Department of Computer Application
Master of Computer Application
Evaluation Scheme

Future University										
MCA (Postgraduate Regular)										
Course Structure/ Degree Award Checklist 2024-2026										
Program Name:		**MCA**								**Program Code: 05**
Total Credit of Program: 96										

Semester-I

			Theory	**Week**			**Evaluation Scheme**		**Total**	**Credit**
SN.	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**		
1	Major Core Course	MCA501	Fundamental of Computers & Emerging Technologies	3	0	0	30	70	100	3
2	Major Core Course	MCA503	Object Oriented Programming Concepts Using C++	3	1	0	30	70	100	4
3	Ability Enhancement Course	MAS501	Professional Communication	2	0	0	0	50	50	2
4	Minor Course	MAS503	Discrete Mathematics	4	0	0	30	70	100	4
5	Major Core Course	MCA505	Web Development Technologies	4	0	0	30	70	100	4
6	Skill Enhancement Course	MCA507	Cyber Security	2	0	0	30	70	100	2
7	Multidisciplinary	IKS501	IKS-I (Indian Knowledge System - I)	1	0	0	50	0	50	1
Practical										
1	Major Core Course	MCA571	Office Automation Lab	0	0	2	50	50	100	1
2	Major Core Course	MCA573	OOPs Concepts Using C++ Lab	0	0	2	50	50	100	1
3	Major Core Course	MCA575	Web Development Technologies Lab	0	0	2	50	50	100	1
			TOTAL	**19**	**1**	**6**	**350**	**550**	**900**	**23**

Semester -II										
			Theory	Week			Evaluation Scheme		Total	Credit
SN.	Course Category	Course Code	Course Title	L	T	P	CA	EE		
1	Minor Course	MCA502	Operating Systems	4	0	0	30	70	100	4
2	Major Core Course	MCA504	Data Structures & Analysis of Algorithms	4	0	0	50	100	150	4
3	Major Core Course	MCA506	Relational Database Management Systems	4	0	0	30	70	100	4
4	Major Core Course	MCA508	Artificial Intelligence Using Python	4	0	0	30	70	100	4
5	Minor Course	MCA510	Computer Based Numerical Techniques	4	0	0	50	50	100	4
6	Skill Enhancement Course	LSM502	LSM-I (Life Skills & Mentoring – I)	0	0	0	0	0	0	0
Practical										
1	Major Core Course	MCA580	Data Structure Using C++ Lab	0	0	2	50	50	100	1
2	Major Core Course	MCA582	RDBMS Lab	0	0	2	50	50	100	1
3	Major Core Course	MCA584	A. I. using Python Lab	0	0	2	50	50	100	1
4	Minor Course	MCA586	Seminar - I	0	0	2	50	0	50	1
			TOTAL	**20**	**0**	**8**	**390**	**510**	**900**	**24**

Semester -III										
			Theory	Week			Evaluation Scheme		Total	Credit
SN.	Course Category	Course Code	Course Title	L	T	P	CA	EE		
1	Major Core Courses	MCA601	Advance Machine Learning	3	0	0	30	70	100	3
2	Minor Courses	MCA603	Project Management	3	0	0	30	70	100	3
3	Major Core Courses	MCA605	Advance Java Programming	3	0	0	30	70	100	3
4	Minor Courses	MCA607	**Elective-I**	3	0	0	30	70	100	3
5	Minor Courses	MCA615	**Elective-II**	3	0	0	30	70	100	3
6	Skill Enhancement Course	MCA613	AI for Everyone	2	0	0	30	70	100	2
7	Value Added Course	MCA621	**MOOC-I**	Self-Paced Learning					100	3
Practical										
1	Major Core Courses	MCA671	Advance Machine Learning LAB	0	0	2	50	50	100	1
2	Major Core Courses	MCA673	Advance Java Programming LAB	0	0	2	50	50	100	1
3	Research Project/ Dissertation	MCA675	Mini Project LAB	0	0	4	100	0	100	2
			TOTAL	**17**	**0**	**8**	**380**	**520**	**1000**	**24**

Semester -IV										
			Theory	**Week**			**Evaluation Scheme**			
SN.	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**	**Total**	**Credit**
1	Major Core Course	MCA602	Introduction to Research Methodology	3	0	0	30	70	100	3
	Minor Course	MAS602	Mathematics-III	3	0	0	30	70	100	3
2	Major Core Course	MCA604	**Elective-III**	3	0	0	30	70	100	3
3	Value Added Course	MCA610	**MOOC-II**	Self-Paced Learning					100	3
Practical										
1	Major Core Courses	MCA680	Research Methodology Lab	0	0	2	50	50	100	1
2	Major Core Courses	MCA682	Major Project LAB	0	0	24	200	300	500	12
			TOTAL	**9**	**0**	**26**	**340**	**560**	**1000**	**25**

Note: In the second semester, Mathematics-III will be a compulsory subject from the list of papers for those students who did not have Mathematics in Intermediate (12th) class.

Sr.N	Course Category
1	Major(Core)
2	Minor Stream
3	Multidisciplinary
4	Ability Enhancement Course
5	Skill Enhancement Course
6	Value Added Courses Common for All UG
7	Summer Internship
8	Research Project/ Dissertation

List of Elective Courses		
Discipline Specific Elective-I		
1	MCA607	Cloud Computing (EL)
2	MCA609	Natural Language Processing (EL)
3	MCA611	Neural Network (EL)
Discipline Specific Elective-II		
1	MCA615	Cryptography & Network Security (EL)
2	MCA617	Quantum Computing (EL)
3	MCA619	Blockchain Architecture (EL)
Discipline Specific Elective-III		
	MCA621	Mobile Computing (EL)
	MCA623	Big Data (EL)
	MCA625	Data Science using Python (EL)
	MCA627	Internet of Things (EL

Syllabus

MCA 1stYear
Ist Semester

MCA501: FUNDAMENTAL OF COMPUTERS& EMERGING TECHNOLOGIES		
Course Outcome (CO)		
CO1	Demonstrate the knowledge of the basic structure, components, features and Generations of computers.	
CO2	Describe the concept of computer languages, language translators and construct Algorithms to solve problems using programming concepts.	
CO3	Compare and contrast features, functioning &types of operating system and computer networks.	
CO4	Demonstrate architecture, functioning &service of the Internet and basics of multimedia.	
CO5	Illustrate the emerging trends and technologies in the field of Information Technology.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Computer:** Definition, Computer Hardware and Computer Software. **Components:** Hardware – Introduction, Input devices, Output devices, Central Processing Unit, Memory- Primary and Secondary Software - Introduction, Types – System and Application. **Computer Languages:** Introduction, Concept of Compiler, Interpreter & Assembler **Problem solving concept:** Algorithms– Introduction, Definition, Characteristics, Limitations, Conditions in pseudo-code, Loops in pseudo code.	**8**
II	**Operating system:** Definition, Functions, Types, Classification, Elements of command based and GUI based operating system. **Computer Network:** Overview, Types (LAN, WAN and MAN), Data communication, topologies.	**8**
III	**Internet:** Overview, Architecture, Functioning, Basic services like WWW, FTP, Telnet, Gopher etc., Search engines, E-mail, Web Browsers. **Internet of Things (IoT):** Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.	**8**
IV	**Block chain:** Introduction, overview, features, limitations and application areas fundamentals of Block Chain. **Crypto currencies:** Introduction, Applications and use cases **Cloud Computing:** It nature and benefits ,AWS, Google, Microsoft& IBM Services	**8**
V	**Emerging Technologies:** Introduction, overview, features, limitations and application areas of Augmented Reality, Virtual Reality, Grid computing, Green computing, Big data analytics, Quantum Computing and Brain Computer Interface.	**8**

Suggested Readings:

1. Computer Fundamentals fourth edition by Pradeep K. Sinha and Priti Sinha BPB publications.
2. Computer Fundamentals by A. Goel, Pearson Education, 2010.
3. Discovering Computers 2016 (First Edition) Cengage Learning By Misty E. Vermaat; Susan L. Sebok; Steven M. Freund; Jennifer T. Campbell; Mark Frydenberg (Shelly Cashman Series)
4. Pearson India By M. Morris R. Mano
5. Fundamentals of Computer (First Edition- 2009) Publisher: McGraw-Hill by Balaguruswamy

Computer Fundamentals (First Edition-2010) Publisher: Pearson by Anita Goel

MCA503: OBJECT ORIENTED PROGRAMMING CONCEPTS USING C++		
Course Outcome (CO)		
CO1	Understand the difference between the top-down and bottom-up approach.	
CO2	Describe the object-oriented programming approach in connection with C++.	
CO3	Illustrate the process of data file manipulations using C++.	
CO4	Apply virtual and pure virtual function & complex programming situations.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to OOP:** Advantages of OOP, Need of object-oriented programming, Procedure Oriented Vs Object Oriented Programming. **Introduction to C++ :** C++ Programming Basics, Basic Program Construction of C++, Key words in C++, Input/Output in C++, Variables, Constants, Data Types and Operators in C++, Precedence of Operators, Storage Classes Arrays in C++.	8
II	**Decision Making and Loops in C++ :** Conditional statement, Switch Statement, Break Statement, Continue Statement, Go to Statement Loops in C++, While, Do-While, For loop. **Arrays:** Array notation and representation, Declaring one-dimensional array, Initializing arrays, Accessing array elements, Manipulating array elements, Arrays of unknown or varying size, Two-dimensional arrays, Multidimensional arrays.	8
III	**Strings:** Introduction, Initializing strings, Accessing string elements, Array of strings, Passing strings to functions. **Functions :** User Defined Functions, library functions, General form of a function, scope rules of functions, function arguments(Call by value, Call by Reference), Recursion Calling Functions with arrays, Returning by reference, Friend Functions, Inline Functions, Structures and Unions in C++, Pointers in C++, Pointers with structure, Pointer with functions. **Structure:** Introduction, defining and declaring structure, Accessing members, Operations on structures, Structure within structure, Array of structure, Pointers to structure. **Union:** Introduction, Declaring union, Usage of unions, Operations on union. Enumerated data types **Storage classes:** Introduction, Types-automatic register static and external.	8
IV	**Pointers:** Introduction, Characteristics, * and & operators, Pointer type declaration and assignment, Pointer arithmetic, Call by reference, Passing pointers to functions, array of pointers, Pointers to functions, Pointer to pointer, Array of pointers. **Dynamic Allocation Operators** – Function Overloading – Default function arguments – Overloading Constructors – Ambiguity in function overloading.	8
V	**Objects and classes :** Structure and Classes, Union and Class, friend classes, Scope resolution operator, specifying and using class and object, Constructors, objects and function arguments. **Inheritance:** Base Class, Derived Class, access specifies Single Inheritance, Multiple Inheritance, Multilevel Inheritance. **Polymorphism:** Compile time, Run time, Operator Overloading, Function Overloading, Virtual functions, Dynamic Binding, Static Binding **Dynamic Memory Allocation:** Introduction, new and delete operators. **File Handling:** Basics, File types, File operations, File pointer, File opening modes, File handling functions, File handling through command line argument, Record I/O in files.	8

Suggested Readings:

1. R. S. Salaria, Mastering Object-Oriented Programming with C++, Khanna Publishing House
2. C++ Programming, Black Book, Steven Holzner, dreamtech
3. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia
4. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson.

MAS501: PROFESSIONAL COMMUNICATION		
Course Outcome (CO)		
CO1	Describe primary features, processes and principles of management.	
CO2	Explain functions of management in terms of planning, decision making and organizing.	
CO3	Illustrate key factors of leadership skill in directing and controlling business resources and processes.	
CO4	Exhibit adequate verbal and non-verbal communication skills	
CO5	Demonstrate effective discussion, presentation and writing skills.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Management**: Need, Scope, Meaning and Definition .The process of Management, Development of Management thought F.W. Taylor and Henry Fayol, Hartshorne S t u d i e s , Qualities of an Efficient Management.	**8**
II	**Planning& Organizing:** Need, Scope and Importance of Planning ,Steps in planning, Decision making model. Organizing need and Importance, Organizational Design, Organizational structure, centralization and De-centralization, Delegation.	**8**
III	**Directing & Controlling:** Motivation—Meaning, Importance, need. Theories of Motivation, Leadership—meaning, need and importance, leadership style, Qualities of effective leader, principles of directing, Basic control process, Different control Techniques.	**8**
IV	**Introduction to Communication:** What is Communication, Levels of communication, Barriers to communication, Process of Communication, Non- verbal Communication, The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group) Communication, Technology Enabled communication, Impact of Technology, Selection of appropriate communication Technology, Importance of Technical communication.	**8**
V	**Business letters:** Sales& Credit letters; Claim and Adjustment Letters; Job application and Resumes. **Reports:** Types; Structure, Style& Writing of Reports. **Technical Proposal:** Parts; Types; Writing of Proposal; Significance. Nuances of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Communication skills, Presentation strategies, Group Discussion; Interview skills; Workshop; Conference; Seminars.	**8**

Suggested Readings:

1. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning PLtd
2. Business Correspondence and Report Writing by Prof. R.C.,Sharma & Krishna Mohan, TMH
3. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
4. Developing Communication skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd.
5. Manual of Practical Communication by L.U.B. Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
6. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.

MAS503: DISCRETE MATHEMATICS		
Course Outcome (CO)		
CO1	Use mathematical and logical notation to define and formally reason about basic Discrete structures such as Sets, Relations and Functions	
CO2	Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic	
CO3	Identify and properties of Algebraic Structures like Groups, Rings and Fields	
CO4	Formulate and solve recurrences and recursive functions	
CO5	Apply the concept of combinatorics to solve basic problems in discrete mathematics	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Set Theory:** Introduction, Size of sets and Cardinals, Venn diagrams, Combination of sets, Multi sets, Ordered pairs and Set Identities. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation. **Functions:** Definition, Classification of functions, Operations on functions, Recursively defined functions.	8
II	**Natural Numbers:** Introduction, Piano's axioms, Mathematical Induction, Strong Induction and Induction with Nonzero Base cases. **Recurrence Relation& Generating functions:** Introduction and properties of Generating Functions. Simple Recurrence relation with constant coefficients and Linear recurrence relation without constant coefficients. Methods of solving recurrences.	8
III	**Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection. **Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic.	8
IV	**Posets, Hasse Diagram and Lattices:** Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction of lattices, Properties of lattices– Bounded, Complemented, Modular and Complete lattice. **Boolean Algebra:** Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean functions, Karnaugh maps, Logic gates.	8
V	**Algebraic Structures:** Introduction to algebraic Structures and properties. Types of algebraic structures: Semi group, Monoid, Group, Abelian group and Properties of group. Subgroup, Cyclic group, Co sets, Permutation groups, Homomorphism and Isomorphism of groups. **Rings and Fields:** Definition and elementary properties of Rings and Fields.	8

Suggested Readings:

1. C.L. Liu, "Elements of Discrete Mathematics" Mc Graw Hill Book Co., 1985
2. N. Deop, "Graph Theory with applications to Engineering and Computer Science", PHI 1993.
3. B. Colman and Robert C. Busby, "Discrete Mathematical structure for Computer Science," PHI.
4. Olympia Nicodemi, "Discrete Mathematics" CBS Publication, Delhi.
5. M.N.S. Swamy and K. Thulasiraman, "Graphs, Networks and Algorithms," Wiley Inter Science, NY, 1989.

MCA505: WEB DEVELOPMENT TECHNOLOGIES		
Course Outcome (CO)		
CO1	Define the principle of Web page	
CO2	Define the basics in web design	
CO3	Visualize the basic concept of HTML.	
CO4	Recognize the elements of HTML.	
CO5	Develop the concept of web publishing	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction**: Introduction to Internet, www, Internet browsers, what is web, Introduction to Client Server Concepts, History of the web, Growth of the web, protocols governing the web, web development strategies, Web applications, web project, web team.	**8**
II	**Web Page Designing**: HTML: list, table, images, frames, forms, Cascading Style Sheet (CSS); XML: Introduction to XML, DTD, XML schemes, presenting and using XML.	**8**
III	**Scripting:** Introduction to Java script, variables, control structures, looping structures, documents, forms, statements, functions, objects, event and event handling, Arrays; Introduction to VB Script, Fundamental of AJAX.	**8**
IV	**Server Site Programming**: Introduction to java server pages (JSP), JSP application design, tomcat server, JSP Life Cycle, JSP Implicit objects, JSP Scripting Elements, declaring variables, and methods, debugging, sharing data between JSP pages, Session, Database with JSP, Introduction to active server pages (ASP), ASP.NET.	**8**
V	**PHP (Hypertext Preprocessor**): Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form mail, file upload, session, error, exception, filter, PHP-ODBC.	**8**

Suggested Readings:

1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley
2. Xavier, C, "Web Technology and Design", New Age International
3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication
4. Hans Bergsten, "Java Server Pages", SPD O'Reilly
5. Margaret Levine Young, "The Complete Reference Internet", McGraw Hill.
6. Greg Lim, "Beginning Node.js, Express & MongoDB Development", 1 September 2020, Greg Lim
7. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, "MongoDB: The Definitive Guide, 3rd Edition", December 2019, O'Reilly Media, Inc.

MCA507: CYBER SECURITY		
Course Outcome (CO)		
CO1	Students will be able to identify some of the factors driving the need for network security.	
CO2	Students can identify and classify particular examples of attacks.	
CO3	Students will able define the terms vulnerability, threat and attack.	
CO4	They may identify physical points of vulnerability in simple networks.	
CO5	Students can compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack, and explain the characteristics of hybrid systems.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Information Security:-** Definition and Importance: What is information security?,. Why is it crucial for organizations and individuals? **Historical Overview:-** Evolution of cybersecurity threats and solutions, Key Concepts:- Confidentiality, Integrity, Availability (CIA Triad).	8
II	**Cybersecurity Principles:** Risk Management: Identifying and managing risks, risk assessment, and risk mitigation strategies. **Security Policies and Procedures:** Developing and implementing security policies, standards, and procedures. **Incident Response:** How to prepare for, detect, respond to, and recover from security incidents.	8
III	**Introduction to cyber-attacks:** Application security (design, development and testing), operations security, monitoring, identifying threats and remediating them, Principles of data security - Confidentiality, Integrity and Availability, Data Privacy, Data breaches, preventing attacks and breaches with security controls, Compliance standards, Computer Ethics	8
IV	**Threats and Vulnerabilities:** Malware: Viruses, worms, trojans, ransomware, and spyware. **Phishing and Social Engineering:** Techniques used to deceive individuals into divulging confidential information. **Network Attacks:** Denial of Service (DoS), Distributed Denial of Service (DDoS), Man-in-the-Middle (MitM), and others.	8
V	**Security Controls and Measures: Access Control:** Authentication, authorization, and accounting (AAA). **Encryption:** Principles of cryptography, types of encryption (symmetric, asymmetric), and practical applications. **Firewalls and Intrusion Detection Systems (IDS):** Functionality and configuration of firewalls and IDS.	8

Suggested Readings:

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, Publish Date 2013.
2. Basta, Basta, Brown, Kumar, Cyber Security and Cyber Laws, 1st edition , Cengage Learning publication
3. Dr. Surya PrakashTripathi, RitendraGoyal, Praveen Kumar Shukla, KLSI. "Introduction to information security and cyber laws". Dreamtech Press. ISBN: 9789351194736, 2015.
4. Cyber Security and Date Privacy by Krishan Kumar Goyal , Amit Garg , Saurabh Singhal , HP HAMILTON LIMITED Publication, ISBN-13-978-1913936020
5. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing
6. Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978-1-118- 84965-1.

IKS501: IKS-I (INDIAN KNOWLEDGE SYSTEM – I)		
Course Outcome (CO)		
CO1	Creating awareness amongst the youths about the true history and rich culture of the country.	
CO2	Understanding the scientific value of the traditional knowledge of Bharata.	
CO3	Promoting the youths to do research in the various fields of Bhartiya knowledge system.	
CO4	Converting the Bhartiya wisdom into the applied aspect of the modern scientific paradigm.	
CO5	Adding career, professional and business opportunities to the youths.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Indian Education** • Vedic Education: Focuses on the traditional system of learning during the Vedic period. • Spiritual and Moral Development: The role of education in promoting ethics and spiritual growth. • Intellectual Growth: How Vedic education contributed to intellectual advancement. • Social and Cultural Refinement: The cultural impact of education on society.	
II	**Methodology of Indian Knowledge System** • **Pramana:** The means of obtaining knowledge and validation in Indian philosophy. • **Nyaya:** Logical reasoning and debate in the Indian knowledge tradition.	
III	**Indian Metallurgy** • **Indian Text for Metallurgy:** Ancient Indian scriptures related to metallurgy. • **Important Specimens of Metals Preserved/Found:** Notable examples of metalwork from Indian history. • **Vedic References of Metals:** Mentions of metals in Vedic texts and their significance.	
IV	**Indian Health Sciences** • **Literature:** o **Vedic Foundations of Ayurveda:** Ancient texts that form the basis of Ayurveda. o **Ayurveda Concern for Good Health:** Focus on holistic well-being. o **Three Guna, Three Dosha, Panch Mahabhoot, Sapta Dhatu, Six Rasa:** Concepts central to Ayurveda. o **Dincharya & Ritucharya:** Daily and seasonal regimens for health. • **Practical:** o **Sushruta Samhita:** Ancient text on surgery. o **Charaka Samhita:** Ayurvedic text on medicine. o **Ashtanga Hridaya – Sutra Sthana:** An Ayurvedic classic. o **Qualities of a Surgeon:** The required attributes of a good surgeon.	

	Surgical Practices: Ancient Indian surgical methods.	
V	**Foundational Literature of Indian Civilization** **Vedang, Ayurveda, Natya Shastra, Dharma Shastra, Arthashastra:** Key texts that shaped Indian civilization in various fields like linguistics, health, arts, law, and politics.	**8**
VI	**Bharata varsha—A Land of Rare Natural Endowments** **Seasons, Land Variations, Heritage, Natural Resources, Geographical Isolation:** The geography of India and how it shaped the country's culture, heritage, and resources.	

Suggested Readings:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

MCA571: OFFICE AUTOMATION LAB		
Course Outcome (CO)		
CO1	Demonstrate the knowledge of the basic structure, components, features and Generations of computers.	
CO2	Describe the concept of computer languages, language translators and construct Algorithms to solve problem using programming concepts.	
CO3	Compare and contrast features, functioning & types of operating system and computer networks.	
CO4	Demonstrate architecture, functioning & services of the Internet and basics of Multimedia.	
CO5	Illustrate the emerging trends and technologies in the field of Information Technology.	
DETAILED SYLLABUS		
	Demonstrate the various hardware components of computer system. 1. Open the command prompt and create a directory in C: system drive using MS DOS commands. Now change the directory and create a subdirectory in this folder. 2. Create the following directory structure using MS DOS commands ❖ UIM ❖ UIT • CSE • MECH ❖ LAW ❖ USCS • MCA • BCA • BSCIT i.Remove the directory named MECH and MGT. ii.Remove the directory named UIT in single step. iii.Rename the directory LAW to LLB iv.Display the directory structure of UU. v.Rename the directory named BSCIT to BSIT. 3. Create Microsoft Word document with the name as UIM-MY-BIOGRAPHY. Write about your basic information, likes, dislikes, strengths and weakness. Along with, write the fields in which you excel. Also write about the concepts that inspire you. The font size of the title must be 14 and that of remaining text as 12. The font must be Times New Roman. Write a short biography having not more than 150 words. 4. Create your C.V. using pre-installed templates in WORD. 1- Use table for education qualification, apply paragraph formatting while stating the summary at the end of your C.V., use bullets and numbering wherever applicable 2- Use TIMES NEW ROMAN with font of size 12 and for heading size 14. 5. Invite your friends and relatives to your birthday party by creating a .mdb and linking it with the word document using a utility called Mail Merge. The list of invitees should not be less than 15. Apply formatting to the invitation - apply page borders to the final merged document. Provide the word "birthday invitation " in the header part and “name and contact number" in the footer part.	

6. Create the following table in MS Word and name it as UIM-Student.

Roll no.	Name	Father's Name
1	Aman	Akhilesh Sharma
2	Raman	Narendra Gupta

Insert one more row in the existing table and input the data as: Roll no=3, Name= Daman, Father's Name= Anuj Kumar. Insert one more column named Mother's Name, next to the Column named Father's Name and complete the data of existing records. The student named "Raman" decided to leave the course, so his record needs to be removed from the table. Apply table design to improve its visibility.

7. Create a power point presentation of topic of your own choice and apply different transitions, animations to the slide in your presentation. You must have at least 15 slides in your presentation.

NOTE:- The presentation must have table of contents, consisting of

1. Introduction
2. History/ Background
3. Features
4. Working
5. Advantages
6. Limitation
7. Conclusion, if applicable
8. References- mandatory
9. Thank you .

8. Create the record of at least 10 students in MS Excel consisting of the following Columns:-

Column 1. Serial number
Column 2. Roll number
Column 3. University ID
Column 4. Your name
Column 5. Father's name
Column 6. Mother's name
Column 7. Address
Column 8. Your contact number
Column 9. Father's contact number
Column 10. Mother's contact number
Column 11. Date of birth
Column 12. Total Marks obtained in previous semester
Column 13. Percentage obtained in previous semester

Consider the following sample table:

Student Data												
S. No.	R. No.	UID	Name	Father's Name	Mother's Name	Address	Contact No.	Father's Contact no.	Mother's Contact No.	Date of Birth	Marks Obtained in Previous Semester	Percentage Obtained in Previous Semester
1	1	UU101	Aman	Amrit	Sunita	#123, Prem Nagar, Dehradun, UK	7060909060	7060610908	7060915756	12 March 2000	404	
3	4	UU104	Cherry	Amar	Priya	#1199, Selaqui, Dehradun, UK	7060907272	7060612120	7060616968	24 March 2000	408	
4	5	UU105	Daman	Sonar	Anita	#1233, Clement Town, Dehradun, UK	7060907878	7060612726	7060617574	10 April 2000	420	
5	6	UU106	Ekdsh	Amit	Priya	#1323, Sudhowala, Dehradun, UK	7060608488	7060613322	7060618180	26 April 2000	340	
6	7	UU107	Gagan	Gurighal	Vashudhri	#1324, Sudhowala, Dehradun, UK	7060609060	7060613938	7060618786	17 March 2000	350	
7	9	UU109	Ishar	Jasjeet	Mamta	#1234, Clement Town, Dehradun, UK	7060609990	7060614544	7060619362	28 October 2000	359	
8	10	UU110	Jagan	Anuj	Rajshree	#1235, Clement Town, Dehradun, UK	7060610202	7060615150	7060619998	19 January 2000	351	
9	11	UU111	Kamal	Abhishek	Priyanka	#1026, Vasant Vihar, Dehradun, UK	7060610908	7060615756	7060620604	22 March 2000	440	
10	12	UU112	Madan	Pururaj	Anamika	#126, Prem Nagar, Dehradun, UK	7060611514	7060616362	7060621210	26 June 2000	468	

Column 4. Subject 2
Column 5. Subject 3
Column 6. Subject 4
Column 7. Subject 5
Column 8. Calculate the sum of marks obtained in all the subject
Column 9. Calculate percentage marks obtained
Column 10. If percentage is >=40 then display "Pass" in front of that cell otherwise display "Fail"?
Consider the following sample data:

Student Data												
S. No.	R. No.	UID	Name	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5	Marks Obtained	Percentage	Result	Remarks
1	1	UU101	Aman	61	76	88	66	67	358	71.6	Pass	
2	2	UU102	Baman	43	82	40	82	87	334	66.8	Pass	
3	4	UU104	Cherry	90	67	52	81	82	372	74.4	Pass	
4	5	UU105	Daman	40	78	54	58	67	297	59.4	Pass	
5	6	UU106	Elvish	89	63	85	62	83	382	76.4	Pass	
6	7	UU107	Gagan	98	54	90	56	68	366	73.2	Pass	
7	9	UU109	Ishar	97	74	61	68	94	394	78.8	Pass	
8	10	UU110	Jagan	50	93	72	71	58	344	68.8	Pass	
9	11	UU111	Kamal	92	88	72	83	40	375	75	Pass	
10	12	UU112	Madan	91	51	57	83	48	330	66	Pass	

10. In the above task include the following column as well:
Column 11. Display remarks as "Excellent" if percentage of student is greater than or equal to 85 but less than 95 and display remarks as "Distinction" if percentage is greater than or equal to 95 but less than or equal to 100.

11. Consider the following sample data of students:

S. No.	Male Height	Female Height
1	159	152
2	162	148
3	163	156
4	164	155

1. Find the average height of male and female students respectively.
2. Find the maximum and minimum height of male and female students respectively.

MCA573: OOPS CONCEPTS USING C++ LAB		
Course Outcome (CO)		
CO1	Understand the difference between the top-down and bottom-up approach.	
CO2	Describe the object-oriented programming approach in connection with C++.	
CO3	Apply the concepts of object-oriented programming.	
CO4	Illustrate the process of data file manipulations using C++.	
CO5	Apply virtual and pure virtual function & complex programming situations.	
DETAILED SYLLABUS		

1

Raising a number n to a power p is the same as multiplying n by itself p times. Create a function called power ( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

2

Create a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

```
Enter coordinates for P1: 3 4
Enter coordinates for P2: 5 7
Coordinates of P1 + P2
are : 8, 11
```

3

Create the equivalent of a four-function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the Specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result.

When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be Y or N . Some sample interaction with the program might look like this.

```
Enter first number, operator, second
number: 10/ 3 Answer = 3.333333
Do another (Y/ N)? Y
Enter first number, operator, second
number 12 + 100 Answer = 112
Do another (Y/ N)? N
```

4

A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Develop a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

```
Enter your area code, exchange, and number:
415 555 1212 My number is (212) 767-8900
Your number is (415) 555-1212
```

I	5 Create two classes DM and DB which store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results may be a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or meters and centimeters depending on the object on display.
	6 Create a class rational which represents a numerical value by two double values- NUMERATOR & DENOMINATOR. Include the following public member Functions:constructor with no arguments (default). constructor with two arguments. void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator. Overload + operator to add two rational number. Overload >> operator to enable input through cin. Overload << operator to enable output through cout. Write a main ( ) to test all the functions in the class.
	7 Consider the following class
	definition class father {
	protected : int age;
	public;
	father (int x) {age = x;}
	virtual void iam()
	{ cout << I AM THE FATHER, my age is : << age<< end1:}
	};
	Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes.Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.
	8 A hospital wants to create a database regarding its indoor patients. The information to store include
	a. Name of the patient
	b. Date of admission
	c. Disease
	d. Date of discharge
	Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).
	9 Imagine a toll booth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash
		8

total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

10 Write a function called reversit ( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon s famous phrase. Able was I ere I saw Elba) .

11 Make a class Employee with a name and salary. Make a class Manager inherit from Employee. Add an instance variable, named department, of type string. Supply a method to string that prints the manager s name, department and salary. Make a class Executive inherit from Manager. Supply a method to String that prints the string Executive followed by the information stored in the Manager superclass object. Supply a test program that tests these classes and methods.

12 Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data ( ) to initialize base class data members and another member function display_area ( ) to compute and display the area of figures. Make display_area ( ) as a virtual function and redefine this function in the derived classes to suit their requirements.Using these three classes, design a program that will accept dimensions of a triangle or a rectangle interactively and display the area.

Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows: Area of rectangle = x * y,

Area of triangle =

½ * x * y

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MCA575: WEB DEVELOPMENT TECHNOLOGIES LAB		
Course Outcome (CO)		
CO1	Define the principle of Web page	
CO2	Define the basics in web design	
CO3	Visualize the basic concept of HTML.	
CO4	Recognize the elements of HTML.	
CO5	Develop the concept of web publishing	
DETAILED SYLLABUS		
	1 Develop static pages (using only HTML) of an online Book store. The pages should resemble: www.amazon.com The website should consist the following pages. • Home page, • Registration and user Login, • User profile page, • Books catalog, • Shopping cart, • Payment By credit card, • Order confirmation. 2 Validate the Registration, user login, user profile and payment by credit card pages using JavaScript. 3 Design a web page using CSS (Cascading Style Sheets) which includes the following: • Use different font, styles: In the style definition you define how each selector should work (font, color etc.). • Then, in the body of your pages, you refer to these selectors to activate the styles. 4 Design a web page using CSS (Cascading Style Sheets) which includes the following: • Set a background image for both the page and single elements on the page • Control the repetition of the image with the background-repeat property 5 Design an HTML page with JavaScript that takes a number from one text field in the range 0-999 and display it in other text field in words. If the number is out of range, it should show "out of range" and if it is not a number, it should show "not a number" message in the result box. 6 Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt 7 Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems: a. Parameter: A string Output: The position in the string of the left-most vowel b. Parameter: A number Output: The number with its digits in the reverse order 8 Develop a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings. 9 Develop a PHP program to gerent online electricity bill where user provides the input	

of previous reading and present reading and prepare an electricity bill using the following conditions.

Units Consumed	Rate
<100	Rs 3/Unit
Between 100 and 200	Rs 4/Unit
Between 201 and 300	Rs 5/Unit
>301	Rs 6 /Unit

10 Design an HTML form to input the salary details of an employee (Employee name, Basic pay, DA and HRA). Write a PHP script to accept user input data and store it in a text file. Write a PHP script to display the contents of the file.

11 Develop a PHP program to implement a session based counter which counts the number of how time dose the user view the web page for this create a session variable using PHP. Display the session variable using PHP.

12 Create a PHP program to develop a web application which display the result of the student I which users inputs the marks list of the student and connect to a database and retrieve data from a table and show the details in a neat format
a) Mark list of a student is entered and saved to MySQL table using PHP
b) Data stored in MySQL table is displayed

Syllabus

MCA 1st Year

IInd Semester

MCA502: OPERATING SYSTEMS		
Course Outcome (CO)		
CO1	To understand the basic components of a computer operating system, and the interactions among the various components.	
CO2	The course will cover an introduction on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.	
CO3	Responsible for allocating resources to users and processes	
CO4	Some operating systems implement significant OS functionality in user-mode, e.g. User-mode such as Linux.	
CO5	Program execution, Access to I/O devices – Display, disk, network, printer, keyboard, camera, etc.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction**: Operating System Structure- Layered structure, System Components, Operating system functions, Classification of Operating systems-Batch, Interactive, Timesharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multi process Systems, Multithreaded Systems, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.	**8**
II	**Concurrent Processes**: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation, Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem ,Inter Process Communication models and Schemes, Process generation.	**8**
III	**CPU Scheduling:** Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block(PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.	**8**
IV	**Memory Management:** Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.	**8**
V	**I/O Management and Disk Scheduling**: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File System implementation issues, File system protection and security	**8**

Suggested Readings:

1. Silberschatz A., Galvin P. B. and Gagne G., "Operating Systems Concepts", Wiley Pub.
2. Halder S. and Arvind A. A "Operating Systems", Pearson Education.
3. Dietel H. M, " An Introduction to Operating System", Pearson Education.
4. Stallings W., "Operating Systems: Internals and Design Principles", Pearson Education.
5. Harris J.A., "Operating Systems (Schaum's Outlines)", McGraw Hill Education.

MCA504: DATA STRUCTURE & ANALYSIS OF ALGORITHM		
Course Outcome (CO)		
CO1	Understanding the linear and non-linear data structures, sorting and searching operations, File structures.	
CO2	Analyse the performance of - Stack, Queue, and Lists.	
CO3	Analyse the performance of Trees, Graphs, Searching and Sorting techniques.	
CO4	Implement all the applications of Data structures in a high-level language.	
CO5	Design and apply appropriate data structures for solving computing problems	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to data structure:** Data, Entity, Information, Difference between Data and Information, Data type , Build in data type, Abstract data type, Definition of data structures, Types of Data Structures :Linear and Non- Linear Data Structure, Introduction to Algorithms: Definition of Algorithms, Difference between algorithm and programs, properties of algorithm, Algorithm Design Techniques, Performance Analysis of Algorithms, Complexity of various code structures, Order of Growth, Asymptotic Notations. **Arrays:** Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulaefor1-D, 2-D Array Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable.	**8**
II	**Stacks**: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C++, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C++, Dequeue and Priority Queue. **Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution. Techniques used in Hashing.	**8**
III	**Sorting:** Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time: Counting Sort and Bucket Sort. **Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component.	**8**
IV	**Trees:** Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Complete Binary Tree, A Extended Binary Trees, Tree Traversal algorithms: In-order, Pre-order and	**8**

	Post-order, Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching &Modification of data in Binary Search Tree. Threaded Binary trees, Huffman coding using Binary Tree, AVL Tree and B Tree.	
V	Divide and Conquer with Examples Such as Merge Sort, Quick Sort, Matrix Multiplication: Strassen's Algorithm Dynamic Programming: Dijikstra, Algorithm, Bellman Ford Algorithm, All- pair Shortest Path: Warshal Algorithm, Long Common Sub-sequence Greedy Programming Primsand Kruskal algorithm	**8**

Suggested Readings:

1. Cormen T. H., Leiserson C. E., Rivest R. L. and Stein C., "Introduction to Algorithms", PHI.
2. Horowitz E., Sahni S. and Rajasekharan S., "Fundamentals of Computer Algorithms", Universities Press.
3. Dave P. H. and Dave H. B, "Design and Analysis of Algorithms", Pearson Education.
4. Lipschuts S., "Theory and Problems of Data Structures Schaum's Series)", Tata McGraw-Hill.
5. Goyal K. K., Sharma S. and Gupta A., "Data Structures and Analysis of Algorithms", HP Hamilton.
6. Samanta D., "Classic Data Structures", Prentice Hall India.
7. Goodrich M. T. and Tomassia R., "Algorithm Design: Foundations, Analysis and Internet Examples", John Wiley and sons.
8. Sridhar S., "Design and Analysis of Algorithms", Oxford Univ. Press.
9. Aho A., Ullman J. and Hopcroft J., "Design and Analysis of algorithms", Pearson Education.
10. Neapolitan R. and K. Naimipour, "Foundations of Algorithms", Jones and Bartlett Student Edition.

MCA506: RELATIONAL DATABASE MANAGEMENT SYSTEMS		
Course Outcome (CO)		
CO1	Identify the basic concepts and various data model used in database design ER modelling concepts and architecture use and design queries using SQL.	
CO2	Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression from queries.	
CO3	Recognize and identify the use of normalization and functional dependency, indexing and hashing technique used in database design.	
CO4	Recognize/ identify the purpose of query processing and optimization and also demonstrate the basic of query evaluation.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction:** Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modelling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	**8**
II	**Relational data Model and Language:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PLSQL	**8**
III	**Data Base Design& Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design	**8**
IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict& View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Check points, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System	**8**
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	**8**

Suggested Readings:

1. Silbertschatz A., Korth H. and Sudarshan S., "Database Concepts", McGraw Hill.
2. Date C. J., "An Introduction to Database Systems", Addision Wesley.
3. Elmasri R. and Navathe S., "Fundamentals of Database Systems", Pearson Education.
4. O'Neil P., "Databases", Elsevier Publications.

MCA508: ARTIFICIAL INTELLIGENCE USING PYTHON		
Course Outcome (CO)		
CO1	Under the basic concepts of Python Programming	
CO2	Develop algorithmic solutions to simple computational problems	
CO3	Structure simple Python programs for solving problems	
CO4	Represent compound data using Python lists, tuples, dictionaries	
CO5	Develop applications using file and exception handling concepts	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Artificial Intelligence:** Introduction to artificial intelligence, Historical development and foundation areas of artificial intelligence, Tasks and application areas of artificial intelligence. Introduction, types and structure of intelligent agents, Computer Vision, Natural language processing.	**8**
II	**Searching Techniques**: Introduction, Problem solving by searching, Searching for solutions, Uniformed searching techniques, Informed searching techniques, Local search algorithms, Adversarial search methods, Search techniques used in games, Alpha-Beta pruning	**8**
III	**Introduction to Python**: Importance of Python, Installing and working with Python in Windows, Linux and Mac, Using Python as calculator, Comments, How to define main function in Python The concept of data types - Variables, Arithmetic Operators and Expressions.	**8**
IV	**String manipulations** - Subscript Operator, Indexing, Slicing a string, Converting strings to numbers and vice versa, split function, Control flow - if statements, for and while loops, nested loops, Shortcircuit (lazy evaluation), range() function, break and continue statements, pass statements	**8**
V	**Data Structures**: Lists - Basic list operations, Replacing, inserting, removing an element; Searching and sorting a list, Methods of list objects, Using lists as Stacks and Queues, How efficient lists are when used as stack or queue, List and nested list Comprehensions Tuple, Sets, Difference between list and tuple, Dictionary - adding and removing keys, accessing and replacing values, traversing dictionaries.	**8**

Suggested Readings:

1. Russell S. and Norvig P., "Artificial Intelligence – A Modern Approach", Pearson Education.
2. Rich E. and Knight K., "Artificial Intelligence", McGraw Hill Publications.
3. Charnik E. and McDermott D., "Introduction to Artificial Intelligence", Pearson Education.
4. Patterson D. W., "Artificial Intelligence and Expert Systems", Prentice Hall of India Publications.
5. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

MCA510: COMPUTER BASED OPTIMIZATION TECHNIQUES		
Course Outcome (CO)		
CO1	Ability to apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems	
CO2	Ability to go in research by applying optimization techniques in problems of Engineering and Technology	
CO3	Ability to solve the mathematical results and numerical techniques of optimization theory to concrete Engineering problems by using computer software	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**PRELIMINARIES: -** Inventory Models and Replacement problems: Inventory models – various costs-deterministic inventory models, Single period inventory model with shortest cost, stochastic models, Application of inventory models, Economic lot sizes- price breaks, and Replacement problems-capital equipment-discounting costs- replacement in anticipation of failure- group replacement-stochastic nature underlying the failure phenomenon	**8**
II	**LINEAR PROGRAMMING PROBLEMS (LPP): -** Definition of LPP, Graphical Solutions of Linear Programming Problems, Simplex Method, and Artificial Variable Method, Two Phase Method, Charnes' Big-M Method, Sensitivity Analysis, Revised Simplex Method, Duality, Dual Simplex Method	**8**
III	**INTEGER LINEAR PROGRAMMING PROBLEMS: -** Integer Linear Programming Problems, Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and Bound Method, 0-1 integer linear programming problem. Transportation Problems: Introduction to Transportation Model, Matrix Form of TP, Applications of TP Models, Basic Feasible Solution of a TP, Degeneracy in TP, Formation of Loops in TP, Solution Techniques of TP, Different Methods for Obtaining Initial Basic Feasible Solutions viz. Matrix Minima Method, Row Minima Method, Column Minima Methods, Vogel's Approximation Method, Techniques for Obtaining. Assignment Problems: Definition, Hungarian Method for AP.	**8**
IV	**INTRODUCTION TO NLP: -** Definition of NLP, Convex Programming Problems, Quadratic Programming Problems, Wolfe's Method for Quadratic Programming, Kuhn-Tucker Conditions, Geometrical Interpretation of KT- Conditions, KT-Points etc. Dynamic Programming: Bellman's Principle of optimality of Dynamic Programming, Multistage decision problem and its solution by Dynamic Programming with finite number of stages, Solution of linear programming problems as a Dynamic Programming problem	**8**
V	**QUEUING THEORY: -**Introduction to Queues, Basic Elements of Queuing Models, Queue Disciplines, Memoryless Distribution, Role of Exponential and Poisson Distributions, Markovian Process, Erlang Distribution, Symbols and Notations, Distribution of Arrivals, Distribution of Service Times, Definition of Steady and Transient State, Poisson Queues.	**8**

Suggested Readings:

1. Hadley, G., "Linear Programming, and Massachusetts", Addison-Wesley
2. Taha, H.A," Operations Research – An Introduction", Macmillian.
3. Hiller, F.S., G.J. Lieberman," Introduction to Operations Research", Holden-Day
4. Swarup K etal, "Operation Research", S. Chand.

MCA580: DATA STRUCTURE USING C++ LAB		
Course Outcome (CO)		
CO1	Understanding the linear and non-linear data structures, sorting and searching operations, File structures.	
CO2	Analyse the performance of - Stack, Queue, and Lists.	
CO3	Analyse the performance of Trees, Graphs, Searching and Sorting techniques.	
CO4	Implement all the applications of Data structures in a high-level language.	
CO5	Design and apply appropriate data structures for solving computing problems	
DETAILED SYLLABUS		
	Program in C++ for following: 1. To implement addition and multiplication of two 2D arrays. 2. To transpose a 2D array. 3. To implement stack using array. 4. To implement queue using array. 5. To implement circular queue using array. 6. To implement stack using linked list. 7. To implement queue using linked list. 8. To implement circular queue using linked list. 9. To implement binary tree using linked list. 10. To implement binary search tree using linked list. 11. To implement tree traversals using linked list. 12. To implement BFS using linked list. 13. To implement DFS using linked list. 14. To implement Linear Search. 15. To implement Binary Search. 16. To implement Bubble Sorting. 17. To implement Selection Sorting. 18. To implement Insertion Sorting. 19. To implement Merge Sorting. 20. To implement Heap Sorting.	

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MCA582: RDBMS LAB

Course Outcome (CO)		
CO1	Identify the basic concepts and various data model used in database design ER modelling concepts and architecture use and design queries using SQL.	
CO2	Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression from queries.	
CO3	Recognize and identify the use of normalization and functional dependency, indexing and hashing technique used in database design.	
CO4	Recognize/ identify the purpose of query processing and optimization and also demonstrate the basic of query evaluation.	
CO5	Apply and relate the concept of transaction, concurrency control and recovery in database.	

DETAILED SYLLABUS

1. Create a table named uim_employee having attributes such as: Employee id, Employee name, Employee's department number, Employee's date of joining, Employee's salary, Employee's email_id and Employee's contact number.
   Consider the following table:

Attribute	Datatype	Size
employee_id	Varchar2	10
employee_name	Char	25
employee_department_no	Number	03
employee_date_of_joining	Date	-
employee_salary	Number	8,2
employee_email_id	Varchar2	30
employee_contact_no	Number	12

Note: Insert department number values as 111, 222, 333, 444, ……..etc.

Note: Insert employee id values as UU1001, UU1002, UU1003, UU1004, ……..etc.

Write SQL queries to:

i. Insert at least 10 tuples in the table.

ii. Display employee's complete details including *employee_id, employee_name, employee_department_no, employee_date_of_joining, employee_salary, employee_email_id* and *employee_contact_no.*

iii. Display employee's complete details including *employee_id, employee_name, employee_department_no, employee_date_of_joining, employee_salary, employee_email_id* and *employee_contact_no* who work in department number 444.

iv. Display *employee_id, employee_name* and *employee_date_of_joining who work in* work in department number 222.

v. Delete the employee's details having *employee_id* as UU1003.

vi. Update employee_contact_no to 9592929295 having *employee_id* as UU1007.

2. Implement DDL and DML on the uim_employee table.

Consider the following table:

Attribute	Datatype	Size
employee_id	Varchar2	10
employee_name	Char	25
employee_department_no	Number	03
employee_date_of_joining	Date	-
employee_salary	Number	8,2
employee_email_id	Varchar2	30
employee_contact_no	Number	12

i. Add a new column named *employee_address* having data type as varchar2, size 30 in the *uim_employee* table.

ii. Update the addresses of existing uim_employees in the table.

iii. Drop the column named *employee_date_of_joining* from the table.

iv. Modify the size of the column named *employee_contact_no* to 14.

v. Rename the table to *uim_employee_details* from the table name *uim_employee*.

vi. Truncate as the records from the *uim_employee_details* table.

vii. Drop the table named *uim_employee_details.*

3. Implementation of keys and constraints concept. Create a table named uim_student having attributes such as: student's roll number, student's name, student's date of birth, student's course, student's house address, student's contact number, student's aadhaar number. The attribute named: student_roll_no has a PRIMARY KEY constraint, student_name has NOT NULL constraint, student_ aadhaar _no as UNIQUE constraint.

Consider the following table:

Attribute	Datatype	Size	Constraint
student_roll_no	Number	3	PRIMARY KEY
student_name	Char	25	NOT NULL
student_date_of_birth	Date	-	-
student_course	Varchar	15	-
student_address	Varchar2	30	-
student_contact_no	Number	10	-
student_aadhaar_no	Number	12	UNIQUE

i. Describe the structure of uim_student table.

ii. Insert few tuples in the table.

iii. Examine the error message by inserting same *student_roll_no* values for two rows. Write the error message and reason.

iv. Examine the error message by NOT inserting *student_name* value in a row in the table.

Write the error message and reason.

v. Examine the error message by inserting same *student_ aadhaar_no* values for two rows. Write the error message and reason.

4. Implementation of Foreign key concept using two tables named: uim_employee and uim_department. The employee table has employee's id, employee's name and employee's department number. The department table has department number, department name and department location.

Consider the following two tables:

Table name: uim_employee			
Attribute	Data type	Size	Constraint
employee_id	Char	8	-
employee_name	Varchar2	20	-
employee_department_no	Number	3	FOREIGN KEY

Table name: uim_department			
Attribute	Data type	Size	Constraint
department_no	Number	3	PRIMARY KEY
department_name	Char	15	-
department_location	Varchar2	20	-

i. Display the structure of uim_employee table
ii. Display the structure of uim_department table
iii. Insert at least three department details in the uim_department table.
iv. Display the data of uim_department table.
v. Insert employee's details working in the corresponding departments as in the uim_department table.
vi. Display the data of uim_department table.
vii. Examine the error message by inserting a value in *employee_department_no* which is NOT there in uim_department table's *department_no*. Write the error message and reason.
iii. Delete any department number from the uim_department table and examine its effects in uim_employee table.

5. Create a table named *employee_contact_details* from *employee* table by taking the attribute named: *employee_id*.

Consider the table below:

Table name: *employee_contact_details*		
Attribute	Datatype	Size
employee_id	employee_id from employee table	

i. Display the contents of *employee_contact_details*table

ii. Add a new column employee_contact_no having data type as Number and size as 12 in *employee_contact_details* table

iii. Display the contents of employee_contact_details table.
iv. Update the contact details of existing employees

v.Display the updated contents of employee_contact_details table

6. Create a table named uim_book having the attributes related to book id, book name and book theme. The *book_theme* attribute can have only two values: IT or MGT where IT is Information Technology and MGT is Management. Apply CHECK constraint on the attribute named *book_theme*.
Consider the table below:

Table name: book			
Attribute	Datatype	Size	Constraint
Book_id	Number	10	PRIMARY KEY
book_name	Varchar2	25	NOT NULL
book_theme	Char	4	CHECK

i.Describe the structure of uim_book table.

ii.Insert few tuples in the uim_book table.

iii.Display the contents of uim_book table.

iv.Examine the error message by inserting a value other than IT/MGT in column named *book_theme*. Write the error message and reason.

7. Extract the data from both the tables by performing join. Given two tables named: uim_employee and uim_department. The employee table has attributes related to employee's id, employee's name and employee's department number. The department table has attributes related to department number, department name and department location.
Consider the following two tables:

Table name: uim_employee			
Attribute	Data type	Size	Constraint
employee_id	Char	8	-
employee_name	Varchar2	20	-
employee_department_no	Number	3	FOREIGN KEY

Table name: uim_department			
Attribute	Data type	Size	Constraint
department_no	Number	3	PRIMARY KEY
department_name	Char	15	-
department_location	Varchar2	20	-

i.Display the structure of uim_employee table
ii.Display the structure of uim_department table
iii.Insert at least three department details in the department table.

iv.Display the data of uim_department table.
v.Insert employee's details in uim_employee table who workin the corresponding departments as in the uim_department table.
vi.Display the data of uim_employee table.
vii.Display employee_id, employee_name, department_no and department_name of employees from both the tables uim_employee and uim_department by performing join.

viii. Display employee_id, department_no, department_name and department_location of employees from both the tables uim_employee and uim_department by performing join.

8. The data in the table can be grouped based on certain attributes. Consider the book table having attributes as book_id, book_name, book_theme and book_price.
Consider the table below:

Table name: uim_book			
Attribute	Datatype	Size	Constraint
Book_id	Number	10	PRIMARY KEY
book_name	Varchar2	25	NOT NULL
book_theme	Char	4	CHECK

Note: the book_theme can either be 'it' or 'mgt' only.

i. Add a new column named book_price having data type as Number and size as 7,2 in the exisiting table named uim_book.

ii. Display the contents of uim_book table.

iii. Update the book prices of available books in the uim_book table.

iv. Display the contents after updation in uim_book table.

v. Find the sum of all the book price based on the book theme.

vi. Display the maximum book_price in each group of book_theme.

9. There are numerous aggregate functions that can be performed on table(s). Consider the attributes in the employee table as: employee's id, employee's name, employee's department number, employee's designation, employee's date of joining, employee's salary, employee's email id, employee's contact no and employee's aadhaar number.
Consider the following uu_employee table:

Attribute	Datatype	Size	Constraint
employee_id	Varchar2	10	PRIMARY KEY
employee_name	Char	25	NOT NULL
employee_department_no	Number	03	NOT NULL
employee_designation	Varchar2	15	NOT NULL
employee_date_of_joining	Date	-	NOT NULL
employee_salary	Number	8,2	NOT NULL
employee_email_id	Varchar2	30	NOT NULL
employee_contact_no	Number	12	NOT NULL
employee_aadhaar_no	Number	12	UNIQUE

i. Insert few tuples in the uu_employee table.

ii. Display the contents of uu_employee table

iii. Calculate the sum of salaries of all the employees.

iv. Calculate the sum of salaries of employees working in department number 222.

10. Demonstrate the following based on the uu_employee table.

Consider the following table data:

uu_employee									
EMPLOYEE_ID	EMPLOYEE_NAME	EMPLOYEE_DEPARTMENT_NO	EMPLOYEE_DESIGNATION	EMPLOYEE_DATE_OF_JOINING	EMPLOYEE_SALARY	EMPLOYEE_EMAIL_ID	EMPLOYEE_CONTACT_NO	EMPLOYEE_AADHAAR_NO	EMPLOYEE_DATE_OF_RESIGNING
uu1001	aman	111	assistant prof.	17-Sep-18	30000	uu.aman@gmail.com	7060106060	617289452563	
uu1002	baman	222	assistant prof.	1-Aug-18	30000	uu.baman@gmail.com	7060106070	617289055563	
uu1003	chaman	111	professor	1-Jul-18	70000	uu.chaman@gmail.com	7160106060	697289452563	
uu1004	daman	111	assistant prof.	7-Aug-19	35000	uu.daman@gmail.com	7060101060	607289452563	10-Jul-20
uu1005	raman	111	professor	2-Feb-20	32000	uu.raman@gmail.com	7080106060	637289452563	

i. Count the number of employees in the uu_employee table.

Display the maximum salary of employees having *employee_designation* as "assistant prof.".

ii. Display the minimum salary of employees having *employee_designation* as "Professor".

iii. Calculate the average of salaries of all the employees.

11. Implement the single-row character function on the customer table. The customer table as attributes related to customer's id, customer's first name, customer's last name, customer's contact number, customer's house number, customer's street of address, customer's city of address, customer's state of address and customer's email id.

Consider the following customer table:

Table name: uim_customer			
Attribute	Datatype	Size	Constraint
customer_id	Varchar2	10	PRIMARY KEY
customer_first_name	Char	25	NOT NULL
customer_last_name	Char	25	-
customer_contact_no	Number	03	NOT NULL
customer_house_no	Number	03	-
customer_home_street	Varchar2	15	-
customer_home_city	Varchar2	15	-
customer_home_state	Varchar2	15	-
customer_email_id	Date	-	-

i. Insert few tuples in the uim_customer table

ii. Concatenate customer_first_name as My first name is ……. in display.

iii. Display the customer_first_name in upper case.

iv. Display the customer_ home_city in with first letter as capital and remaining in lower case (e.g. Dehradun).

12. Implement the date functions on uu_employee table. Consider the attributes in the employee table as: employee's id, employee's name, employee's department number, employee's designation, employee's date of joining, employee's salary, employee's email id, employee's contact no, employee's aadhaar number and employee's date of resigning.
Consider the following employee table:

Attribute	Datatype	Size	Constraint
employee_id	Varchar2	10	PRIMARY KEY
employee_name	Char	25	NOT NULL
employee_department_no	Number	03	NOT NULL
employee_designation	Varchar2	15	NOT NULL
employee_date_of_joining	Date	-	NOT NULL
employee_salary	Number	8,2	NOT NULL
employee_email_id	Varchar2	30	NOT NULL
employee_contact_no	Number	12	NOT NULL
employee_aadhaar_no	Number	12	UNIQUE
employee_date_of_resigning	Date	-	

i. Describe the structure of uu_employee table.

ii. Add a new column named employee_date_of_resigning having date data type in uim_employee table

iii. Update the data in uu_employee table those who have resigned (wherever applicable)

iv. Display the number of months between employee's joining and resignation. (Note: There might be few employees who have resigned).

v. Display the last day of the month in which employees have resigned.

vi. Calculate the working employee's experience in the current organization. (Note: Use sysdate)

MCA684: A. I. USING PYTHON LAB		
Course Outcome (CO)		
CO1	Under the basic concepts of Python Programming	
CO2	Develop algorithmic solutions to simple computational problems	
CO3	Structure simple Python programs for solving problems	
CO4	Represent compound data using Python lists, tuples, dictionaries	
CO5	Develop applications using file and exception handling concepts	
DETAILED SYLLABUS		
	1. Write a python program to implement Breadth First Search Traversal? 2. Write a python program to implement Water Jug Problem? 3. Write a python program to remove punctuations from the given string? 4. Write a python program to sort the sentence in alphabetical order? 5. Write a program to implement Hangman game using python. 6. Write a program to implement Tic-Tac-Toe game using python. 7. Write a python program to remove stop words for a given passage from a text file using NLTK? 8. Write a python program to implement stemming for a given sentence using NLTK? 9. Write a python program to POS (Parts of Speech) tagging for the give sentence using NLTK? 10. Write a python program to implement Lemmatization using NLTK? Write a python program to for Text Classification for the give sentence using NLTK	

LSM602: LSM-I (LIFE SKILLS & MENTORING -I)		
Course Outcome (CO)		
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession.	
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	
CO3	Understand the value of harmonious relationship based on trust and respect in their life and profession.	
CO4	Understand the role of a human being in ensuring harmony in society and nature.	
CO5	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	
DETAILED SYLLABUS		
I	**Overview of Life Skills:** Meaning and significance of life skills, Life skills identified by WHO: Self- awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion. Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ	
II	**Self-awareness:** definition, need for self-awareness; Coping With Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback. Stress Management: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action- oriented, emotion oriented, acceptance- oriented, resilience, Gratitude Training, **Coping with emotions:** Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques. **Morals, Values and Ethics:** Integrity, Civic Virtue, Respect for Others, Living Peacefully. Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Cooperation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.	
III	21st century skills: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence. Steps in problem solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking	
IV	Group and Team Dynamics: Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, Virtual Teams.	

	Managing team performance and managing conflicts, Intrapreneurship.	
V	Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.	

Suggested Readings:

1. Girish Batra, Experiments in Leadership, Chennai: Notion Press, 2018
2. Mitesh Khatri, Awaken the Leader in You, Mumbai: Jaico Publishing House, 2013
3. Carnegie Dale, Become an Effective Leader, New Delhi: Amaryllis, 2012
4. Hall, C.S., Lindzey. G. & Campbell, J.B Theories of Personality. John Wiley & Sons,1998
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.

Syllabus

MCA 2nd Year
IIIrd Semester

MCA601: ADVANCED MACHINE LEARNING		
Course Outcome (CO)		
CO1	Classify the fundamentals of Machine Learning and Python programming.	
CO2	Implement and evaluate supervised learning models.	
CO3	Apply unsupervised learning techniques and dimensionality reduction.	
CO4	Develop deep learning models using TensorFlow and Keras.	
CO5	Explore advanced ML topics and real-world applications.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Machine Learning & Python Basics:** Overview of Machine Learning (ML), Types of ML: Supervised, Unsupervised, Reinforcement Learning; Applications of ML in Various Domains; Python Basics for ML: NumPy, Pandas, Matplotlib, Seaborn; Introduction to Scikit-Learn & TensorFlow	**8**
II	**Supervised Learning Techniques:** Regression Models: Linear Regression, Polynomial Regression, Ridge & Lasso Regression; Classification Models: Logistic Regression, Decision Trees, Random Forest, SVM; Performance Metrics: Accuracy, Precision, Recall, F1-Score, AUC-ROC; Overfitting & Underfitting, Cross-Validation	**8**
III	**Unsupervised Learning & Dimensionality Reduction:** Clustering Algorithms: K-Means, Hierarchical Clustering, DBSCAN; Dimensionality Reduction Techniques: PCA, LDA, t-SNE; Anomaly Detection & Outlier Analysis; Feature Engineering & Feature Selection; Applications of Unsupervised Learning	**8**
IV	**Deep Learning & Neural Networks:** Introduction to Neural Networks & Perceptron; Deep Learning with TensorFlow & Keras; Convolutional Neural Networks (CNN) for Image Processing; Recurrent Neural Networks (RNN) & LSTMs for Time Series Data; Transfer Learning & Pretrained Models	**8**
V	**Advanced Topics & Real-World Applications:** Natural Language Processing (NLP) with Python (NLTK, SpaCy); Reinforcement Learning Basics; Explainable AI & Model Interpretability (SHAP, LIME); Deploying ML Models (Flask, FastAPI, Streamlit); Case Studies: ML in Healthcare, Finance, E-commerce, and Cybersecurity	**8**

Suggested Readings:

1. **"Machine Learning with Python" –** Abhishek Vijayvargia
2. **"Practical Machine Learning with Python" –** Dipanjan Sarkar
3. **"Python Machine Learning" –** Ritesh Bhagwat
4. **"Machine Learning Using Python" –** U Dinesh Kumar, Manaranjan Pradhan
5. **"Hands-On Machine Learning with Python" –** Ashwin Pajankar

MCA613: AI FOR EVERYONE		
Course Outcome (CO)		
CO1	**Understand** the fundamental principles and applications of AI in different industries.	
CO2	**Explain** key AI techniques, including supervised and unsupervised learning, deep learning, and neural networks.	
CO3	**Analyze** ethical challenges and biases in AI systems and their impact on society.	
CO4	**Apply** AI-driven solutions in fields like healthcare, finance, and automation.	
CO5	**Critically evaluate** the benefits and risks associated with AI technologies.	

DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to AI (Concept + Hands-on):** What is AI? Understanding AI vs. Machine Learning vs. Deep Learning, AI in daily life: Smart assistants, AI in social media, AI in e-commerce, Prompt Engineering, Real Life Applications of AI. Tools: Explore AI-based tools (Google AI, ChatGPT , MetaAI,Gemini).	**8**
II	**Introduction to Machine Learning and Deep Learning:** Introduction to learning theory, Methods and Models.Supervised vs. Unsupervised Learning (Examples from real life), Reinforcement Learning, Introduction to ANN and Deep Learning.	**9**
III	**Computer Vision & Image Processing:** Introduction to Image processing and Computer Vision ?, Hardware used, Face Recognition, Object Detection, and AI-powered Cameras, How AI understands text & speech, AI in Chatbots, Sentiment Analysis, and AI-based Translation Practical	**9**
IV	**AI in Automation & Robotics:** AI-powered automation in businesses, How AI is used in robotics and smart homes, Ethical AI & Responsible AI, Bias in AI and fairness in decision-making, How to use AI responsibly.	**8**
V	**Mini AI Projects (Without Coding):** Hands-on Project Options: AI for Image Classification: Train an AI model to recognize objects Create an AI Chatbot: Use Dialog flow or Chatbot.com AI in Business: Automate tasks using AI-based productivity tools.	**8**

Suggested Readings:

1. **Software Engineering**, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
2. Software **2Engineering: A Primer**, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Software Engineering, **3Principles and Practices**, Deepak Jain, Oxford University Press.
4. Software Engineering1: **4Abstraction and modelling**, Diner Bjarne, Springer International edition, 2006.
5. Software **5Engineering2:** Specification of systems and languages, Diner Bjorner, Springer International edition 62006.
6. **Software Engineering** Principles and Practice, Hans Van Vliet, 3rd edition, John Wiley & 7Sons Ltd.
7. **7. Software Engineering3**: Domains, Requirements, and Software Design, D. Bjorner, 8Springer International Edition. 8. Introduction to Software Engineering, R. J. Leach, CRC Press.

MCA603: PROJECT MANAGEMENT		
Course Outcome (CO)		
CO1	Understand the principles and lifecycle of software project management.	
CO2	Identify and analyze project feasibility and scope.	
CO3	Apply scheduling, budgeting, and resource management techniques.	
CO4	Manage risks, quality, and communication in software projects.	
CO5	Use project management tools and methodologies like Agile, Scrum, and MS Project.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	Introduction to Project Management: Definition and Characteristics of a Project, Project Life Cycle and Process Groups, Roles of a Project Manager, Project Selection Methods, Project Feasibility Study.	**8**
II	Project Planning and Scheduling: Work Breakdown Structure (WBS), Project Scope Management, Time Estimation Techniques, Project Scheduling (Gantt Chart, PERT, CPM), Resource Allocation.	**9**
III	Cost, Risk, and Quality Management: Cost Estimation and Budgeting, Risk Management Planning, Risk Identification and Mitigation, Quality Planning, Assurance, and Control, Software Configuration Management.	**9**
IV	Project Execution and Communication: Team Formation and People Management, Conflict and Stakeholder Management, Communication Planning, Performance Monitoring (KPIs), Change Management.	**8**
V	Modern Approaches & Tools in Project Management: Agile Project Management & Scrum, Overview of Kanban, DevOps, Tools: Microsoft Project, Trello, JIRA, Project Closure and Post Implementation Review, Case Studies on Real-Life IT Projects.	**8**

Suggested Readings:

1. "Software Project Management" – Bob Hughes, Mike Cotterell, Rajib Mall – Tata McGraw Hill
2. "Information Technology Project Management" – Kathy Schwalbe – Cengage Learning
3. "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" – Harold Kerzner – Wiley
4. "Agile Project Management with Scrum" – Ken Schwaber – Microsoft Press
5. PMBOK® Guide (Project Management Body of Knowledge) – Project Management Institute (PMI)

MCA605: ADVANCE JAVA PROGRAMMING		
Course Outcome (CO)		
CO1	Establish database connections using JDBC, Execute SQL queries and manage database transactions.	
CO2	To Handle exceptions and manage resources effectively.	
CO3	Create and configure Java Servlets to handle HTTP requests and responses.	
CO4	Create JSP pages to generate dynamic web content, Use JSP expressions, scriptlets, and directives effectively.	
CO5	Understand the Model-View-Controller (MVC) design pattern.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to JDBC**: Overview of JDBC and its architecture, Setting up a database and JDBC driver, Establishing a database connection; **Executing SQL Queries with JDBC**: CRUD operations (Create, Read, Update, and Delete), Prepared statements and batch processing, Handling transactions and rollback.	**8**
II	**Exception Handling and Resource Management in JDBC**: Exception handling in JDBC, Closing connections and managing resources, Connection pools concepts; **Introduction to Servlets**: Overview of Servlets and their role in web applications, Creating and configuring a simple Servlet, Understanding the servlet lifecycle.	**8**
III	**Handling HTTP Requests and Responses** : Processing GET and POST requests, Reading request parameters and headers, Sending responses and setting response headers,; **Session Management and Cookies:** Understanding sessions in web applications, Implementing session tracking with cookies and URL rewriting, Managing session attributes.	**8**
IV	**Introduction to JSP:** Overview of JSP and its advantages, Creating a simple JSP page, Understanding JSP lifecycle; **JSP Expressions, Scriptlets, and Directives:** Using expressions and scriptlets in JSP, JSP directives and their usage, Integrating JSP with JavaBeans.	**8**
V	**Custom Tags and EL (Expression Language)**: Creating custom tags in JSP, Using Expression Language for data access, Best practices for JSP development; **Implementing MVC Architecture:** Understanding the MVC design pattern, Applying MVC principles in Servlets and JSP, Building a simple MVC web application.	**8**

Suggested Readings:

1. The Complete Reference: Java, Herbert Schieldt, TMH, 7th Edition 2006
2. Programming in JAVA, E. Balagurusamy, TMH, 2nd Edition 2007
3. Object Oriented Modeling and Design, James Rumbaugh et al, PHI, 4th Edition 2003
4. Object Oriented Analysis & Design with Application, Booch Grady, Pearson Education, New Delhi, 3rd Edition, 2006.

MCA607 :CLOUD COMPUTING (EL)		
Course Outcome (CO)		
CO1	Describe architecture and underlying principles of cloud computing.	
CO2	Explain need, types and tools of Virtualization for cloud.	
CO3	Describe Services Oriented Architecture and various types of cloud services.	
CO4	Explain Inter cloud resources management cloud storage services and their providers Assess security services and standards for cloud computing.	

DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction To Cloud Computing:** Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On- demand Provisioning.	**8**
II	**Cloud Enabling Technologies Service Oriented Architecture:** REST and Systems of Systems – Web Services – Publish, Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.	**8**
III	**Cloud Architecture, Services And Storage:** Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.	**8**
IV	**Resource Management And Security In Cloud:** Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.	**8**
V	**Cloud Technologies And Advancements Hadoop:** MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.	**8**

Suggested Readings:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.
5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

MCA609: NATURAL LANGUAGE PROCESSING (EL)		
Course Outcome (CO)		
CO1	Explain the Gain knowledge in automated Natural Language Generation and Machine Translation.	
CO3	Demonstrate the applications of NLP	
CO4	Analyze the semantic analysis of natural language.	
CO5	Examine the language generation and discourse analysis	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**OVERVIEW AND MORPHOLOGY:** Introduction – Models -and Algorithms - -Regular Expressions Basic Regular Expression Patterns – Finite State Automata Understand the wireless sensor network principles. Morphology -Inflectional Morphology - Derivational Morphology. Finite-State Morphological Parsing -- Porter Stemmer	**9**
II	**WORD LEVEL AND SYNTACTIC ANALYSIS:** N-grams Models of Syntax-Counting Words- Unsmoothed N-grams. Smoothing- Back-off Deleted Interpolation – Entropy - English Word Classes - Tag sets for English Part of Speech Tagging-Rule Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging.	**9**
III	**CONTEXT FREE GRAMMARS**: Context Free Grammars for English Syntax- Context-Free Rules and Trees -Understand the network simulation tools. Sentence- Level Constructions–Agreement – Sub Categorization. Parsing – Top-down – Early Parsing - feature Structures – Probabilistic Context-Free Grammars	**9**
IV	**SEMANTIC ANALYSIS:** Representing Meaning-Meaning Structure of Language-First Order Predicate Calculus Representing Linguistically Relevant Concepts -Syntax-Driven Semantic Analysis - Semantic Attachments -Syntax-Driven Analyzer. Robust Analysis - Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation - Information Retrieval	**9**
V	**LANGUAGE GENERATION AND DISCOURSE ANALYSIS**: Discourse -Reference Resolution - Text Coherence -Discourse Structure – Coherence. Dialog and Conversational Agents - Dialog Acts – Interpretation -Conversational Agents. Language Generation– Architecture-Surface Realizations - Discourse Planning. Machine Translation -Transfer Metaphor– Interlingua – Statistical Approaches	**9**

Suggested Readings:

1. Daniel Jurafsky and James H Martin," Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008
2. C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA:,1999

MCA611: NEURAL NETWORK (EL)		
Course Outcome (CO)		
CO1	Classify the role of neural networks in engineering, artificial intelligence, and cognitive modelling.	
CO2	Describe the concepts and techniques of neural networks through the study of important neural network models.	
CO3	Evaluate whether neural networks are appropriate to a particular application.	
CO4	Implement neural networks to particular application.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction: Biological Neuron:** Artificial Neural Model - Types of activation functions **Architecture:** Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks. **Learning:** Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem.	**9**
II	**Supervised Learning:** Perceptron learning and non-separable sets, a-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, g-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Multi-layered Network Architecture, Back propagation Learning Algorithm, Practical consideration of BP algorithm.	**9**
III	**Support Vector Machines and Radial Basis Function:** Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition.	**9**
IV	**Attractor Neural Networks:** Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application ofHopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.	**8**
V	**Self-organization Feature Map:** Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.	**8**

Suggested Readings:

Text Books:

1. Neural Networks A Classroom Approach— Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books:

1. Introduction to Artificial Neural Systems-J.M. Zurada, Jaico Publications 1994.
2. Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.

MCA615: CRYPTOGRAPHY & NETWORK SECURITY (EL)		
Course Outcome (CO)		
CO1	Define cryptography, its use, areas where cryptography is needed.	
CO2	Discuss the different available algorithms in terms of complexity, response time, key size, data size, security assurance, etc.	
CO3	Develop code to implement a cryptographic algorithm using any programming language.	
CO4	Classify the security concepts, Ethics in Network Security, security threats, and the security services.	
CO5	Analyze all key less and keyed algorithms to identify their strength and weaknesses and try to solve and remove the limitations or optimize the complexity of algorithm(s).	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Cryptography:** Introduction To Security Attacks, Services & Mechanisms, And Conventional Encryption: Classical Techniques, cryptanalytic attacks.	**6**
II	**Private Key Encryption:** Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, Double DES, Triples DES.	**8**
III	**Public Key Encryption:** Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm, public key distribution, symmetric key distribution using asymmetric cryptosystem.	**8**
IV	**Hash Functions:-** Message Authentication& Hash Functions, Authentication Functions, Message Authentication Codes (MAC), Secure Hash Algorithm (SHA), Digital Signatures.	**8**
V	**Application Layer Security:** Electronic Mail Security, Pretty Good Privacy (PGP). **Transport Layer Security:** Secure Socket Layer &Transport Layer Security. **Network Layer Security:** Authentication Header, Encapsulating Security Payloads. **Network and System Security:** Authentication Applications-KerberosX.509, Secure Electronic Transaction (Set), System Security: Intruders, Viruses, Firewall Design Principles.	**10**

Suggested Readings:

1. Cryptography and Network Security: Principles and Practice, William Stallings, Prentice Hall, New Jersey, 4th Edition.
2. Introduction to cryptography , JohannesA.Buchmann,Springer,Verlag,2001.
3. Cryptography and Network Security, Atul Kahate, TMH, 2nd Edition.
4. Cryptography, Forouzan, TMH,2007.

MCA617: QUANTUM COMPUTING (EL)		
Course Outcome (CO)		
CO1	The most relevant mathematical techniques	
CO2	Basic postulates of quantum mechanics and applications	
CO3	Basic EM theory with applications	
CO4	Basic statistical physics with applications to quantum systems	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	**8**
II	**Quantum correlations:** Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	**9**
III	**Quantum computing:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	**9**
IV	**Quantum information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	**8**
V	**Quantum error correction:** Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.	**8**

Suggested Readings:

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel, Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback – Import, Oct 2014
3. Computing since Democritus by Scott Aaronson, Computer Science: An Introduction by N. DavidMermin Yanofsky's and Mannucci, Quantum Computing for Computer Scientists

MCA619: BLOCKCHAIN ARCHITECTURE (EL)		
Course Outcome (CO)		
CO1	Define the Growth of blockchain technology, History of blockchain and Bitcoin	
CO2	Construct the Methods and Routes of decentralization, Decentralized organizations and platforms for decentralization.	
CO3	Sketch the Architecture, Life use cases of blockchain, Bitcoin digital keys and addresses, Limitations of Bitcoin.	
CO4	Describe the Double Spending, Bitcoin Network and payments, Bitcoin Clients and APIs.	
CO5	Demonstrate the Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, Design a distributed application, Blockchain applications.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Blockchain:** Definition and Key Characteristics of Blockchain; History and Evolution of Blockchain Technology; Distributed Ledger Technology (DLT); Types of Blockchain: Public, Private, Consortium, Hybrid; Advantages, Challenges, and Limitations of Blockchain	**8**
II	**Cryptographic Foundations:** Fundamentals of Cryptography; Hash Functions (SHA-256, Keccak); Digital Signatures and Public Key Cryptography; Merkle Trees and their Role in Blockchain;	**8**
III	**Blockchain Consensus Mechanisms:** Proof of Work (PoW); Proof of Stake (PoS); Delegated Proof of Stake (DPoS); Practical Byzantine Fault Tolerance (PBFT)	**8**
IV	**Blockchain Architecture and Components:** Structure of a Blockchain Block; Blockchain Network Components: Nodes (Full Nodes, Light Nodes, Mining Nodes); Smart Contracts and Decentralized Applications (DApps); Peer-to-Peer (P2P) Network and its Importance; Forks in Blockchain (Soft Forks vs. Hard Forks); Smart Contract Development with Solidity (Basics)	**9**
V	**Blockchain Platforms & Use Cases:** Bitcoin and Ethereum: Architecture and Features; Hyperledger and Permissioned Blockchain Networks; Decentralized Finance (DeFi) & Non-Fungible Tokens (NFTs); Blockchain in Supply Chain Management, Healthcare, and IoT; Legal and Regulatory Challenges in Blockchain	**9**

Suggested Readings:

1. "Mastering Blockchain" Imran Bashir
2. "Blockchain Technology and Applications" - Narayan Prusty
3. "Blockchain Technology: Concepts and Applications" - Debajani Mohanty
4. "Blockchain for Enterprise Architecture" - Vivek Acharya
5. "Blockchain and Smart Contracts: Design, Architecture, and Applications" Ashish M. Gujarathi

MCA671: MACHINE LEARNING with PYTHON PROGRAMMING LAB		
Course Outcome (CO)		
CO1	Understand and apply basic ML algorithms using Python.	
CO2	Perform data preprocessing and analysis.	
CO3	Build, train, and evaluate ML models.	
CO4	Select suitable algorithms for real-world problems.	
CO5	Develop a mini-project demonstrating end-to-end ML workflow.	

DETAILED SYLLABUS

Program No.	Topic	Hours
1	Basic Python operations (variables, lists, loops, functions)	**1**
2	NumPy for array operations and matrix manipulation	
3	Load and explore datasets using Pandas	**1**
4	Data cleaning – handle missing values, normalization, encoding	
5	Visualize data using Matplotlib and Seaborn (histograms, scatter plots, heatmaps)	**2**
6	Implement Linear Regression using Scikit-learn	
7	Implement Logistic Regression for classification	**1**
8	Implement K-Nearest Neighbors (KNN)	
9	Implement Decision Tree Classifier	**2**
10	Implement Support Vector Machine (SVM)	
11	Model accuracy, confusion matrix, precision, recall, F1-score	**1**
12	Implement K-Means Clustering	
13	Implement Hierarchical Clustering	**2**
14	Feature selection using correlation matrix or feature importance	
15	Train-Test Split and Cross-validation for model validation	

Suggested Readings:

1. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller and Sarah Guido, Publisher: O'Reilly Media

MCA673: ADVANCED JAVA PROGRAMMING LAB		
Course Outcome (CO)		
CO1	Designing of window based applications.	
CO2	To create a client and server communication using net package.	
CO3	Design reusable software components using java beans.	
CO4	Develop server side programming.	
CO5	Develop the dynamic web pages using JSP	
DETAILED SYLLABUS		
Sr No.	**Topic**	**Hours**
1	1. Write a Java Program to create an applet that show a simple message along with background and foreground colors? 2. Write a Java Program to create an applet that scrolls a message from left to right? 3. Write a Java Program to create an applet that receives a string and returns either it Uppercase or Lowercase, Reverse of given string, and length of a given String. 4. Write a java program to draw Lines, ovals, filled ovals and arcs, filled arcs? 5. Write a java program to draw rectangle, filled rectangle and rounded rectangle and filled rounded rectangle with any two colors? 6. Write a java program to draw a smiley face? 7. Write a Java program to demonstrate the mouse event handlers. 8. Write a Java program to demonstrate the key event handlers. 9. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box. 10. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. 11. Write a Java Program to create 4 push Buttons bearing the names of 4 colors. When a button is licked, that particular color is set as background color in a frame? 12. Write a Java Program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light	**1**

is turned on, and only one light can be on at a time No light is on when the program starts.

13. Write a Java Program a simple user form which reads the name of a user and mail id in Text fields, select gender with radio buttons, and selects some Known languages using checkboxes, and also enters an address in a text area. After filling details whenever a user press the "submit" button, then displays all the information about the user input.
14. Write a Java Program to create multiple frames, which create a Frame2 with a 'back 'button, such that when a user click 'back' button, Frame 2 is closed and we see the Frame1 only?
15. Write a Java Program to create an applet using Swings which contains two push buttons. If a user presses a particular button then display a message 'selected' button is pressed.
16. Write a Java Program to create a frame using swing in which create a push button with a label and image. When the button is clicked an image is displayed in the Frame?
17. Write a Java Program to create a student table, which includes name, roll no, branch and age or DOB?
18. Write a Java Program to create a tabbed pane with two tabs. In the first tab sheet, display some push buttons with names of Branches. In second tab sheet, display checkboxes with names of subjects.
19. Write a java program to create a menu with several menu items by implementing JMenu.
20. Write a java program to create a combo box with some name of some places. The user can select any one name from the list and the selected country name is displayed in the frame? (Use JComboBox)
21. Write a java program to select multiple places and displayed in Frame using JList?
22. Write a java program to create a simple visual bean with a area filled with a color. The shape of the area depends on the property shape. If it is set to true then the shape of the area is Square and it is Circle, if it is false. The color of the area should be changed dynamically for every mouse click. The color should also be changed if we change the color in the "property window ".
23. Write a java program to create a bean that performs conversion of American dollar to Indian rupee.
24. Write a java program to create a bean that counts the number of button clicks?
25. Write a Java program that implements a simple client/server application. The client sends data to a server. The server receives the data, uses it to produce a result, and then sends the result back to the client. The client displays the result on the console. For ex: The data sent from the client is the radius of a circle, and the result produced by the server is the area of the circle. (Use java.net)
26. Write a Java program to retrieve the information from the given URL? (Note: Read

	the URL from Command Line Arguments). 27. Write a java program to create a sample TCP chat application where client and server can chat with each other? 28. Installation of Apache Tomcat webserver. 29. Write a java Program to create a simple servlet and run it using tomcat server. 30. Write a java Program to create a servlet to read information from client Registration page? 31. Write a java Program to create a JSP page to display a simple message along with current Date? 32. Write a java Program to create a JSP page to display the random number?	

Suggested Readings:

1. Java; the complete reference, 7th editon, Herbert schildt, TMH.
2. Introduction to Java programming 6th edition, Y. Daniel Liang, pearson education.
3. An introduction to Java programming and object oriented application development, R.A. Johnson Thomson.
4. Core Servlets and Java Server pages volume1: Core Technologies By Marty Hall and Larry Brown Pearson.

MCA675: Mini Project LAB		
Course Outcome (CO)		
CO1	Identify project/research problems; understand information and grasp meaning; translate knowledge into new context; use information, methods, concepts, and theories of fundamental topics in computer science in new situations (Knowledge, Comprehension);	
CO2	Apply computer science principles and practices to a real-world problem; demonstrate in-depth knowledge in the area of the project they have undertaken; solve problems using required knowledge and skills; implement and test solutions/algorithms (Application and Evaluation);	
CO3	Identify potential solutions/algorithms for the project problem; see patterns and modularize the problem, recognize hidden meanings and identify components, show proficiency in software engineering principles (Analysis);	
CO4	Apply a software development methodology currently practiced in industry to produce software system in a rigorous and systematic way using different software life cycle phases (specification, architecture, design, implementation, validation, documentation) (Synthesis);	
CO5	Show evidence (group collaboration, regular meetings, email communications, significant knowledge and skills contributions, etc.) of working productively as an individual and in a team on a project that produces a significant software product (Team Work);	
CO6	Show evidence of competency in oral and written communications skills through oral presentations (project presentation, department seminar or conferences, client interactions), technical reports and/or published research papers in conferences and/or journals (Communications);	
CO7	Use modern techniques, skills and tools necessary for computer science practices relevant to the project they undertake; use techniques in recent research papers to solve problems (Lifelong Learning).	
DETAILED SYLLABUS		
Sr. N	**Topic**	**Hours**
	LAB: Besides completing the subject/Lab assignments, the students will be required to complete one mini project as follows: **MINI-PROJECT in VB, VC++ or Java under Linux(UNIX)/Windows** **In addition to completing Mini-Project, the students will be doing the exercises** provided by the respective teachers in their class rooms. The individual teachers who are teaching the courses will be responsible for completing their respective lab assignments.	

	Some of the representative areas/problems may include the following:	
1	Developing Window Based Applications using recent technologies using .NET Platform or Java Technologies like Java Servlet, Java Beans, COM, CORBA etc.	
2	Students should learn languages such as PROLOG or LISP to solve the Laboratory exercises.	
3	An expert system shell such as IITM rule be used to create a small expert system for, say, troubleshooting moped, VCR etc. Some suggested experiments are : Tour of India, Stable marriage problem, Game playing (such as bridge), coin change problem etc.	

Suggested Readings:

1. Robert Lafore, “Object Oriented Programming in C++”, Pearson
2. R. Brown, "Visual Basic .NET – Your Visual Blueprint for Building Versatile Programs on the .NET Framework", Wiley Publishing, Inc.
3. Ivan Bayross, "Oracle", BPB
4. E.N. Mackay, "Developing user Interfaces for Windows", WP Publishers & Distributors Pvt. Ltd.

Syllabus

MCA 2nd Year
IVth Semester

MAC602: INTRODUCTION TO RESEARCH METHODOLOGY		
Course Outcome (CO)		
CO1	Define the basic framework of research process.	
CO2	Formulate hypotheses or suggested solutions.	
CO3	Use various sources of research design, information for literature review and data collection.	
CO4	Discuss the different sampling techniques	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Research:** Meaning of Re-search, Retracing the path, Importance of re-search. Philosophies, and the language of research theory building Theoretical background of a research philosophy. The meaning of methodology (structured definition and examples). Understanding research terminologies i.e., Concepts, Constructs, Variables, and Definitions etc.	**8**
II	**Problems and Hypotheses:** Identifying research problem, State-of-the-Art, The problem definition lifecycle. Meaning/Definition of a hypothesis. Real world examples. Testing and Verification of Hypothesis.	**8**
III	**Research design:** Experimental and Non-experimental research design. Field research, Survey Research, Survey outcomes. Methods of data collection – Secondary data collection methods, qualitative methods of data collection, and Survey methods of data collection.	**8**
IV	**Sampling Techniques:** Research Population and Sample. Target Population, Accessible Population. Sampling techniques – The nature of sampling, Probability sampling design. Nonprobability sampling design, Determination of sample size.	**8**
V	**Data Analysis & Report Generation:** Types of Data Sources, Web Data, Survey Data. Data attributes, Discrete vs. Continuous Data attributes. Mean, Median, Mode; Range, Quartile, Variance, SD, Interquartile Range	**8**

Suggested Readings:

Text book(s):

1. Bryman, Alan & Bell, Emma (2011). Business Research Methods (Third Edition), Oxford University Press.
2. Kerlinger, F.N., & Lee, H.B. (2000). Foundations of Behavioural Research (Fourth Edition), Harcourt Inc.
3. Rubin, Allen & Babbie, Earl (2009). Essential Research Methods for Social Work, Cengage Learning Inc., USA.

Other References:

1. Chawla, Deepak & Sondhi, Neena (2011). Research methodology: Concepts and cases, Vikas Publishing House Pvt. Ltd. Delhi.
2. Pawar, B.S. (2009). Theory building for hypothesis specification in organizational studies, Response Books, New Delhi.
3. Neuman, W.L. (2008). Social research methods: Qualitative and quantitative approaches, Pearson Education.

MAS602: MATHEMATICS-III		
Course Outcome (CO)		
CO1	Recalls limit continuity & differentiation.	
CO2	Describe various theorems of calculus.	
CO3	Recall proper and improper integrals.	
CO4	Compute multiple integrals.	
CO5	Interpret vector calculus.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	Differential Calculus-I Review of limit, continuity and differentiability, uniform continuity, Sequences and series, limsup, liminf, convergence of sequences and series of real numbers, absolute and conditional convergence, Successive differentiation, Leibnitz‟s theorem for the nth derivative of the product of two function.	**8**
II	Differential Calculus-II Mean value theorem, Maclaurin‟s & Taylor‟s expansion of functions, Functions of several variables, limit and continuity, partial derivatives and differentiability, gradient, directional derivatives, chain rule, Taylor‟s theorem, maxima and minima and the method of Lagrange multipliers, curve tracing.	**9**
III	Integral Calculus Riemann integral, fundamental theorem of integral calculus, applications of definite integrals, improper integrals, beta and gamma functions.	**9**
IV	Multiple Integrals Double Integration: Evaluation of Double Integral (In Cartesian and Polar form), change of order of integration, Jacobian and change of variables. Triple integrals: Triple integration, change to spherical- Coordinates, calculation of volume, surface area, mass.	**8**
V	Vector Calculus Vector differentiation, scalar and vector point function, Geometric meaning of gradient, Equation of normal line and normal plane, Equation of tangent line and tangent plane, Directional derivative, Divergence of vector function and its interpretation, Curl and their physical interpretation, Line integral, Surface integral, Volume integral, Gauss and Stokes‟ theorems with applications.	**8**

Suggested Readings:

1. Dass, H.K; Introduction to Engg. Mathematics, Vol-I, S.Chand
2. Bali, N. P.; Engg. Mathematics Vol-I, Laxmi Publication
3. Grewal, BS; Engg. mathematics Vol-I, Khanna Publication
4. Vashishtha, A.R.; Engg. Mathematics Vol-I, PragatiPrakashan

MCA621: MOBILE COMPUTING (EL)		
Course Outcome (CO)		
CO1	Apply the fundamental design paradigms and technologies to mobile Computing applications.	
CO2	Demonstrate the different wireless technologies such as CDMA, GSM and GPRS etc.	
CO3	To understand the different productive protocols & Routing protocols.	
CO4	To understand the mobile transport and application layer.	
CO5	To understand the mobile platforms and applications such as iOS,Android etc.	

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction: Introduction** to Mobile Computing — Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing — Spread spectrum -MAC Protocols —SDMA- TDMA- FDMA- CDMA, Cellular concept and cellular architecture.	**8**
II	**Mobile Telecommunication System**: Introduction to Cellular Systems — GSM — Services & Architecture — Protocols —Connection Establishment — Frequency Allocation — Routing — Mobility Management —Security — GPRS- UMTS — Architecture — Handover — Security.	**8**
III	**Mobile Network Layer:** Mobile IP — DHCP — AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols — DSR, AODV, Hybrid routing –ZRP, Multicast Routing-ODMRP, Vehicular Ad Hoc networks (VANET)–MANET Vs. VANET — Security.	**8**
IV	**Mobile Transport and Application Layer:** Mobile TCP– WAP — Architecture — WDP — WTLS — WTP –WSP — WAE — WTA, Architecture — WML.	**8**
V	**Mobile Platforms and Applications:** Mobile Device Operating Systems — Special Constraints & Requirements — Commercial **Mobile** Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues.	**8**

Text and Reference Books:

1. Ashok K Talukdar: Mobile Computing-Technology, Applications and Service Creation, 1st Edition, TMH Publication, 2006.
2. J Schillar: Mobile Communications, 2nd Edition, Pearson Education, 2009.
3. Vishnu Sharma- Mobile computing, 4th Edition, Pearson Education, 2010.

MCA623: BIG DATA (EL)		
Course Outcome (CO)		
CO1	Discuss the Big Data Platform and its Use cases.	
CO2	Provide an overview of Apache Hadoop.	
CO3	Provide HDFS Concepts and Interfacing with HDFS.	
CO4	Understand Map Reduce Jobs.	
CO5	Apply analytics on Structured, Unstructured Data.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	INTRODUCTION TO BIG DATA AND HADOOP, Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	**8**
II	HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	**8**
III	Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	**8**
IV	Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction.	**8**
V	Data Analytics with R Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.	**8**

Suggested Readings:

1. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.

MCA625: DATA SCIENCE USING PYTHON (EL)		
Course Outcome(CO)	**Bloom's Knowledge Level(KL)**	
CO1	Classify the basic concept of cloud computing	K_2,K_3
CO2	Describe the virtualization fundamentals in cloud.	K_2,K_4
CO3	Use SAAS and PAAS in cloud environment.	K_3
CO4	Compare various cloud storage mechanisms.	K_2,K_3
CO5	Develop applications in cloud	K_1,K_2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	Big Data and its relationship to Data Science, Why Data Science is essential today, Skills required for Data Science, **Python Basics for Data Science**-Python installation and environment setup (Anaconda, Jupiter Notebook)Key Python libraries for Data Science, **NumPy** (for numerical computations)**Pandas** (for data manipulation), **Matplotlib** and **Seaborn** (for visualization).	**9**
II	**Exploratory Data Analysis and the Data Science Process-** Exploratory Data Analysis and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: RealDirect (online real estate firm) 4. Three Basic Machine Learning Algorithms - Linear Regression - kNearest Neighbors (k-NN) - k-means	**10**
III	**Building a User-Facing Data Product-** Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system 8. Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs	**10**
IV	**Machine Learning Algorithm and Usage in Applications-** Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web 6. Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests	**10**
V	**Basic principles**, ideas and tools for data visualization , Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists	**9**

Suggested Reading:

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. V
2. Cambridge University Press. 2014. (free online)
3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
4. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)
6. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science. (Note: this is a book currently being written by the three authors.

MCA627: INTERNET OF THINGS (IOT) (EL)		
Course Outcome (CO)		
CO1	Classify the fundamentals of IoT, its architecture, and applications.	
CO2	Identify and use IoT hardware, networking components, and communication protocols.	
CO3	Organize the IoT data handling techniques and security challenges.	
CO4	Develop IoT applications using programming and cloud platforms.	
CO5	Evaluate case studies and emerging technologies in IoT.	
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to IoT :** Definition, Characteristics, and Evolution of IoT, IoT Architecture & Layers, IoT vs. Traditional Embedded Systems, IoT Communication Models & Protocols, IoT Ecosystem and Applications (Smart Homes, Healthcare, Agriculture, Smart Cities, etc.)	**8**
II	**IoT Hardware & Networking :** Sensors, Actuators, and Microcontrollers (Raspberry Pi, Arduino), IoT Communication Technologies: Wi-Fi, Bluetooth, Zigbee, LoRa, NB-IoT, IoT Connectivity: IPv6, MQTT, CoAP, HTTP, Edge Computing and Fog Computing in IoT, Power Management in IoT Devices	**8**
III	**IoT Protocols & Data Handling :** IoT Protocols: MQTT, CoAP, AMQP, HTTP; Cloud Computing for IoT, IoT Data Processing & Storage (Big Data & NoSQL Databases), Security & Privacy Issues in IoT, IoT Middleware and IoT Platforms (AWS IoT, Google IoT Core, Azure IoT)	**8**
IV	**IoT Application Development & Security :** IoT Programming (Python for IoT, Node.js), IoT Operating Systems (Contiki, RIOT, FreeRTOS), Security Challenges in IoT (Threats, Authentication, Cryptography), Blockchain for IoT Security, IoT Testing & Debugging Tools	**8**
V	**Case Studies & Future Trends in IoT :** IoT Applications in Smart Cities, Agriculture, Healthcare, Industry 4.0; AI and Machine Learning for IoT, Digital Twin Technology in IoT, Future Trends in IoT (5G & Beyond, Quantum IoT), Ethical & Social Implications of IoT	**8**

Suggested Readings:

1. "Internet of Things: A Hands-On Approach" – By Arshdeep Bahga & Vijay Madisetti
2. "Internet of Things (IoT): Principles, Paradigms and Applications" – By Rajkumar Buyya & Amir Vahid Dastjerdi
3. "The Internet of Things: Connecting Objects to the Web" – By Hakima Chaouchi
4. "Internet of Things (IoT) with Raspberry Pi and Arduino" – By Rajesh Singh & Anita Gehlot
5. "IoT and Smart Cities: Advances in Green Computing" – By Pradeep Tomar & Gurjit Kaur

MCA680: RESEARCH METHODOLOGY LAB		
Course Outcome (CO)		
CO1	Identify and formulate research problems with an understanding of research design.	
CO2	Conduct systematic literature reviews using reliable sources and databases.	
CO3	Apply appropriate methodologies, tools, and techniques for data collection and analysis.	
CO4	Demonstrate academic integrity, ethical considerations, and proper citation practices.	
CO5	Draft high-quality research proposals, papers, and technical reports.	
CO6	Present research findings effectively through oral presentations and visual aids.	
DETAILED SYLLABUS		
Sr. N	**Topic**	**Hours**
1	Introduction to Research: Definition, types, and significance of research. Research process: Problem identification, objectives, hypothesis. Research ethics and plagiarism.	
2	Literature Review: Importance and sources of literature. Using digital libraries: IEEE Xplore, Springer, Scopus, Google Scholar. Reference management tools: Mendeley, Zotero, EndNote.	
3	Research Design and Methodology: Qualitative vs Quantitative research. Sampling methods, data collection tools, surveys, experiments. Case studies and simulation methods.	
4	Data Analysis and Tools: Statistical analysis basics: Mean, median, mode, standard deviation. Tools: Excel, SPSS, R, Python (pandas, matplotlib). Interpretation and visualization of data.	
5	Research Documentation and Writing: Research paper structure: Abstract, Introduction, Methodology, Results, Discussion, Conclusion. Technical report writing. Referencing styles: APA, IEEE, MLA.	
6	Research Communication: Preparing presentations and posters. Publishing in journals, conferences. Handling peer review and revision.	

Suggested Readings:

1. C.R. Kothari, Research Methodology: Methods and Techniques, New Age International, 2004.
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, SAGE Publications, 2019.
3. Jonathan Schwabish, Better Data Visualizations, Columbia University Press, 2021.
4. Eliot Freidson, Professional Powers: A Study of the Institutionalization of Formal Knowledge, University of Chicago Press.
5. IEEE/ACM Style Manuals – Available online for reference.

MCA682: DISSERTATION/MAJOR PROJECT LAB		
Course Outcome (CO)		
CO1	To help students develop openness to new ideas in computer science, develop the ability to draw reasonable inferences from observations and learn to formulate and solve new computer science problems using analytical and problem-solving skills;	
CO2	To help students develop the ability to synthesize and integrate information and ideas, develop the ability to think creatively, develop the ability to think holistically and develop the ability to distinguish between facts and opinion;	
CO3	To help students acquire the necessary competences to build a real-life software system by completing different software life cycle phases (like, specification, architecture, design, implementation, validation, documentation, etc);	
CO4	To help students develop the ability to work individually and as part of a team, develop a commitment to accurate work, develop management skills, improve speaking and writing skills, improve the ability to follow directions, instructions and plans, and improve the ability to organize and use time effectively;	
CO5	To help students develop a commitment to personal achievement, the ability to work skillfully, informed understanding of the role of science and technology, a lifelong love of learning, and cultivates a sense of responsibility for one's own behavior and improves self-esteem/self-confidence.	
DETAILED SYLLABUS		
Sr. N	**Topic**	**Hours**
	Course Content This course consists of the development of a realistic application, representative of a typical real-life software system or to carry a research based project in an area related to CS & IT. 1. The students are expected to propose, analyze, design, develop, test and implement a real life software system using recent technologies. 2. In case of a research based project, the students are required to follow a proper research methodology to propose a solution (in terms of a model/ framework/ algorithm, etc) of a research problem related to computer science and IT. 3. The student will deliver oral presentations, progress reports, and a final report. **A.** Depending on the topic of the project and the chosen software development methodology, the following themes may be addressed to some extent: Software development methodologies, static (products) and dynamic aspects (processes);	

	Requirement analysis (goals, use cases), software architectures, architectural styles and patterns, model-driven engineering(MDE); • Programming techniques, software development environments, refactoring; • Software validation through unit tests, integration tests, functional and structural tests, and code reviews. • Project management, planning, resource estimation, reporting. • Version management by using a version management tool. • Examples of kinds of systems to be developed are distributed systems, client/server systems, web based systems, secure systems, mobile systems, adaptable systems, optimizations of existing systems or data-intensive systems, etc. **B.** Typical process **of research based problems** may include, selection of a research topic followed by an extensive literature survey with an aim to find the research gap. Proposing a solution based on the findings (i.e., research gap) and publishing the research work.	

Suggested Readings:

1. Robert Lafore, "Object Oriented Programming in C++", Pearson
2. R. Brown, "Visual Basic .NET – Your Visual Blueprint for Building Versatile Programs on the .NET Framework", Wiley Publishing, Inc.
3. Ivan Bayross, "Oracle", BPB
4. E.N. Mackay, "Developing user Interfaces for Windows", WP Publishers & Distributors Pvt. Ltd.