberschatz, Sudarshan (Mcgraw Hill)

Suggested Readings

3. An Introduction to Database Systems By Bipin C. Desai (Galgotia Publication.)
4. SQL, PL/SQL Programming By Ivan Bayross (BPB)
5. Commercial Application Development Using Oracle Developer 2000 By Ivan Bayross (BPB)

Web Resources

1. http://www.mysqltutorial.org/mysql-stored-procedure-tutorial.aspx

Masters of Computer Applications
Semester System

Paper Code:MCA-202
Paper Name : Data Communication and Networking

Course Objectives:

After completion of this course the student will be able to-

CO1. To gain ability to create a new protocol and test its efficiency
CO2. To design a new network architecture using protocols and interfaces
CO3. To create a hybrid topology using the existing topologies, and check inefficiency
CO4. To apply different encoding and decoding mechanisms involved in various types of transmission media and measure the transmission impairments
CO5. To design a model internet with various categories of networks and test the transmission rate
CO6. To understand the basics of data communication, networking, the internet, and their importance
CO7. To analyze the services and features of various protocol layers in data networks
CO8. To differentiate wired and wireless computer networks
CO9. To analyze TCP/IP and their protocols
CO10. To recognize the different internet devices and their functions
CO11. To identify the primary security threats of a network

Learning Outcomes:

After completion of this course the student will be able to-

LO1. Create a new protocol and test its efficiency.
LO2. Design a new network architecture using protocols and interfaces.
LO3. Create a hybrid topology using the existing topologies, and check inefficiency.
LO4. Apply different encoding and decoding mechanisms involved in various types of transmission media and measure the transmission impairments.
LO5. Design a model internet with various categories of networks and test the transmission rate.
LO6. Understand the basics of data communication, networking, the internet, and their importance.
LO7. Analyze the services and features of various protocol layers in data networks.
LO8. Differentiate wired and wireless computer networks.
LO9. Analyze TCP/IP and their protocols.
LO10. Recognize the different internet devices and their functions.
LO11. Identify the primary security threats of a network.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section C** will consist of 6 questions (2 questions from each unit). The word limit of parts A, B, and C are 50, 200, and 500 respectively

Unit - I

Data Communication and Networking: Overview, Network Types, LAN Technologies, Topologies, Models- OSI Model, TCP/IP Stack, Security

Physical Layer: Introduction, Impairments, Performance, Digital Transmission, modes, digital to digital, analog to digital, Analog Transmission, digital to analog, analog to analog, Transmission media, Wireless Transmission, Multiplexing, FDM, TDM, CDM, WDM, **Switching techniques:** Circuit Switching, Packet switching, Datagram, Virtual circuit, and Permanent Virtual Circuit, Connectionless and connection-oriented communication, Message switching,

Unit - II

Data Link Layer: Introduction, Error detection, and Correction, Data Link Control: Line Discipline- Enq/Ack, Poll/Select, **Flow Control**: Stop And Wait, Sliding Window, **Error Control:** ARQ, Stop and Wait ARQ, Sliding Window ARQ.

Network Layer: Introduction, Network Addressing, Routing, Internetworking, Tunneling, Packet Fragmentation, Network Layer Protocols, ARP, ICMP, IPv4, IPv6

Transport Layer: Introduction, Function, End to end communication, Transmission Control Protocol, User Datagram Protocol

Application Layer: Introduction, Client-Server Model, Application Protocols, Network Services

Unit - III

Cyber Security: definition, cybercrime and information security, cybercriminals, classification of cybercrime. Cyber offenses: categories of cybercrime.

Tools and methods used in cybercrime: phishing, types of phishing, types, and techniques of ID theft, password cracking, keyloggers and spyware, backdoors, steganography, DoS, SQL Injection.

Cybercrime on mobile and wireless devices: attacks on wireless networks, Authentication security service, attacks on mobile phones. Cyber Law, The Indian IT Act, Digital Signatures, Anti- Cybercrime Strategies, Cyberterrorism, Indian ITA 2000.

Recommended Readings

1. Cyber Security by Nina Godbole & sunit Belapure
2. Data Communication and Networking By Forozan (Tata McGraw Hill)

Suggested Readings

3. Data Communication And Computer Networks By Dr. Madhulika Jain, Satish Jain (BPB)
4. William Stallings, “Data and Computer Communications”, Pearson Education, 2008.
5. A. S. Tanenbaum, “Computer Networks”, Fourth Edition, Pearson Education.

Masters of Computer Applications
Semester System

Paper Code:MCA-203
Paper Name: Operating System

Course Objectives:

CO1. To be able to design and understand the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory, and Paging systems.
CO2. To be able to evaluate, and compare OS components through instrumentation for performance analysis.
CO3. To analyze the various device and resource management techniques for time sharing and distributed systems
CO4. To develop and analyze simple concurrent programs using transactional memory and message passing, and understand the trade-offs and implementation decisions

Learning Outcome:

After completion of this course the student will be able to-

LO1. Allocate Main Memory based on various memory management techniques
LO2. Compare Memory allocation using Best fit, Worst fit, and first hold policies
LO3. Apply page replacement policies for dynamic memory management
LO4. Schedule CPU time using scheduling algorithm for processors
LO5. Compare various device scheduling algorithms. serve

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credits: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Introduction to Operating System, layered Structure, Functions, Types; Process: Concept, Process States, PCB; Threads, System calls; Process Scheduling: types of schedulers, context switch, CPU Scheduling, Preemptive Scheduling, Scheduling Criteria- CPU Utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling Algorithms- FCFS, SJF, Priority Scheduling, Round Robin Scheduling, MLQ Scheduling, MLQ With Feedback.

Unit II

Synchronization: Critical Section Problem, Requirements for a solution to the critical section problem; Semaphores,simple solution to Readers-Writers Problem. Deadlock: Characterization, Prevention, Avoidance, Banker's Algorithm, Recovery from Deadlock. Memory Management: Physical and virtual address space, Paging, Overview of Segmentation;Virtual Memory Management: Concept,Page Replacement techniques- FIFO, LRU, Optimal

Unit III

Linux:features of Linux, steps of Installation, Shell and kernel, Directory structure, Users and groups,file permissions, commands- ls, cat, cd, pwd, chmod, mkdir, rm, rmdir, mv, cp, man,

apt, cal, uname, history etc. ; Installing packages; Shell scripts: writing and executing a shell script,shell variables, read and expr, decision making (if else,case), for and while loops.

Recommended Readings

1. Operating System Principles By Abraham Silberschatz, Peter Baer Galvin (John Wiley And Sons Inc.)
2. Operating System Concepts And Design By Milan Milen Kovic (Tata Mcgraw Hill)

Suggested Readings

3. Modern Operating System Andrew S. Tanenbaum, Herbert Bos
4. Linux in easy steps, Mike McGrath, in easy steps limited
5. Unix concepts and applications , TMH, Sumitabha Das

Masters of Computer Applications
Semester System

Paper Code:**MCA-204**
Paper Name : Python

Course Objectives:

CO1. Apply language features including strings, lists, tuples, dictionaries, regular expressions.
CO2. Create and call functions.
CO3. Create and manipulate files.
CO4. Develop classes using OO features.
CO5. Develop internet applications using packages such as urllib.
CO6. To understand why Python is a proper scripting language for developers.
CO7. To learn how to design and program Python applications.
CO8. To learn how to use lists, tuples, and dictionaries in Python programs.
CO9. To learn how to identify Python object types.
CO10.To learn how to use indexing and slicing to access data in Python programs.
CO11. To define the structure and components of a Python program.
CO12. To learn how to write loops and decision statements in Python.
CO13. To learn how to write functions and pass arguments in Python.
CO14. To learn how to build and package Python modules for reusability.
CO15. To learn how to read and write files in Python.
CO16. To learn how to design object-oriented programs with Python classes.
CO17. To learn how to use class inheritance in Python for reusability.
CO18. To learn how to use exception handling in Python applications for error handling.

Learning Outcomes:

After completing this course, students will be able to:
LO1. Apply language features including strings, lists, tuples, dictionaries, regular expressions. LO2. Create and call functions.
LO3. Create and manipulate files.
LO4. Develop classes using OO features.
LO5. Develop internet applications using packages such as urllib.
LO6. To understand why Python is a proper scripting language for developers.
LO7. To learn how to design and program Python applications.
LO8. To learn how to use lists, tuples, and dictionaries in Python programs.
LO9. To learn how to identify Python object types.
LO10.To learn how to use indexing and slicing to access data in Python programs.
LO11. To define the structure and components of a Python program.
LO12. To learn how to write loops and decision statements in Python.
LO13. To learn how to write functions and pass arguments in Python.
LO14. To learn how to build and package Python modules for reusability.
LO15. To learn how to read and write files in Python.
LO16. To learn how to design object-oriented programs with Python classes.
LO17. To learn how to use class inheritance in Python for reusability.
LO18. To learn how to use exception handling in Python applications for error handling.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Basics: Python Interpreter, writing code in Jupyter Notebook, Indentation, comments, importing a module, binary operators, standard scalar data types, type casting, if-else statements, loops(while, for), pass, range, ternary expressions. Data Structures and Sequences: Tuples, Lists and slicing, Built-in Sequence functions, Dictionary, Sets; List, Set, and Dict Comprehensions.

Unit II

Functions: Namespaces, Scope, and Local Functions; Returning Multiple Values, Anonymous (Lambda) Functions, Partial Argument Application, Generators, Errors and Exception handling. Basic File Handling. Objects and Methods in Python. NumPy: creating N-dimensional arrays, arithmetic with NumPy arrays, basic indexing and slicing, Psuedorandom number generation.

Unit III

Pandas: Overview of Series and DataFrames, reading data from csv file, DataFrame operations- working with data using functions like head, tail , info, shape, reshape, columns, isnull, dropna, mean, sum, describe, value_counts, corr, loc, iloc, apply. Matplotlib- plotting basic figures, subplots, line plots, bar plots, histograms, scatter plots. Overview of Scikit-learn, SciPy, networkx. Applications of python.

Recommended Readings

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, by Wes McKinney, O'Reilly Media, 2017Python All-in-One for Dummies, by John Shovic and Alan Simpson, John Wiley & Sons, Inc., 2019

Suggested Readings

2. Programming in Python 3: A Complete Introduction to the Python Language, Mark Summerfield, Pearson.
3. Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.
4. Introduction to Computation and Programming Using Python. By John V. Guttag, MIT Press.
5. Learning Python , Mark Lutz, David Ascher, O'Reilly
6. T. Budd, Exploring Python, TMH, 1st Ed, 2011

Web Resources

1. https://www.learnpython.org/
2. https://nptel.ac.in/courses/106/106/106106212/
3. http://greenteapress.com/thinkpython/thinkpython.pdf
4. Python tutorial: https://docs.python.org/3/tutorial/index.html
7. Python All-in-One for Dummies, by John Shovic and Alan Simpson, John Wiley & Sons, Inc., 2019

Semester III

Paper Code:MCA-301
Paper Name: Data Structures

Course Objectives:

CO1. To Create and initialize variables, constants, arrays, pointers, structures, and unions.
CO2. To Manipulate values of variables, arrays, pointers, structures, unions, and files.
CO3. To Create a function that can receive variables, arrays, pointers, and structures.
CO4. To define functions that can receive variables, arrays, pointers, and structures.
CO5. To create open, read, manipulate, write and close files.
CO6. To select and use appropriate data structures for the given problems.
CO7. To design efficient algorithms using various algorithm designing strategies
CO8. To analyze the problem and develop the algorithms related to these problems
CO9. To classify the problem and apply the appropriate design strategy to develop an algorithm
CO10. To design algorithm in the context of space and time complexity and apply the asymptotic notation
CO11. To be able to analyze algorithms and algorithm correctness.
CO12. To be able to summarize searching and sorting techniques
CO13. To be able to describe stack, queue, and linked list operations.
CO14. To be able to know. tree and graphs concepts

Learning Outcomes:

After completing this course, students will be able to:
LO1. Create and initialize variables, constants, arrays, pointers, structures, and unions.
LO2. Manipulate values of variables, arrays, pointers, structures, unions, and files.
LO3. Create a function that can receive variables, arrays, pointers, and structures.
LO4. Define functions that can receive variables, arrays, pointers, and structures.
LO5. Create open, read, manipulate, write and close files.
LO6. Select and use appropriate data structures for the given problems.
LO7. Design efficient algorithms using various algorithm designing strategies
LO8. Analyze the problem and develop the algorithms related to these problems
LO9. Classify the problem and apply the appropriate design strategy to develop an algorithm
LO10. Design algorithm in the context of space and time complexity and apply the asymptotic notation
LO11. Ability to analyze algorithms and algorithm correctness.
LO12. Ability to summarize searching and sorting techniques
LO13. Ability to describe stack, queue, and linked list operations.
LO14. Ability to know. tree and graphs concepts

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Algorithm: Efficiency & Analysis Algorithm: Time and Space complexity of Algorithm. **Abstract Data Type: Linked List-** Linear, Circular, Two Way List, Basic Operation on Linked Lists, Application of Linked List.

Unit II

Stack : primitive operations, stack Application- Infix, postfix, prefix and Recursion Array and Linked Representation of Stack. **Queue:** Primitive operation, Circular Queue, Priority Queue, D-queue, Array and Linked Representation of Queue.

Unit III

Trees : Basic terminology, **Binary Tree** : Representation as Array and link List, Basic operation, **Tree Traversal** : Inorder, Preorder, Postorder, Application of Binary Tree. B-tree, Height Balance Tree (AVL Tree) **Graph :** Basic Terminology, Directed, Undirected, Weighted, Representation of Graphs, **Graph Traversal** : Depth First Traversal, Breadth First Search.

Recommended Readings

1. Expert Data Strutcture with 'C' By R.B Patel (Khana Book Publishing Co.(P))
2. Data structure By Lipschutz (Tata McGraw Hill)

Suggested Readings

3. Data Structure By Yashvant Kanitkar (BPB)
4. An Introduction to Data Structures with Applications By Jean-Paul Tremblay, Paul G.Sarerson (Tata McGraw Hill)
5. Data Structure Using C and C++ By Yedidyah Langsam, Moshe J.Augenstein, Arora M. Tenenbaum (Prentice- Hall India)

Masters of Computer Applications
Semester System

Paper Code:MCA-302
Paper Name : Java

Course Objectives:

CO1. To use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
CO2. To read and make elementary modifications to Java programs that solve real-world problems.
CO3. To validate input in a Java program.
CO4. To identify and fix defects and common security issues in code.
CO5. To document a Java program using Javadoc.
CO6. To use a version control system to track source code in a project.

Learning Outcomes:

After completing this course, students will be able to:
LO1. Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
LO2. Read and make elementary modifications to Java programs that solve real-world problems.
LO3. Validate input in a Java program.
LO4. Identify and fix defects and common security issues in code.
LO5. Document a Java program using Javadoc.
LO6. Use a version control system to track source code in a project.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Introduction to Java: evolution, features, comparison with C and C++; Java program structure; tokens, keywords, constants, variables, data types, type casting, statements, Operators and Expression; Conditional Statements and Loop Statements. **Class:** syntax, instance variable, class variables, methods, constructors, overloading.

Unit II

Inheritance: types of inheritance, use of super, method overriding, final class, abstract class, wrapper classes.

Arrays, Strings and Vectors, Packages and Interfaces, visibility controls

Unit III

Errors and Exceptions: Types of errors, Exception classes, Exception handling in java, use of try, catch, finally, throw and throws. Taking user input, Command line arguments. **Multithreaded Programming:** Creating Threads, Life cycle of thread, Thread priority, Thread synchronization, Inter-thread communication, Implementing the Runable Interface.

Recommended Readings

1. The Complete reference Java Ninth Edition By Herbert Schildt (Tata McGraw Hill)
2. Beginning Programming with Java For Dummies by Burd, For Dummies; 3 edition

Suggested Readings

3. Java: A Beginner's Guide, Sixth Edition: A Beginner's Guide by Herbert Schildt, McGraw-Hill Osborne MediaProgramming in JAVA By E. Balagurusamy (TMH)
4. JAVA 2 programming Black Book By Steven Holzner et al. (Dreamtech Press)
5. Programming in JAVA By E. Balagurusamy (TMH)

Masters of Computer Applications
Semester System

Paper Code:MCA-303a
Paper Name : PHP

Course Objectives:

LO1. To understand the differences between LAMP, WAMP, and MAMP
LO2. To successfully install a version of LAMP, WAMP, or MAMP
LO3. To search the Internet for troubleshooting problems
LO4. To explain the difference between a programming language and a scripting language
LO5. To create an error-free simple PHP program

Learning Outcomes:

After completing this course, students will be able to:
LO1. Understand the differences between LAMP, WAMP, and MAMP
LO2. Successfully install a version of LAMP, WAMP, or MAMP
LO3. Search the Internet for troubleshooting problems
LO4. Explain the difference between a programming language and a scripting language
LO5. Create an error-free simple PHP program

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13
Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit – I

PHP: Installation of PHP. **Building Blocks of PHP:** Variables, data types, Operators & Expressions, Constants, Switching, Flow, Loops. **Functions:** Meaning, Calling, Defining a function. Return value from user defined function. **Arrays:** Creating arrays, Array related functions.**Working with String, Date & Time:** Formatting String with PHP, Using Date and time Functions with PHP. Working with file and Directories.

Unit – II

Forms: Creating simple input Form. Accessing Form input with user defined arrays, HTML and PHP Code on a single page. Redirecting User. Working with File Upload. Uploading & Downloading.**State management:** Using query string(URL rewriting), Using Hidden field, Using cookies, Using session. **Email**: Sending Email, Headers. **Exception Handling:** Understanding Exception and error, Try, catch, throw

Unit – III

Connecting to the MYSQL: Selecting a database, Adding data to a table, Displaying returned data on Web pages, Inserting data, Deleting data, Entering and updating data, Executing multiple queries, executing stored procedures.

Recommended Readings

1. Teach Yourself PHP, MYSQL &Apache ByMeloni, Pearson Education

Suggested Readings

2. Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl & PHP By James Lee, Pearson Education.
3. PHP: A Beginner's Guide ByVaswani, Vikram Tata Mc-Graw Hill.

Masters of Computer Applications
Semester System

Paper Code:**MCA-303b**
Paper Name : Cloud Computing

Objective – After completing this course the student will have an understanding of key aspects of cloud computing

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Introduction to Cloud Computing, Services provided by cloud-SaaS, PaaS, IaaS, DaaS etc. Functioning of cloud computing, Advantages, Disadvantages, Applications, Cloud Service Providers- Amazon AWS, Google App Engine, Microsoft, VMware. Virtualization concepts, Objectives, Types of Virtualization & its benefits, Introduction to Various Virtualization OS (Hypervisor). Virtualization for Enterprises

Unit II

Designing and Implementing a Data Center-Based Cloud, Industry and International Standards for Cloud Implementation, Building private cloud using open source tools, Integration of Public and Private Cloud. Private, Public & Hybrid Clouds, their Advantages & Disadvantages, On Premises and Off Premises Cloud services, installing a Cloud service.

Unit III

Cloud Security issues - Infrastructure Security, Network level security, Host level security, Application level security, Data privacy and security Issues, Jurisdictional issues raised by Data location, Access Control, Trust, Reputation, Risk and Authentication in cloud computing

Recommended Readings

1. Cloud Computing Concepts Technology and Architecture by Thomas Erl, Prentice Hall
2. Cloud Computing principles and paradigms by Rajkumar Buyya, James Broberg and Andrzej Goscinski, John Wiley and Sons, Inc. Publication
3. Cloud Computing Theory and Practice by Dan C. Marinescu, Morgon Kaufman Publication

Masters of Computer Applications
Semester System

Paper Code:MCA-303c
Paper Name : Machine Learning

Course Objectives:
CO1. To be able to design Finite Automata machines for given problems;
CO2. To be able to analyze a given Finite Automata machine and find out its Language;
CO3. To be able to create Pushdown Automata machine for given CF language(s);
CO4. To be able to generate the strings/sentences of given context-free languages using its grammar;
CO5. To be able to design Turing machines forgivenApplyto identifyInterprettational problem.

Learning Outcomes:
After completing this course, students will be able to-
LO1. Able to design Finite Automata machines for given problems;
LO2. Able to analyze a given Finite Automata machine and find out its Language;
LO3. Able to create Pushdown Automata machine for given CF language(s);
LO4. Able to generate the strings/sentences of given context-free languages using its grammar;
LO5. Able to design Turing machines forgivenApplyto identifyInterprettational problem.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier. Tools for Machine Learning and Linear Algebra Overview: Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tools/libraries with Python.

Unit II

Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection. Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

Unit III

Regularization: Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance. Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm.

Recommended Readings

1. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013
2. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012

Suggested Readings

1. Machine Learning For Dummies, John Paul Mueller, Luca Massaron,For Dummies; 1st edition
2. Machine Learning for Absolute Beginners: A Plain English Introduction, O Theobald, Scatterplot Press; 2nd edition
3. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido,O′Reilly; 1st edition
4. https://www.cmpe.boun.edu.tr/~ethem/i2ml3e/

Masters of Computer Applications
Semester System

Paper Code:MCA-303d
Paper Name : Internet of Things

Course Objectives:

CO1. To understand the definition and significance of the Internet of Things
CO2. To discuss the architecture, operation, and business benefits of an IoT solution
CO3. To examine the potential business opportunities that IoT can uncover
CO4. To explore the relationship between IoT, cloud computing, and big data
CO5. To identify how IoT differs from traditional data collection systems
CO6. To understand the definition and significance of the Internet of Things
CO7. To discuss the architecture, operation, and business benefits of an IoT solution
CO8. To examine the potential business opportunities that IoT can uncover
CO9. To explore the relationship between IoT, cloud computing, and big data
CO10. To identify how IoT differs from traditional data collection systems.

Learning Outcomes:

After completing this course, students will be able to:
LO1. Understand the definition and significance of the Internet of Things
LO2. Discuss the architecture, operation, and business benefits of an IoT solution
LO3. Examine the potential business opportunities that IoT can uncover
LO4. Explore the relationship between IoT, cloud computing, and big data
LO5. Identify how IoT differs from traditional data collection systems
LO6. Understand the definition and significance of the Internet of Things
LO7. Discuss the architecture, operation, and business benefits of an IoT solution
LO8. Examine the potential business opportunities that IoT can uncover
LO9. Explore the relationship between IoT, cloud computing, and big data
LO10. Identify how IoT differs from traditional data collection systems.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

M2M to IoT : Introduction, Market Prespective, Architectural Overview. M2M to IOT Technology- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, IoT analytics, Knowledge management, IOT Architecture, Architecture Reference Model, Real world design constraints.

Unit II

IOT Use Cases- Asset Management, **Industrial Automation-** Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, **Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Unit III

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, IOT and Smart Cities, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

Recommended Readings

1. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence by Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1st Edition, Academic Press, 2014.
2. Internet of Things (A Hands-on-Approach) by Vijay Madisetti and Arshdeep Bahga, 1stEdition, VPT, 2014.
3. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything by Francis daCosta, 1st Edition, Apress Publications, 2013

Suggested Readings

4. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
5. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems by Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers
6. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , Arshdeep Bahga
7. Building the internet of things with ipv6 and mipv6, The Evolving World of M2M Communications, Daniel Minoli John Wiley & Sons

Masters of Computer Applications
Semester System

Paper Code:MCA-303e
Paper Name : Big Data & Data Mining

Course Objectives:
CO1. To explain characteristics and use cases and applications of Big Data
CO2. To develop MapReduce operation using Hadoop
CO3. To be able to understand the role of Virtualization Technologies
CO4. To design and implement systems for data mining.
CO5. To evaluate the performance of different data-mining algorithms.
CO6. To propose data-mining solutions for various applications.

Learning Outcomes:
After completing this course, students will be able to:
LO1. Explain characteristics and use cases and applications of Big Data
LO2. Develop MapReduce operation using Hadoop
LO3. Ability to understand the role of Virtualization Technologies
LO4.design and implement systems for data mining.
LO5. Evaluate the performance of different data-mining algorithms.
LO6. Propose data-mining solutions for various applications.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Note: Scientific Calculator may be allowed in the end-semester examination.

Unit I

Data mining Introduction: Definition, Data mining tasks, Data mining as a step of Knowledge discovery process, Applications of Data mining; Data objects and types of attributes, Recalling mean, median ,mode and weighted arithmetic mean, Data quality , overview of data preprocessing.

Unit II

Classification analysis- definition, Overview of various classification techniques; Decision tree induction- working, examples ,specifying attribute test conditions , Measures of node impurity, measures for selecting best split; Evaluating the performance of a classifier- Holdout method, Random subsampling , cross-validation, Bootstrap.

Unit III

Association analysis: support, confidence, association rules, Frequent Item sets; Frequent itemset generation - Apriori principle , Apriori algorithm and examples, FP growth algorithm and examples; Closed and maximal frequent itemsets. Cluster analysis: Definition , overview of basic clustering methods, Density based methods-DBSCAN.

Required Readings
Recommended Readings

1. Data Mining: Concepts and Techniques, 3rd edition, Jiawei Han and Micheline Kamber
2. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education.

Suggested Readings

3. Data Mining: A Tutorial Based Primer, Richard Roiger, Michael Geatz, Pearson Education 2003.
4. Introduction to Data Mining with Case Studies, G.K. Gupta, PHI 2006
5. Insight into Data mining: Theory and Practice, Soman K. P., DiwakarShyam, Ajay V., PHI 2006
6. Data Mining:: Practical Machine Learning Tools and Techniques (Morgan Kaufmann Series in Data Management Systems) by Witten, Frank, Hall

Masters of Computer Applications
Semester System

Paper Code:MCA-305a
Paper Name : Data Analysis Using R

Course Objectives:

CO1. To use Jupyter Notebook for interactive computation
CO2. To practice Python features such as lists, dictionaries, and files for the given problem
CO3. To use NumPy functions for array processing
CO4. To apply Pandas Dataframe for data wrangling
CO5. To generate graphs for the given data using Matplotlib
CO6. To understand the basics of R programming in terms of constructs, control statements, string Functions.
CO7. To understand the use of R for Data analytics.
CO8. To conduct your independent data analysis.
CO9. To be able to appreciate and to apply the R programming from a statistical perspective.

Learning Outcomes:

After completing this course, students will be able to:
LO1. Use Jupyter Notebook for interactive computation
LO2. Practice Python features such as lists, dictionaries, and files for the given problem
LO3. Use NumPy functions for array processing
LO4. Apply Pandas Dataframe for data wrangling
LO5. Generate graphs for the given data using Matplotlib
LO6. Understand the basics of R programming in terms of constructs, control statements, string Functions.
LO7. Understand the use of R for Data analytics.
LO8. Conduct your independent data analysis.
LO9. Able to appreciate and to apply the R programming from a statistical perspective.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit of syllabus). **Section-C** will consist of 6 questions (2 questions from each unit of syllabus). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Foundations for data analysis-matrices, notion of probability, concept of random variables and various distributions, mean, variance, covariance, normal distributions, overview of sampling , hypothesis testing, confidence interval, concept of optimization.

Unit II

installation of R, data editing, use of R as a calculator; functions and assignments. matrix operations, logical operators, Conditional executions and loops, data management with sequences, repeats, sorting and ordering, lists, vector indexing, factors; display and formatting of strings.

Unit III

Working with data frames, Importing data files; Graphics and plots; basic statistical functions for central tendency, variation, box plots, skewness and kurtosis, correlations; overview of using R functions for a simple hypothesis testing, Applications of R .

Recommended Readings

1. Hands–On Programming with R, Garrett Grolemund , O′Reilly Publishers.
2. R for Beginner - https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf

Suggested Readings

3. A Learning Guide to R - https://www.westernsydney.edu.au/__data/assets/pdf_file/0011/830909/Rnotes_20180905_web.pdf
4. Applied Statistics and Probability For Engineers – by Douglas Montgomery, John Wiley & Sons Inc.
5. Research Methodology : Methods And Techniques, C.R. Kothari , New Age International Publishers.
6. Design and Analysis of Experiments (Wiley India) , Montgomary, Douglas C.

Masters of Computer Applications
Semester System

Paper Code:MCA-305b
Paper Name : LaTeX: a document preparation system

Course Objectives:

CO1. To apply various Excel tools and add-ins for analyzing Business problems.
CO2. To compare mathematical formulas with Spreadsheet formulas
CO3. To explore, query, and summarize business data.
CO4. To apply descriptive statistical measures for business decisions.
CO5. To perform progression analysis and forecasting techniques.
CO6. To understand how to write documents containing mathematical formulas.
CO7. To understand how to write articles in different journal styles.
CO8. To understand how to create PPT in a more presentable manner.
CO9. To understand how to create using built-in templates.

Learning Outcomes:

After completing this course, students will be able to:
LO1. Apply various Excel tools and add-ins for analyzing Business problems.
LO2. Compare mathematical formulas with Spreadsheet formulas
LO3. Explore, query, and summarize business data.
LO4. Apply descriptive statistical measures for business decisions.
LO5. Perform progression analysis and forecasting techniques.
LO6. Understand how to write documents containing mathematical formulas.
LO7. Understand how to write articles in different journal styles.
LO8. Understand how to create PPT in a more presentable manner.
LO9. Understand how to create using built-in templates.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Installation of the software LaTeX, Structure of LaTeX documents; Special Characters, Producing equations, Matrices, Tables, itemised lists, hypertext links ;Page Layout –Title, Abstract , Chapters, Sections, References.

Unit II

Including graphics, images, floating bodies; Producing basic mathematical graphics like line segments, arrows, circles, ovals, Generating index and bibliography, creating PDF file.

Unit III

Adding a new command; generating spaces ,colored text ; Writing a sample resume, question paper , article/ research paper; Creating presentation using beamer.
of part A, B and C are 50, 200 and 500 respectively

Recommended Readings

1. LaTeX: A Document Preparation System, By Leslie Lamport, Addison- Wesley.

Suggested Readings

2. LaTeX Beginner's Guide , by Stefan Kottwitz , Packt Publishing Limited
3. Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schegle: The Not So Short Introduction to LaTeX 2e, https://tobi.oetiker.ch/lshort/lshort-a5book.pdf, 2014.

Semester IV

Paper Code:MCA-401
Paper Name : Natural Language Processing

Course Objectives:

CO1. To have an introduction of the fundamental concepts and techniques of natural language processing (NLP).
CO2. To gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
CO3. To examine NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
CO4. To understand critical concepts from NLP are used to describe and analyze language.
CO5. To perform POS tagging and context-free grammar for English language.
CO6. To understanding semantics and pragmatics of English language for processing·
CO7. To Write programs in Python to carry out natural language processing

Learning Outcomes:

After completing this course, students will be able to-
LO1. Introduction to the fundamental concepts and techniques of natural language processing (NLP).
LO2. Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
LO3. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
LO4. Critical concepts from NLP are used to describe and analyze language.
LO5. POS tagging and context-free grammar for English language.
LO6. Understanding semantics and pragmatics of English language for processing·
LO7. Writing programs in Python to carry out natural language processing

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Introduction, Basics of text processing, Spelling Correction: Edit Distance; N-Gram Language Models, Evaluation of Language Models, Basic Smoothing, Computational Morphology, Introduction to POS Tagging, Overview of Hidden Markov Model, Basics of Models for Sequential tagging – Introduction to Maximum entropy and Conditional Random Fields.

Unit II

Constituency syntax parsing, examples of parsing using CKY and PCFG, Introduction to Dependency Grammars and Parsing, understanding of Transition Based Parsing; Distributional Semantics - Introduction, Applications; Word Embedding: Frequency based embedding, Prediction based embeddings. Lexical Semantics: overview of WordNet, Word Sense Disambiguation.

Unit III

Topic models: introduction, LDA; Introduction to Entity Linking and Information Extraction; Text Summarization: overview of various approaches; Text Classification: introduction and simple practical implementation using Python. Sentiment Analysis: Concept, Analysis and Applications.

Recommended Readings

1. Natural Language Understanding, Pearson Education; 2nd edition, James Allen
2. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, 2e, Jurafsky / Martin.
3. Handbook of Natural Language Processing, Nitin Indurkhya, Fred J. Damerau, Taylor and Francis; Second edition
4. The Handbook of Computational Linguistics and Natural Language Processing, Alexander Clark, Chris Fox, Shalom Lappin, Wiley-Blackwell; 1st edition
5. Natural Language Processing with Python: Analysing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, Edward Loper, Shroff pub.
6. Foundations of Statistical Natural Language Processing, Christopher D. Manning, Hinrich Schütze, MIT press.

Suggested Readings

1. Statistical Methods for Speech Recognition (Language, Speech, and Communication) Fourth Printing Edition, by Frederick Jelin
2. Neural Network Methods for Natural Language Processing Synthesis Lectures on Human Language Technologies, Yoav Goldberg, Graeme Hirst, Morgan and Claypool Life Sciences.

Masters of Computer Applications
Semester System

Paper Code:MCA-402
Paper Name : Machine Learning

Course Objectives:
CO1. To be able to design Finite Automata machines for given problems;
CO2. To be able to analyze a given Finite Automata machine and find out its Language;
CO3. To be able to create Pushdown Automata machine for given CF language(s);
CO4. To be able to generate the strings/sentences of given context-free languages using its grammar;
CO5. To be able to design Turing machines forgivenApplyto identifyInterprettational problem.

Learning Outcomes:
After completing this course, students will be able to-
LO1. Able to design Finite Automata machines for given problems;
LO2. Able to analyze a given Finite Automata machine and find out its Language;
LO3. Able to create Pushdown Automata machine for given CF language(s);
LO4. Able to generate the strings/sentences of given context-free languages using its grammar;
LO5. Able to design Turing machines forgivenApplyto identifyInterprettational problem.

Scheme of Examination

Maximum Marks: 50 Duration: 3 Hours
Minimum Passing Marks: 13 Credit: 5

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Unit I

Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier. Tools for Machine Learning and Linear Algebra Overview: Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tools/libraries with Python.

Unit II

Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection. Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

Unit III

Regularization: Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance. Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm.

Recommended Readings

1. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013
2. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012

Suggested Readings

1. Machine Learning For Dummies, John Paul Mueller, Luca Massaron,For Dummies; 1st edition
2. Machine Learning for Absolute Beginners: A Plain English Introduction, O Theobald, Scatterplot Press; 2nd edition
3. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido,O′Reilly; 1st edition
4. https://www.cmpe.boun.edu.tr/~ethem/i2ml3e/

Paper Code:MCA-403, 404
Paper Name : Combined Practical & Project/Dissertation/Industrial Training

Course Objectives:
CO1. Identify and define the problem statement
CO2. Define and justify the scope of the proposed problem
CO3. Gather and analyze system requirements
CO4. Propose an optimized solution among the existing solutions
CO5. Practice software analysis and design techniques
CO6. Develop technical report writing and oral presentation skills
CO7. Develop a functional application based on the software design
CO8. Apply to code, debugging, and testing tools to enhance the quality of the software
CO9. Prepare the proper documentation of software projects following the standard guidelines
CO10. Become a master in specialized technology
CO11. Become updated with all the latest changes in the technological world.
CO12. Ability to communicate efficiently.
CO13. Ability to be a multi-skilled engineer with sound technical knowledge, management, leadership, and entrepreneurship skills.
CO14. Capability and enthusiasm for self-improvement through continuous professional development and life-long learning
CO15. Awareness of the social, cultural, global, and environmental responsibility of an engineer.

Learning Outcomes
After completing this course, students will be able to:
LO1. Identify and define the problem statement
LO2. Define and justify the scope of the proposed problem
LO3. Gather and analyze system requirements
LO4. Propose an optimized solution among the existing solutions
LO5. Practice software analysis and design techniques
LO6. Develop technical report writing and oral presentation skills
LO7. Develop a functional application based on the software design
LO8. Apply to code, debugging, and testing tools to enhance the quality of the software
LO9. Prepare the proper documentation of software projects following the standard guidelines
L10. Become a master in specialized technology
LO11. Become updated with all the latest changes in the technological world.
LO12. Ability to communicate efficiently.
LO13. Ability to be a multi-skilled engineer with sound technical knowledge, management, leadership, and entrepreneurship skills.
LO14. Capability and enthusiasm for self-improvement through continuous professional development and life-long learning
LO15. Awareness of the social, cultural, global, and environmental responsibility of an engineer.

Scheme of Examination

Maximum Marks: 50 | Duration: 3 Hours
Minimum Passing Marks: 13 | Credits: 10

1. Marks distribution for External Project report of 40 marks is as under
    a. External Evaluation-

i. Project Dissertation 25 marks
ii. Presentation 10 marks
iii. External Viva Voce 5 marks

b. Internal Evaluation- Dissertation 10 Marks

Practical Training and Project Work:

1. Project Work may be done individually or in groups in case of bigger projects. However if the project is done in groups, each student must be given a responsibility for a distinct module and care should be taken to monitor the individual student.
2. Project Work can be carried out in the college or outside with prior permission of college.
3. The Student must submit a synopsis of the project report to the college for approval. The Project Guide can accept the project or suggest modification for resubmission. Only on acceptance of the draft project report the student should make the final copies.
4. **Project Report should be hand written.**

Submission Copy:
The Student should submit a spiral bound copy of the project report.

Format of the Project:

1. **Paper:**
   The Report shall be typed on White Paper of A4 size.
2. **Final Submission:**
   The Report to be submitted must be original.
3. **Typing:**
   Font:- Times New Roman
   Heading:- 16 pt., Bold
   Subheading:- 14 pt, Bold
   Content:- 12 pt.
   Line Spacing:- 1.5 lines.
   Typing Side :-One Side
   Font Color:- Black.
4. **Margins:**
   The typing must be done in the following margin:
   Left : 0.75”
   Right: 0.75”
   Top: 1”
   Bottom: 1”
   Left Gutter: 0.5”
5. **Binding:**
   The report shall be Spiral Bound.
6. **Title Cover:**
   The Title cover should contain the following details:
   Top: Project Title in block capitals of 16pt.
   Centre: Name of project developer’s and Guide name.
   Bottom: Name of the university, Year of submission all in block capitals of 14pt letters on separate lines with proper spacing and centering.

7. **Blank sheets:**
   At the beginning and end of the report, two white blank papers should be provided, one for the Purpose of Binding and other to be left blank.
8. **Content:**
   - **I).** Acknowledgement
   - **II).** Institute/College/Organization certificate where the project is being developed.
   - **III).** Table of contents
   - **IV).** A brief overview of project
   - **V).** Profiles of problem assigned
   - **VI).** Study of Existing System
   - **VII).** System Requirement
   - **VIII).** Project plan
     - Team Structure
     - Development Schedule
     - Programming language and Development Tools
     - **IX).** Requirement Specification
     - **X).** Design
     - Detailed DFD and Structure Diagram
     - Data structure, Database and File Specification
   - **XI).** Project Legacy
     - Current Status of project
     - Remaining Areas of concern
     - Technical and Managerial Lessons Learnt
     - Future Recommendations
   - Nomenclature and Abbreviations.
   - Bibliography
   - Source Code

Masters of Computer Applications
Semester System

Teaching-Learning Process

The teaching learning process may include the following-

- Lectures
- Discussions
- Simulations
- Virtual Labs
- Role Playing
- Participative Learning
- Interactive Sessions
- Seminars
- Research-based Learning/ Dissertation/ Case Study/ Project Work

The Blended Learning mode of teaching and learning is preferable in which offline (face-to-face) and online learning both are used to provide learners the opportunity to enjoy both of the worlds. Teachers can share instructions, lecture notes, and assignments online. On the other hand, students can share information/work/assignments with teachers and other students directly in a collaborative setting. This may have a more enriched learning experience, and collaboration between students can be improved upon if group activities rely on information gathered from online resources or lessons. Students who complete online coursework followed by interactive, face-to-face class activities have richer educational experiences.

Assessment and Evaluation

ELIGIBILITY FOR ADMISSION

Applicants must have-

i) Passed BCA or Bachelor Degree in Computer Science Engineering or equivalent Degree and obtained at least 55% marks in aggregate (Relaxation to reserved category applicants as per Prevailing Rules);

OR

(ii) Passed B.Sc. or B.Com. or B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University) and obtained at least 55% marks in aggregate (Relaxation to reserved category applicants as per Prevailing Rules);

PASS CRITERIA

For passing in the examination, a candidate is required to obtain at least a Satisfactory Grade in each paper (Internal + External) and also acquire a Satisfactory Grade in theory and practical separately (in each semester examination).

INSTRUCTIONS TO PAPER SETTER

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit).

Masters of Computer Applications
Semester System

The word limit of part A, B and C are 50, 200 and 500 respectively

INSTRUCTIONS FOR PRACTICAL EXAMINATION

a. INSTRUCTIONS FOR PRACTICAL EXAMINATION

Marks Distribution for Practical Exam -

1. Each practical exam is to be conducted by two examiners one External and one Internal. The external examiner should be a senior lecturer from the jurisdiction of other universities. Credit Weightage distribution for external practical of 4 credits is as under
   a) Practical Examination exercise of 3 questions 2 credits
   b) Viva-Voce 1 credit
   c) Laboratory Exercise File 1 credit
2. Marks distribution for External Project report of 40 marks is as under
   a. External Evaluation-
      i. Research Project/ Case Study 2 credits
      ii. Presentation 1 credit
      iii. External Viva Voce 1 credit
   b. Internal Evaluation- Dissertation 1 credit

INSTRUCTIONS FOR STUDENTS

- The student has to complete two months of career oriented summer training from any firm/organization. If the student does not get a chance to go for training, he/she can choose a research topic and can complete the dissertation under the supervision of any of the faculty in his college.
- The student who has opted for training, has to provide a signed certificate from the firm/ organization authority stating that the student has spent two months as a trainee in his organization/firm. The student who has opted for dissertation, has to submit his/her dissertation report with a certificate from his supervisor.
- In both cases the student has to present his work in front of all the faculty members and fellow students at the starting of the next session.
- In terms of credits, every one hour session of L amounts to 1 credit per semester and a minimum of two hour sessions of T or P amounts to 1 credit per semester.

*** An Academic/ Industrial Tour shall be organized by the college/department in every session. A Tour Report shall be prepared and submitted by the students after a study tour to industries/academic institutions of repute**

- A comprehensive and continuous evaluation by mid-semester examinations at regular intervals to find out each course level learning outcome
- Formative assessment on the basis of activities of a learner throughout the program instead of one assessment. for this provision of internal exams, student seminars, and assignments is included
- Open book exam is suggested for internal/ mid-term exams to better facilitate the understanding of the knowledge required
- Group examinations are recommended on problem-solving exercises and in major projects to enhance teamwork capabilities of the learner
- Collaborative/Individual assignments are useful to enhance the capability of learners to gain domain-specific knowledge
- Student Seminars and Quizzes are recommended for the continuous learning and evaluation process

Evaluation

Internal Assessment (10 marks)-	Midterm Examination	10%
	Term paper	10%
	Students Participation	5%
External Assessment(50 marks)-		75%

Examination Paper Pattern

The question paper contains 3 sections. **Section-A** consists of 10 questions (at least 3 questions from each unit of syllabus). **Section-B** will consist of 9 questions (3 questions from each unit). **Section-C** will consist of 6 questions (2 questions from each unit). The word limit of part A, B and C are 50, 200 and 500 respectively

Key Features of Revised Curriculum

Following are the key features of the revised curriculum-

- Student Centric Teaching and Learning approach
- Technology oriented approach of teaching
- Hand-on Practical/ Laboratory Sessions
- Problem-oriented teaching and learning
- Problem-analysis oriented assignments and evaluation
- Enhance logical thinking and analytical capabilities

Appendices

List of Open Electives offered by the University -