NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Evaluation Scheme & Syllabus

For

Master of Computer Applications

MCA

First Year

(Effective from the Session: 2023-2024)

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Master of Computer Applications

MCA

EVALUATION SCHEME

SEMESTER- I

S.No	Subject Codes	ubjects	Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	BMCA0105	Discrete Mathematics	3	0	0	30	20	50		100		150	3
2	BMCA0103	Operating Systems	3	0	0	30	20	50		100		150	3
3	BMCA0101	Business Communication for Technical Students	3	0	0	30	20	50		100		150	3
4	BMCA0102	Data Structures	3	1	0	30	20	50		100		150	4
5	BMCA0154	Problem Solving Using Python Lab	0	0	8				50		100	150	4
6	BMCA0153	Operating Systems Lab	0	0	4				50		50	100	2
7	BMCA0152	Data Structures lab	0	0	4				50		50	100	2
8	BMCA0151	Business Communication for Technical Students –Lab	0	0	4				50		50	100	2
		MOOCs											
		TOTAL										**1050**	**23**

List of MOOCs (Coursera) Based Recommended Courses for First Year (Semester-I) MCA Students

S. No.	Subject Code	Course Name	University/ Industry Partner Name	No. of Hours
1	BMC0006	Introduction to Python	Infosys Springboard	24h 6min
2	BMC0007	Linux Command Line for Beginners	Infosys Springboard	5h 35min

Abbreviation Used: -

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Master of Computer Applications

MCA

EVALUATION SCHEME

SEMESTER-II

S.No	Subject Codes		Periods			Evaluation Schemes				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	BMCA0202	Database Systems	3	1	0	30	20	50		100		150	4
2	BMCA0201	Computer System & Organization	3	1	0	30	20	50		100		150	4
3	BMCA0204	Design Thinking – I	3	0	0	30	20	50		100		150	3
4		Departmental Elective-I	3	0	0	30	20	50		100		150	3
5	BMCA0253	Object Oriented Techniques using JAVA	0	0	8				50		100	150	4
6	BMCA0251	Computer & Organization Lab	0	0	4				50		50	100	2
7	BMCA0252	Database Systems Lab	0	0	4				50		50	100	2
8		Departmental Elective-I Lab	0	0	2				50		50	100	1
		TOTAL										**1050**	**23**

List of MOOCs (Coursera) Based Recommended Courses for First Year (Semester-II) MCA Students

S. No.	Subject Code	Course Name	University/ Industry Partner Name	No. of Hours
1	BMC0001	Design Thinking for Innovation	Infosys Springboard	6h
2	BMC0002	Next Gen Technologies	Infosys Springboard	10h 14min

Abbreviation Used: -

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

List of Departmental Electives-:-

S. No.	Subject Code	Subject Name
Departmental Elective-I		
1	BMCA0211	Fundamentals of Digital Marketing and Analytics
2	BMCA0212	Fundamentals of Digital Marketing and Optimization
3	BMCA0213	CRM Administration
4	BMCA0214	Software Testing

+

S. No.	Subject Code	Subject Name
Departmental Elective-I Lab		
1	BMCA0211P	Fundamentals of Digital Marketing and Analytics Lab
2	BMCA0212P	Fundamentals of Digital Marketing and Optimization Lab
3	BMCA0213P	CRM Administration Lab
4	BMCA0214P	Software Testing Lab

Semester: I
Branch-MCA

Subject Code- BMCA0105	**L-T-P** **3 -0- 0**
Subject Name- Discrete Mathematics	**Credit-3**

Course Objective- To develop mathematical ability in understanding mathematical reasoning, ability to perform combinatorial analysis and knowledge about discrete structures, perform operations on discrete mathematics such as sets, functions and relations, Verify the correctness of an argument using symbolic logic and truth tables. Solve problems using counting techniques and combinatorics, to improve formal reasoning skills acquisition and mathematical knowledge.

Course Outcome –At the end of course, the student will be able to:

CO1 -. Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations, Functions and Induction.

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 prove properties of Algebraic Structures like Groups, Rings and Fields

CO4- Apply the concept of combinatorics to solve basic problems in discrete mathematics

CO5- Formulate and solve recurrences and recursive functions

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P)**	**Aligned Practical/Assignment/Lab**	**CO Mapping**
I	**Set Theory**	Introduction, Size of sets and cardinals, Venn diagrams, Combination of sets, Multisets, Ordered pairs, Set identities and Proofs of some general identities on sets.	Lectures, PPTs and Notes	2T	Assignment based on set.	**CO1**

	Relations & Functions	Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation and Recursive definition of relation	Lectures, PPTs and Notes	2T	Assignment based on relations	**CO1**
	Functions	Definition, Classification of functions, Operations on functions, recursively defined functions and Growth of Functions. Natural Numbers: Introduction, Piano's axioms, Mathematical Induction, Strong Induction and Induction with Nonzero Base cases.	Lectures, PPTs and Interactive Panel	4T	Assignment based on functions	**CO1**
II	**Posets, Hasse Diagram and Lattices**	Introduction, Partial order sets, Combination of partial order sets, Hasse diagram, Introduction of lattices, Properties of lattices – Bounded, Complemented, Modular and Complete lattice.	Lectures, PPTs and Interactive Panel	6T+ 6P	Implement Synchronization problems by using semaphores and mutex	**CO2**
	Graphs	Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring	Lectures, PPTs and Interactive Panel	4T+ 4P	Construct the code and execute Banker's Algorithm	**CO2**
	Trees	Definition, Binary tree, Binary tree traversal (BFS and DFS), Binary search tree.	Lectures, PPTs and Interactive Panel	4T+ 4P	Construct the code and execute Banker's Algorithm	**CO2**
III	**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, Cosets, Permutation and Symmetric groups,	Lectures, PPTs and Interactive Panel	6T + 9P	Design the code of fixed & variable memory allocation techniques with page replacement algorithms.	**CO3**

		Homomorphism and Isomorphism of groups.				
	Rings and Fields	Definition and elementary properties of Rings and Fields.	Lectures, PPTs and Interactive Panel	2T + 4P	Execute various Disc Scheduling Algorithms	**CO3**
IV	**Propositional & Predicate Logic**	Propositions well-formed formula, Truth tables, Tautology, Contradiction, Algebra of propositions, Theory of Inference and Natural Deduction	Lectures and Hands on	2T +8P	Implementation of Linux commands for file management system, Linux Networking Commands and execute the Linux as a system admin.	**CO4**
	Predicate Logic	Theory of predicates, First order predicate, Predicate formulas, quantifiers, Inference theory of predicate logic.	Lectures, PPTs and Interactive Panel			**CO4**
V	**Recurrence Relations and Generating Function**	Introduction and properties of Generating Function, Growth of functions, Recurrences from algorithms, Simple Recurrence relation with constant coefficients and Linear recurrence relation without constant coefficients. Methods of solving recurrences Combinatorics: Introduction, Counting Techniques, Pigeon hole Principle, Pólya's Counting Theory.	Lectures and Hands on	2T + 9P	Shell Scripting Implementation in VI editor	**CO5**

Text Books:

1. Discrete Mathematics and Its Applications,KennethH.Rosen,McGraw-Hill,2006.
2. Discrete Mathematical Structures ,B.Kolman , R.C.Busby,andS.C.Ross,PrenticeHall,2004

Link:

Unit1	https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20&index=1

Unit2	https://www.youtube.com/watch?v=DmCltf8ypks&list=PL0862D1A947252D20&index=3
Unit3	https://www.youtube.com/watch?v=kZ6UqFm8lnw&list=PL0862D1A947252D20&index=5
Unit4	https://www.youtube.com/watch?v=ruwZxR2YRpE&list=PL0862D1A947252D20&index=6
Unit5	https://www.youtube.com/watch?v=9AUCdsmBGmA&list=PL0862D1A947252D20&index=10

Semester: I **Branch-MCA**						
Subject Code- BMCA0103					**L-T-P** **3 -0- 0**	
Subject Name- Operating Systems					**Credit-3**	
Course Objective- objective of this course is to provide an understanding of the basic structure and functions of an operating system and deliver the skills needed to develop Unix/Linux shell programs.						
Course Outcome –At the end of course, the student will be able to: **CO1 -**. Understand operating system concepts, functions and design CPU Scheduling algorithms. **CO2-**. Analyse the various issues related to inter process communication like Synchronization and Deadlocks. **CO3-** Simplify the concepts of Memory Management and Implement disk scheduling algorithms. **CO4-** Implement and use Linux utilities to create and manage simple file processing operations. **CO5-** Demonstrate shell scripts to perform more complex tasks in shell programming environment.						
Course Content						
Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P)**	**Aligned Practical/Assignment/Lab**	**CO Mapping**
I	**Fundamentals of Operating Systems**	Operating System, Operating System characteristics, Functions of Operating Systems, Types of Operating System, Layered Structure, System call, Kernel, Multiprogramming and Multitasking, Overview of Windows OS, Unix/Linux OS.	Lectures, PPTs and Notes	3 T	Assignment based on types of Kernel and DOS commands.	**CO1**
	Process Management	Process Management: Process Concepts, State Transition Diagram. Types of Schedulers: Long Term, Mid Term, Short Term Process Control Block, Inter process communication.	Lectures, PPTs and Notes	3 T	Assignment based on Process Management and Process Data Structure	**CO1**

	CPU Scheduling	CPU Scheduling Criteria, Pre-emptive and Non Pre-emptive Scheduling, Scheduling Algorithm: FCFS, SJF, SRTF, Round Robin, Priority Scheduling, Multilevel Queue Scheduling and Multilevel Feedback Queue Scheduling, Context Switching.	Lectures, PPTs and Interactive Panel	4T+ 6P	Implementation to understand the concepts of various CPU Scheduling algorithms	**CO1**
II	**Process Synchronisation**	Critical Section problem & their solutions, Introduction to Semaphores Classical Problems of Synchronization (Producer Consumer Problem, Readers Writer Problem, Dining philosophers' problem)	Lectures, PPTs and Interactive Panel	6T+ 6P	Implement Synchronization problems by using semaphores and mutex	**CO2**
	Dead Locks	Dead locks: – Characterization, Deadlock concepts & Handling Techniques (Prevention and Detection & Recovery), Dead Lock Avoidance: Banker's Algorithm.	Lectures, PPTs and Interactive Panel	4T+ 4P	Construct the code and execute Banker's Algorithm	**CO2**
III	**Memory Management**	Memory Management: Background, Swapping, Contiguous and Non Contiguous memory allocation, Paging, Segmentation, Segmentation with paging. Virtual Memory: Background, Demand paging, Allocation of frames: First Fit, Best Fit, and Worst Fit, Page replacement algorithms (FCFS, Optimal, LRU), Balady's Anomaly, Thrashing	Lectures, PPTs and Interactive Panel	6T + 9P	Design the code of fixed & variable memory allocation techniques with page replacement algorithms.	**CO3**
	Disc Scheduling	Disk Scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK and C-LOOK	Lectures, PPTs and Interactive Panel	2T + 4P	Execute various Disc Scheduling Algorithms	**CO3**
	File Management System	File Management: Concept and Organization, Access Methods, File System Implementation Directory Structures, Allocation Methods, Free Space Management, Secondary Storage Structure, File System Security and Protection	Lectures, PPTs and Interactive Panel	4T + 4P	Implementation of file Utilities (e.g., find, grep) using the system call API.	**CO3**

IV	**Linux administration**	Linux Components, Shells, Installation of Linux, Virtualization: Definition, Types, Advantages, Virtualization tools. User Administration, Files: Type, Ownership, Permissions and manipulations Commands: Internal and External, Directory and File commands, I/O commands, Pipes, Filters, shell commands. Linux Tools Linux Networking Commands: ipconfig, traceroute, tracepath, ping, host, hostname, iwconfig. System Admin: man, uptime, users, service, pkill,ps	Lectures and Hands on	2T +8P	Implementation of Linux commands for file management system, Linux Networking Commands and execute the Linux as a system admin.	**CO4**
V	**Shell Programming & VI Editor**	Shell Programming - shell script features, shell variables, writing and executing a shell script, positional parameters. Introduction to VI editor, VI editor Models, Invoking VI editor, Configuring the VI environment, The process - parent and child process, process creation, process related commands, Branching control structures- if, case etc., Loop control structures– while, until, for, etc., Jumping control structures – break, continue, exit, etc., Integer and Real arithmetic in shell programs		2T + 9P	Shell Scripting Implementation in VI editor	**CO5**

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts Essentials" 8th Edition, 2010
2. Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education, 4th Edition, 2014
3. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", 2014
4. Marks G. Sobell, "A practical guide to Linux: Commands, Editors and Shell Programming" Fourth Edition, 2017

Reference Books:

1. "Operating Systems: Internals and Design Principles", William Stallings, 8th Edition, 2014
2. "Operating System: A Design-oriented Approach", Charles Patrick Crowley, 9th Edition, 2017
3. "Operating Systems: A Modern Perspective", Gary J. Nutt, 1997
4. "Design of the UNIX Operating Systems", Maurice J. Bach., 1st Edition, 2015
5. "Understanding the Linux Kernel", Daniel Pierre Bovet, Marco, 1st Edition, 2000
6. AS Tanenbaum, AS Woodhull, Operating Systems Design and Implementation, 3rd Ed., Prentice Hall, 2006.

.

Branch-MCA

Subject Code- BMCA0101	**L -T- P** **3-0- 0**
Subject Name- Business Communication for Technical Students	**Credit-3**

Course Objective-Objective of this course is to:

1. To improve proficiency in the English language to at least B1/B2 (Intermediate) level of CEFR(Common European Framework of Reference).
2. To impart business communication skills.
3. To motivate students to look within and create a better version of 'self.'
4. To introduce the key concepts of ethics, etiquette, and life skills.
5. To train for career enhancement

Course Outcome –At the end of course, the student will be able to:

CO1 – Improve proficiency in English to the Intermediate level of CEFR.
CO2 - Develop business communication skills.
CO3 - Demonstrate improved versions of themselves.
CO4 – Acquire the concepts to cope better at the workplace.
CO5 – Participate in the placement process with confidence.

Course Content

Module	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P)**	**Aligned Practical/Assignment/Lab**	**CO Mapping**
I-Introduction to Communication	Importance of communicating in English Overview of the course Objective: To motivate the students to acquire the skill of communicating well. Outcome: The students realize the importance and understand the course and what is expected of them.	Video streaming followed by Discussion	1	Video Clips of famous personalities who have learnt to communicate well e.g., Kapil Dev, Jahnvi Panwar, APJ Abdul Kalam, etc.	**CO1**

	Basics of Workplace Communication - Communication Cycle - Challenges faced while communicating. Objective: To facilitate the student's ability to identify and analyse aspects of miscommunication in real-life situations. Outcome: By analyzing communication through video clips, and the case, students will develop a deeper understanding of the nuances of effective and ineffective communication.	Video streaming and Case-Study followed by Discussions and problem-solving activities	2	Case Study "Barry and the Barriers to Communication"	**CO2**
	Levels of Communication - Intrapersonal - Interpersonal - Group - Organisational Objective: To help the students understand the importance of communicating effectively at various levels. Outcome: By participating in the activity, the students will be able to identify the different levels at which communication takes place. They'll be able to effectively communicate at all the levels.	The students will be discussing various topics at different levels of communication e.g., intrapersonal, interpersonal, etc.	1	Self-Reflection; Deliberation on crucial topics; Meetings and Presentations	**CO2**
	The Flow of Organisational Communication - Conversations in different workplace situations e.g., presenting a report to the Management; giving instructions to the team members; and discussing issues in a meeting with peers. Objective: To facilitate the student's ability to identify and analyse how communication flows in an	The students will be made to participate in Communication Web activity through	1	Communication Web	**CO2**

	organisation. Outcome: The students will be able to understand how each flow impacts the communication methodology and style.	which they will be able to know how communicati on flows in different direction and how each flow impacts the overall communicati on.			
	Critical Reading Objective: To promote critical thinking and engage students in thoughtful discussions about a selected reading material. Outcome: The students will develop skills in identifying key arguments, evaluating evidence, and challenging assumptions.	Group discussion on selected material.	1	Critical Reading Discussion Circle – On short stories, movies, reviews.	**CO3**
	Hansei Session Objective: To develop students' cognitive skills and critical thinking. Outcome: The students will develop self-awareness, metacognition, and a growth mindset, empowering students to become more effective and efficient readers.	The students will be able to reflect on their reading experiences, evaluate their cognitive skills employed during the process, and identify strategies for	1	Hansei activity – Experience sharing	**CO4**

		improving their comprehension.			
II-Cognitive Listening and Reading	Developing Listening Skills - Empathetic Listening - Active Listening vs Passive Listening Objective: To practice active listening, empathy, and effective communication. Outcome: Participants will engage in focused listening and learn to comprehend and respond.	Audio recordings of standard English conversations will be played; a cloze test based on the recordings will be administered, followed by discussion about types of listening.	2	Listening Activity – British Council's Audio followed by a Cloze Exercise	**CO1**
	Acquiring Reading Skills - Reading Comprehension through techniques like skimming, scanning, etc. Objective: To foster students' reading comprehension skills by engaging them in activities that involve comprehending texts, understanding directions, filling forms, and interpreting and reinterpreting stories. Outcome: Students will be able to extract information quickly from a given text.	The students will practice responding to questions based on reading texts using techniques like Skimming, scanning, etc.	2	Reading Texts will be shared with the students for Reading comprehension practice. Assignment 1: Read the book 'The Ideal Team Player' by ParickLencioni and write a Summary	**CO2**

	Reading Skills Contd. - Levels of comprehension Objective: To develop students' ability to analyze and synthesize information from a selected text and use it for meaningful tasks. Outcome: The students will be able to comprehend a text at various levels such as literal, interpretative, and applied.	The students will actively participate in the reading comprehension activity.	2	Reading Passages followed by an Exercise (levels of comprehension will be tested through the exercises)	**CO3**
	Online Assessment: Apply the various reading techniques to extract information from a given text.	Online Assessment	1	Online Assessment: Apply the various reading techniques to extract information from a given text.	
	Infographics: Deciphering graphs, charts, and tables Objective: To develop students' ability to analyse and synthesize information given in the form of tables, charts, diagrams, and holograms. Outcome: The students will be able to decipher the information given in the form of charts, diagrams, tables etc. and synthesize it complete the tasks.	The students will be solving questions based on information provided in the form of tables, charts, diagrams, etc.	1	Pie Chart/Hologram/Graph/ Table Reading for specific information	**CO4**
	The Hansei – Self-reflection Activity Objective: To develop students' cognitive skills and critical thinking through a Hansei activity focused on reading comprehension. Outcome: By engaging in the Hansei activity, students	The students will discuss the key takeaways from the module	1	Self-Reflection activity	**CO4**

	will reflect on their reading experiences, evaluate their cognitive skills employed during the process, and identify strategies for improving their comprehension.				
III-Writing like a Pro	Honing the Writing Skills - Significance of writing in the Workplace Objective: To make the students understand the importance of effective writing at the workplace and the negative impact of poor writing. Outcome: Students will be able to compose correct and effective written messages/documents and express their views and opinions in an organized, logical manner.	The students will be shown examples of poorly written documents followed by Error correction exercises and discussion	1	Examples of poorly written official messages, documents, hoardings, and billboards will be shared	**CO3**
	Workplace Vocabulary Objective: To expand participants' vocabulary and deepen their understanding of word formation. Outcome: Students will develop a comprehensive understanding of word formation techniques and improve professional vocabulary.	The General Service List of Words by Michael West will be shared with the students	1	• Word Games – Crosswords • Online Exercise on 'writing missing words from official documents'	**CO2**
	Getting rid of Verbosity Objective: To help the students understand the importance of being concise. Outcome: The students will be able to get rid of redundancy.	Participation in an activity	1	Match the Columns – One word for a phrase	**CO2**

	Using pauses in Written documents Objective: To make the students realise the importance of proper punctuation. Outcome: Students will develop a comprehensive understanding of using punctuation marks and thereby, making their writings meaningful.	Activity followed by discussion	1	Find the meaning - Writing the gist of a passage (without any punctuation marks). Then rewriting the passage with proper punctuation marks	**CO2**
	Business Documents – The Format: Block, Modified, and Semi-Block Objective: To enable students to write business letters, reports and other documents in a systematic way following the formats in practice. Outcome: Students will be able to create meaningful business documents.	Flipped classroom method will be followed	1	Find the latest format (The students will be asked to find the format in vogue)	**CO2**
	Writing Impactful E-mails Objective: To enable students to write business emails in various business contexts. Outcome: Students will be able to write emails and business writing in real-life corporate scenarios.	Discussion with examples of effective/ineffective emails	1	• Discussion about how, why, and when of writing e-mails • Sharing examples of ineffective emails vs. impactful emails	**CO3**
	Online Assessment: Apply the various writing techniques to prepare effective official correspondence.	Online Assessment	1		
	The Hansei – Self-reflection Activity Objective: To develop students' cognitive skills and critical thinking through a Hansei activity focused on reading comprehension.	The students will discuss the key take aways from the module	1	Self-Reflection activity	**CO4**

	Outcome: By engaging in the Hansei activity, students will reflect on their reading experiences, evaluate their cognitive skills employed during the process, and identify strategies for improving their comprehension.				
IV-Speaking to Express	Effective Speaking: A Key to Professional Success Objective: To help students speak with confidence in public, using various verbal and non-verbal aspects of speech. Outcome: Students will gain awareness of speaking in a professional environment and enhance their overall communication in English.	Discussion with video examples of effective intros followed by review of the students' video introductions	2	Video activity – Students will create their Video Introductions	**CO5**
	Etiquette & Ethics Objective: Students will recognize the key features of corporate etiquette Outcome: Students will be able to learn and imbibe corporate etiquette in real situations.	Discussion on the topic with video examples of corporate ethics and mannerisms	1	Videos on corporate etiquette and recognizing the key features.	**CO4**
	Non-Verbal Cues: Making Verbal delivery effective. Objective: To make the students realize the importance of non-verbal cues in making verbal delivery more effective. Outcome: The students will be able to use non-verbal cues effectively to supplement the verbal delivery.	Discussion and tips to improve non-verbal cues along with the verbal delivery	1	Exercise based on a video on Body language	**CO3**
	Group Discussion – Do's and Don'ts Objective: To help the students understand why GDs are conducted and how to perform well in placement	Pre-requisites will be discussed with video	1	Video of corporate/placement GD will be played	**CO5**

	GDs. Outcome: The students will know why and how to participate in a group discussion.	examples of good corporate/placement GDs.			
	How to crack an Interview – tips and examples Objective: To help the students acquire interview handling skills. Outcome: The students will be able to know the pre-requisites of performing well in an interview.	Discussion with examples of good/bad interviews	1	Video on 'perfect interviewing'	**CO5**
	SWOT Analysis and Resume Objective Formation Objective: To help the students identify their professional strengths and weak areas. Outcome: The students will know the areas where in they need to improve themselves.	Students will be asked to prepare objective for their Resumes and identify the areas wherein they are strong or weak.	2	Identifying strengths and weaknesses	**CO5**
	Preparing Answers to Commonly Asked Interview Questions Objective: To help students with the correct way of responding to some of the commonly asked interview questions. Outcome: The students will be able to prepare answers to common interview questions.	Discussion on Interview FAQs	2	Preparing and practicing answers to the commonly asked interview questions	**CO5**

	Review Class	Questions from the students on the topics covered in the Course will be taken up	1		
	The Hansei – Self-reflection Activity Objective: To develop students' cognitive skills and critical thinking through a Hansei activity focused on reading comprehension. Outcome: By engaging in the Hansei activity, students will reflect on their reading experiences, evaluate their cognitive skills employed during the process, and identify strategies for improving their comprehension.	The students will discuss the key take aways from the module	1	Self-Reflection activity	**CO4**

Reference Books:

1. Cambridge English Business Benchmark (Pre-intermediate to Intermediate), 2nd edition, Norman Whitby, Cambridge University Press, 2006, UK.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Technical Communication – Principles and Practices by Meenakshi Raman &Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
4. Talbot, Fiona. Improve Your Global Business English Kogan Page, 2012.
5. Leech Geoffery. Communicative Grammar of English. Pearson Education Harlow, United Kingdom, 1994.
6. Sethi. J. A Course in Phonetics and Spoken English Prentice Hall India Learning Private Limited; 2 edition (1999)
7. Rebecca Corfield. Preparing The Perfect CV. Kogan Page Publishers, 2009.
8. Anderson, Paul V. Technical communication. 8th ed. Cengage Learning, 2011.
9. IELTS 11: General Training with answers. Cambridge English

Links:
Online reference e books and other reference materials:

1. http://promeng.eu/downloads/training-materials/ebooks/soft-skills/effective-communication-skills.pdf
2. http://ncert.nic.in/textbook/pdf/iees101.pdf
3. http://www.infocobuild.com/education/audio-video-courses/literature/CommunicationSkills-IIT-Kanpur/lecture-09.html

Online Resources:

4. https://www.youtube.com/watch?v=JIKU_WT0Bls
5. https://www.youtube.com/watch?v=6Ql5mQdxeWk
6. https://www.youtube.com/watch?v=fE_cS75Lcvc

Free Apps to Practice English:

7. Memrise - https://www.memrise.com
8. Open Language - https://open-language.en.uptodown.com
9. Duolingo - https://englishtest.duolingo.com/applicants
10. Rosetta Stone - https://www.rosettastone.com/product/mobile-apps/
11. FluentU - https://www.rosettastone.com/product/mobile-apps/

Semester: I
Branch:

Subject Code- BMCA0102	**L - T - P** **3 - 1 - 0**
Subject Name- Data Structures	**Credit-4**

Course Objectives:

- Learn the basic concepts of algorithm analysis, along with implementation of linear and non-linear data structures.

Course Outcomes:
After the completion of the course, the students will be able to

CO1-Describe the need of data structure and algorithms in problem solving and Analyse Time space trade-off.

CO2-Design, implement and evaluate the real-world applications using stacks, Queues.

CO3-Compare and contrast the advantages and disadvantages of linked lists over arrays and implement operations on different types of linked list.

CO4-Implement and evaluate the real-world applications using non-linear data structures.

CO5-Identify and analyse the computational efficiencies of searching and sorting algorithms in real world problems.

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required L=T+P**	**Practical/Assignment/Lab**	**CO Mapping**
1: **Introduction to Data**	Module 1: Data Types Module 2: Arrays Module 3:	Data types: Primitive and non-primitive, Types of Data Structures- Linear & Non-Linear Data	Lectures, Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative Learning, competitive		Implementation of Arrays, Row Major Order, and Column Major Order, Representation of	**CO1**

Structures	Analysis of Algorithms	Structures, List, Tuple, Set, Dictionary. Arrays: Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array. Analysis of algorithms: Time and Space Complexity of an algorithm, Asymptotic notations (Big Oh, Big Theta and Big Omega).	coding Projects, Assessments.	8T+10P	sparse matrix, Linear search, Binary search.	
2: **Stacks and Queues**	Module 1: Stacks, Module 2: Recursion, Module 3: Queues.	Stacks: Primitive Stack operations: Push & Pop, mutual conversion of Infix, Prefix, Postfix, Evaluation of postfix expression. Recursion: Principles of recursion, Types of Recursion, Problem solving using iteration, Tower of Hanoi, Trade-offs between iteration and recursion. Queues: Operations on Queue: Create, Insert, Delete, Full and Empty, Circular queues, Dequeue and Priority Queue.	Lectures, Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative Learning, competitive coding, Projects, Assessments.	8T+10P	Implementation of Stack,Application of stack: Infix, Prefix, Postfix Expressions, Problem solving using recursion with examples such as binary search, Fibonacci series, Implementation of queues.	**CO2**
3: **Linked**	Module 1: Linked List	Linked lists: Comparison of Array, List and Linked list	Lectures, Code Walkthroughs, Hand-on Programming, Problem		Operations on a Linked List: Insertion, Deletion, Traversal,	**CO3**

lists		Types of linked list: Singly Linked List, Doubly Linked List, Circular Linked List, Polynomial Representation and Addition of Polynomials	Solving, Collaborative Learning, competitive coding, Projects, Assessments.	8T+8P	Reversal, Searching,	
4: **Trees**	Module 1: Trees	Basic terminology, Binary Trees, Binary Tree Representation, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Extended Binary Tree, Tree Traversal algorithms: In-order, Pre-order and Post-order. Constructing Binary Tree from given Tree Traversal, Binary Heaps, Heap Operations, Threaded Binary trees, Traversing Threaded Binary trees, AVL Tree, B-Tree.	Lectures, Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative Learning, Projects, Assessments.	8T+10P	Operation of Insertion, Deletion, Searching & Modification of data in Binary Search tree.	**CO4**
5: **Graphs, Sorting Techniques and hashing**	Module 1: Graphs Module 2: Sorting Techniques Module 3:Hashing	Graphs: Terminology used with Graph, Graph Representations: Adjacency matrices, Adjacency List. Connected Component, Spanning Trees, Prim's and Kruskal's algorithm, Shortest Path	Lectures, Code Walkthroughs, Hand-on Programming, Problem Solving, Collaborative Learning, Projects, Assessments.		Graph Traversal: Depth First Search and Breadth First Search. Implementation of minimum cost spanning tree. Implementation of Bubble sort, Insertion sort, Selection sort,	**CO5**

		algorithms: Dijkstra Algorithm, Floyd Warshall's Algorithm. Sorting Algorithms. Hashing: Hash Functions, Collision-Resolution Techniques.		8T+10P	Heap Sort, Merge sort, Quick sort.	

Reference Books:

1. Thareja, "Data Structure Using C" Oxford Higher Education.
2. AK Sharma, "Data Structure Using C", Pearson Education India
3. P. S. Deshpandey, "C and Data structure", Wiley Dreamtech Publication.
4. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education.
5. Berztiss, AT: Data structures, Theory and Practice, Academic Press.
6. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill.

Text Books:

1. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python (An Indian Adaptation)", Wiley Publication
2. Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein, "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India
3. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.
4. Lipschutz, "Data Structures" Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.

Links:

https://nptel.ac.in/courses/106/106/106106127/
https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F
https://www.youtube.com/watch?v=4OxBvBXon5w&list=PLBF3763AF2E1C572F&index=22
https://www.youtube.com/watch?v=cR4rxllyiCs&list=PLBF3763AF2E1C572F&index=23
https://nptel.ac.in/courses/106/106/106106127/
https://www.youtube.com/watch?v=9zpSs845wf8&list=PLBF3763AF2E1C572F&index=24
https://www.youtube.com/watch?v=hk5rQs7TQ7E&list=PLBF3763AF2E1C572F&index=25
https://www.youtube.com/watch?v=KW0UvOW0XIo&list=PLBF3763AF2E1C572F&index=5

Semester: I

Branch: MCA

Subject Code- BMCA0154	**L - T - P** **0 – 0 -8**
Subject Name- Problem Solving Using Python	**Credit-4**

Course Objectives:

- To provide Basic knowledge of Python programming and to implement programming skill for solving real world problems.

Course Outcomes:

After the completion of the course, the students will be able to

CO1-Understanding basic programming logic.

CO2-Implement python programs using decision control statements.

CO3-Implement user defined functions and modules in python

CO4-Implement python data structures –lists, tuples, set, dictionaries

CO5-Apply programming concepts to solve real world problem.

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P) (clearly mention the hours for theory and lab)**	**Practical/Assignment/Lab**	**CO Mapping**
1.	Basics of python programming	Problem Solving, Techniques, Algorithm, Building blocks of algorithms	Lecture , Hands-on exercise, Demonstration, practical lab	6(4+2)	Implementation of basic Python programs.	**CO1**

		(statements, state, control flow, functions), Notation, Flow chart, Pseudo code, programming language, Categories of programming languages.				
		A Brief History of Python, Applications areas of python, The Programming Cycle for Python, Python IDE, Interacting with Python Programs.		3(1+2)	Installation of IDE and Command Prompt.	**CO1**
		Elements of Python: keywords and identifiers, variables, data types and type conversion,		3(1+2)	Demonstrate the use of these in python programs.	**CO1**
		operators in python, expressions in python, strings.		3(1+2)	Develop python program to demonstrate use of Operators.	**CO1**
2	Decision Control Statements	Conditionals: Conditional statement in Python (if-else statement, its working and execution)	Hands-on exercise, Demonstration, lectures, practical lab	3(1+2)	Develop programs for the use of conditional statements.	**CO2**
		Nested-if statement		4(1+3)	Develop programs of different types	**CO2**

		and elif statement in Python, Expression Evaluation & Float Representation.			of statements.	
		Loops: Purpose and working of loops, while loop, For Loop, Nested Loops, Break and Continue, pass statement.		7(2+5)	Hands on practice on Loops.	**CO2**
3	Function and Modules	Introduction of Function, calling a function, Function arguments, built in function, scope rules	Lecture , Hands-on exercise, Demonstration, practical lab	4(1+3)	Learn about how to call or create the functions.	**CO3**
		Passing function to a function, recursion, Lambda functions		7(4+3)	Hands-on functions .	
		Modules and Packages: Importing Modules, writing own modules, Standard library modules, dir( ) Function, Packages in Python		4(1+3)	Develop python programs for modules.	
4	Basic Data structures in Python	Strings: Basic operations, Indexing and Slicing of Strings, Comparing strings	Lecture , Hands-on exercise, Demonstration, practical lab	3(1+2)	Implement and play with strings.	**CO4**
		Regular expressions. Python Basic Data Structure: Sequence,		4(1+3)	Demonstration of the regular expression.	

		Unpacking Sequences, Mutable Sequences,				
		Lists, Looping in lists, Tuples, Sets, Dictionaries. Map, filter, Reduce, Comprehension		7(3+4)	Implement different methods for these data structures.	
5	File and Exception handling	Files and Directories: Introduction to File Handling in Python, Reading and Writing files, Additional file methods, Working with Directories.	Lecture , Hands-on exercise, Demonstration, practical lab	4(1+3)	Learn Python file handling methods and python file operations	**CO5**
		Exception Handling, Errors, Run Time Errors, Handling IO Exception, Try-except statement, Raise		6(2+4)	Learn about Python exception handling methods	**CO5**

Reference Books:

(1) John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
(2) Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.
(3) Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016
(4) Robert Sedgewick, Kevin Wayne, Robert Dondero: Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016.
(5) Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Text Books:
(1) Magnus Lie Hetland, "Beginning Python-From Novice to Professional"—Third Edition, Apress
(2) Python Programming using Problem solving approach by ReemaThareja OXFORD Higher education
(3) Kenneth A. Lambert, ―Fundamentals of Python: First Programs, CENGAGE Learning, 2012.

Links:

UNIT 1
https://nptel.ac.in/courses/106/106/106106182/

UNIT 2
https://nptel.ac.in/courses/106/106/106106212/
https://www.youtube.com/watch?v=PqFKRqpHrjw

UNIT 3
https://nptel.ac.in/courses/106/106/106106145/
https://www.youtube.com/watch?v=m9n2f9lhtrwhttps://www.youtube.com/watch?v=oSPMmeaiQ68

UNIT 4
https://nptel.ac.in/courses/106/106/106106145/
https://www.youtube.com/watch?v=ixEeeNjjOJ0&t=4s

UNIT 5
https://nptel.ac.in/courses/106/106/106106145/
https://www.youtube.com/watch?v=NMTEjQ8-AJM

Lab No.	Unit	Topic	Program Logic Building	CO Mapping	Aligned with university/industry/certifications
1.1	1	Basic Python(Syntax, Variable, Type Conversion)	Python Program to Print Statement	**CO1**	Lab work

1.2	1	Basic Python(Syntax, Variable, Type Conversion)	Swap two variables without using a temporary variable.	**CO1**	Lab work
1.3	1	Basic Python(Syntax, Variable, Type Conversion)	Check if a given number is even or odd.	**CO1**	Lab work
1.4	1	Basic Python(Syntax, Variable, Type Conversion)	Find the largest of three numbers.	**CO1**	Lab work
1.5	1	Basic Python(Syntax, Variable, Type Conversion)	Convert a string to an integer.	**CO1**	Lab work
1.6	1	Basic Python(Syntax, Variable, Type Conversion)	Convert an integer to a string.	**CO1**	Home Assignment
1.7	1	Basic Python(Syntax, Variable, Type Conversion)	Convert a string to a floating-point number.	**CO1**	Home Assignment
1.8	1	Basic Python(Syntax, Variable, Type Conversion)	Convert a floating-point number to an integer.	**CO1**	Home Assignment
1.9	1	Basic Python(Syntax, Variable, Type Conversion)	WAP to demonstrate implicit and explicit type conversion.	**CO1**	Lab work
1.10	1	Basic Python(Syntax, Variable, Type	Convert Employee Count to Binary	**CO1**	Lab work

		Conversion)			
1.11	1	Basic Python(Syntax, Variable, Type Conversion)	Convert Revenue to Currency Format	**CO1**	Lab work
1.12	1	Operators	Write a program to Calculate Sum of 5 Subjects and Find Percentage (Max Mark in each subject is 100).	**CO1**	Lab Work
1.13	1	Operators	Write a program to find gross salary.	**CO1**	Lab Work
1.14	1	Operators	Write a program to Calculate Area of Rectangle, Square.	**CO1**	Lab Work
1.15	1	Operators	Write a program to Calculate Area of Scalene Triangle and Right-angle Triangle.	**CO1**	Home Assignment
1.16	1	Operator	Write a program to find the perimeter of a circle, rectangle and triangle.	**CO1**	Home Assignment
1.17	1	Operator	Write a program to Compute Simple Interest.	**CO1**	Lab Work
1.18	1	Operator	Write a program to Convert Fahrenheit temperature in to Celsius.	**CO1**	Lab Work

1.19	1	Operator	Write a program to Find the Gravitational Force Acting Between Two Objects.	**CO1**	Home Assignment
1.20	1	Operator	Write a program to swap the values of two variables with and without using third variable.	**CO1**	Lab Work
1.21	1	Operator	Write a program to perform arithmetic operations on a = 8, b = 3.	**CO1**	Lab Work
1.22	1	Operator	Write a program to apply relational operations on a=8, b=3.	**CO1**	Lab Work
1.23	1	Operator	Write a program to apply assignment operations on a=8, b=3.	**CO1**	Lab Work
1.24	1	Operator	Write a program to apply logical operations on a=8, b=3.	**CO1**	Lab Work
1.25	1	Operator	Write a program to apply bitwise operations on a=8, b=3.	**CO1**	Lab Work
1.26	1	Operator	Write a program to apply identity operators.	**CO1**	Lab Work
1.27	1	Operator	Write a program to Swap the Contents of two Numbers using	**CO1**	Lab Work

			Bitwise XOR Operation		
1.28	1	Operator	WAP to find the absolute value of the given number.	**CO1**	Home Assignment
1.29	1	Operator	Write a program to Add two Complex Numbers.	**CO1**	Lab Work
1.30	1	Operator	Write a Program to find roots of a quadratic expression.	**CO1**	Home Assignment
1.31	1	Arithmetic Operator	Program to perform basic arithmetic operations (addition, subtraction, multiplication, division) on two numbers.	**CO1**	Lab Work
1.32	1	Arithmetic Operator	Program to calculate the area of a rectangle using the multiplication operator.	**CO1**	Home Assignment
1.33	1	Arithmetic Operator	Program to calculate the average of a list of numbers using the division operator.	**CO1**	Home Assignment
1.34	1	Comparison Operator	Program to compare two numbers and determine if they are equal.	**CO1**	Lab Work
1.35	1	Comparison Operator	Program to compare two numbers	**CO1**	Lab Work

			and determine whether they are greater than or less than .		
1.36	1	Comparison Operator	Program to check if a given string is equal to a specific value.	**CO1**	Lab Work
1.37	1	Logical Operator	Write a program to apply Logical AND operator on two operands.	**CO1**	Lab Work
1.38	1	Logical Operator	Write a program to apply Logical OR operator on two operands.	**CO1**	Lab Work
1.39	1	Logical Operator	Write a program to apply Logical NOT operator on an operand.	**CO1**	Lab Work
1.40	1	Assignment operator	Program to increment or decrement a variable using assignment operators.	**CO1**	Home Assignment
1.41	1	Assignment operator	Program to calculate compound interest using compound assignment operators.	**CO1**	Home Assignment
1.42	1	Bitwise Operator	Program to perform bitwise AND, OR, XOR, left shift, and right shift	**CO1**	Lab Work

			operations.		
1.43	1	Bitwise Operator	Program to check if a given number is odd or even using bitwise operators.	**CO1**	Home Assignment
2.1	2	Conditional Statements	Write a program to Accept two Integers and Check if they are Equal.	**CO2**	Lab Work
2.2	2	Conditional Statements	Write a program to Check if a given Integer is Positive or Negative and Odd or Even.	**CO2**	Lab Work
2.3	2	Conditional Statements	Write a program to Check if a given Integer is Divisible by 7 or not.	**CO2**	Lab Work
2.4	2	Conditional Statements	Write a program to find the greatest of three numbers using else if ladder.	**CO2**	Lab Work
2.5	2	Conditional Statements	Write a program to find the greatest of three numbers using Nested if.	**CO2**	Lab Work
2.6	2	Conditional Statements	Write a program to convert an Upper-case character into lower case and vice-versa.	**CO2**	Lab Work
2.7	2	Conditional Statements	Write a program to check weather an	**CO2**	Home Assignment

			entered year is leap year or not.		
2.8	2	Conditional Statements	Write a Program to check whether an alphabet entered by the user is a vowel or a constant.	**CO2**	Home Assignment
2.9	2	Conditional Statements	Write a program to print day according to the day number entered by the user.	**CO2**	Lab Work
2.10	2	Conditional Statements	Write a program to print color name, if user enters the first letter of the color name.	**CO2**	Lab Work
2.11	2	Conditional Statements	Write a program to Simulate Arithmetic Calculator.	**CO2**	Lab Work
2.12	2	Conditional Statements	Write a menu driven program for calculating area of different geometrical figures such as circle, square, rectangle, and triangle.	**CO2**	Home Assignment
2.13	2	Conditional Statements	WAP that accepts the marks of 5 subjects and finds the percentage marks obtained by the student. It also prints grades according to the following criteria: Between 90-100%	**CO2**	Lab Work

			Print 'A', 80-90% Print 'B', 60-80% Print 'C', 50-60% Print 'D', 40-50% Print 'E', Below 40% Print 'F'.		
2.14	2	Conditional Statements	WAP to enter a character and then determine whether it is a vowel, consonants, or a digit.	**CO2**	Home Assignment
2.15	2	Loops	Write a program to display all even numbers from 1 to 20	**CO2**	Lab Work
2.16	2	Loops	Write a program to print all the Numbers Divisible by 7 from 1 to 100.	**CO2**	Lab Work
2.17	2	Loops	Write a program to print table of any number.	**CO2**	Lab Work
2.18	2	Loops	Write a program to Find the Sum of first 50 Natural Numbers using for Loop.	**CO2**	Lab Work
2.19	2	Loops	Write a program to calculate factorial of a given number using for loop and also using while loop.	**CO2**	Lab Work
2.20	2	Loops	Write a program to count the sum of	**CO2**	Lab Work

			digits in the entered number.		
2.21	2	Loops	Write a program to find the reverse of a given number.	**CO2**	Lab Work
2.22	2	Loops	Write a program to Check whether a given Number is Perfect Number.	**CO2**	Home Assignment
2.23	2	Loops	Write a program to Print Armstrong Number from 1 to 1000.	**CO2**	Lab Work
2.24	2	Loops	Write a program to Compute the Value of X^n.	**CO2**	Lab Work
2.25	2	Loops	Write a program to Calculate the value of ${}^nC_r$.	**CO2**	Home Assignment
2.26	2	Loops	Write a program to generate the Fibonacci Series.	**CO2**	Lab Work
2.27	2	Loops	Write a program to check whether a given Number is Palindrome or Not.	**CO2**	Lab Work
2.28	2	Loops	Write a program to Check whether a given Number is an Armstrong Number.	**CO2**	Home Assignment
2.29	2	Loops	Write a program to print all prime	**CO2**	Home Assignment

			numbers from 1-500.		
2.30	2	Loops	Write a program to find the Sum of all prime numbers from 1-1000.	**CO2**	Home Assignment
2.31	2	Loops	Write a program to display the following pattern: *	**CO2**	Lab Work
2.32	2	Loops	Write a program to display the following pattern: * * * * * * * * * * * * * * *	**CO2**	Lab Work

2.33	2	Loops	Write a program to display the following pattern: 1 1 2 1 2 3 1 2 3 4 1 2 3 4 5	**CO2**	Lab Work
2.34	2	Loops	Write a program to display the following pattern: A B B C CC D DDD E EEEE	**CO2**	Lab Work
2.35	2	Loops	Write a program to display the following pattern: * * * * *	**CO2**	Lab Work

			* * * * * * * * * *		
2.36	2	Loops	Write a program to display the following pattern: 1 2 3 4 5 1 2 3 4 1 2 3 1 2 1	**CO2**	Home Assignment
2.37	2	Loops	Write a program to display the following pattern: * * * * * * * * * * * * * * * *	**CO2**	Home Assignment

2.38	2	Loops	Write a program to display the following pattern: *	**CO2**	Home Assignment
2.39	2	Loops	Write a program to display the following pattern (Pascal Triangle): 1 1 1 1 2 1 1 3 3 1 1 4 6 4 1 1 5 10 10 5 1	**CO2**	Home Assignment
2.40	2	Loops	Write a program to display the following pattern:	**CO2**	Home Assignment

			1 2 3 4 5 6 7 8 9 10		
2.41	2	Loops	Write a program to display the following pattern: A B C D E F G F E D C B A A B C D E F F E D C B A A B C D E E D C B A A B C D D C B A A B C C B A A B B A A A	**CO2**	Lab Work
2.42	2	Loops	Write a program to display the following pattern:	**CO2**	Home Assignment

			* *		
2.43	2	Loops	Write a program to display the following pattern: 0 0 01 10 010 010 0101 1010	**CO2**	Lab Work

			0101001010		
2.44	2	Loops	Write a program to display the following pattern: A B C D E F G H I J K L M N O	**CO2**	Home Assignment
2.45	2	Loops	Write a program to display the following pattern: A BAB CBABC DCBABCD EDCBABCDE	**CO2**	Home Assignment
2.46	2	Loops	Write a program to Find the Sum of A.P Series.	**CO2**	Lab Work
2.47	2	Loops	Write a program to Find the Sum of	**CO2**	Lab Work

			G.P Series.		
2.48	2	Loops	Write a program to Find the Sum of H.P Series.	**CO2**	Lab Work
2.49	2	Loops	Write a program to print the following sequence of integers. 1, 2, 4, 8, 16, 32	**CO2**	Lab Work
2.50	2	Loops	Write a program to find the Sum of following Series: (1*1) + (2*2) + (3*3) + (4*4) + (5*5) + ... + (n*n)	**CO2**	Lab Work
2.51	2	Loops	Write a program to find the Sum of following Series: (1^1) + (2^2) + (3^3) + (4^4) + (5^5) + ... + (n^n)	**CO2**	Home Assignment
2.52	2	Loops	Write a program to find the Sum of following Series: (1!/1) + (2!/2) + (3!/3) + (4!/4) +	**CO2**	Home Assignment

			(5!/5) + ... + (n!/n)		
2.53	2	Loops	Write a program to print the following Series: 1, 2, 3, 6, 9, 18, 27, 54, ... upto n terms	**CO2**	Lab Work
2.54	2	Loops	Write a program to print the following Series: 2, 15, 41, 80, 132, 197, 275, 366, 470, 587	**CO2**	Lab Work
2.55	2	Loops	Write a program to print the following Series:1, 3, 4, 8, 15, 27, 50, 92, 169, 311	**CO2**	Home Assignment
2.56	2	Loops	Write a program to Convert the given Binary Number into Decimal.	**CO2**	Lab Work
2.57	2	Loops	Write a program to Convert Binary to Hexadecimal.	**CO2**	Lab Work
2.58	2	Loops	Write a program to find out L.C.M. of two numbers.	**CO2**	Lab Work
2.59	2	Loops	Write a program to find out H.C.F. of	**CO2**	Home Assignment

			two numbers.		
2.60	2	Loops	Python Program to Accept Three Digits and Print all Possible Combinations from the Digits.	**CO2**	Home Assignment
2.61	2	Loops	Python Program to Print Odd Numbers within a Given Range.	**CO2**	Home Assignment
2.62	2	Loops	Python Program to Find the Smallest Divisor of an Integer.	**CO2**	Home Assignment
2.63	2	Loops	Python Program to Count the Number of Digits in a Number	**CO2**	Home Assignment
2.64	2	Loops	Python program to find GCD between two given integer numbers.	**CO2**	Lab Work
3.1	3	Functions	Write a Python function to find the Max of three numbers.	**CO3**	Lab Work
3.2	3	Functions	Write a Python function to sum all the numbers in a list. Sample List : (8, 2, 3, 0, 7) Expected Output : 20	**CO3**	Lab Work
3.3	3	Functions	Write a Python program to reverse a string.	**CO3**	Lab Work

			Sample String : "1234abcd" Expected Output : "dcba4321"		
3.4	3	Functions	Write a Python function to check whether a number falls in a given range.	**CO3**	Home Assignment
3.5	3	Functions	Write a Python function that accepts a string and calculate the number of upper-case letters and lower-case letters. Sample String: 'The quick Brow Fox' Expected Output : No. of Upper case characters : 3 No. of Lower case Characters : 1	**CO3**	Lab Work
3.6	3	Functions	Write a Python function that takes a number as a parameter and check the number is prime or not.	**CO3**	Lab Work
3.7	3	Functions	Write a Python function that checks whether a passed string is palindrome or not.	**CO3**	Lab Work
3.8	3	Functions	Write a Python function that prints out the first n rows of Pascal's	**CO3**	Lab Work

			triangle.		
3.9	3	Functions	Write a Python function that accepts a hyphen-separated sequence of words as input and prints the words in a hyphen-separated sequence after sorting them alphabetically. *Sample Items:* green-red-yellow-black-white Expected Result: black-green-red-white-yellow	**CO3**	Lab Work
3.10	3	Functions	Python function to convert height (in feet and inches) to centimeters	**CO3**	Lab Work
3.11	3	Functions	Python function to Convert Celsius to Fahrenheit.	**CO3**	Lab Work
3.12	3	Functions	Implement a function to check if two strings are anagrams of each other.	**CO3**	Lab Work
3.13	3	Functions	Python function to display all the Armstrong number from 1 to n.	**CO3**	Lab Work
3.14	3	Recursion	Write a program using recursion to compute factorial of a given number.	**CO3**	Lab Work

3.15	3	Recursion	Write a program to print Fibonacci Series using recursion.	**CO3**	Lab Work
3.16	3	Recursion	Write a program to calculate sum of numbers 1 to N using recursion.	**CO3**	Lab Work
3.17	3	Recursion	Write a program to Find Sum of Digits of the Number using Recursive Function.	**CO3**	Lab Work
3.18	3	Recursion	Write a program to print Tower of Hanoi using recursion.	**CO3**	Home Assignment
3.19	3	Recursion	Python Program to Determine How Many Times a Given Letter Occurs in a String Recursively	**CO3**	Home Assignment
3.20	3	Recursion	Python Program to Find the Binary Equivalent of a Number Recursively	**CO3**	Home Assignment
3.21	3	Recursion	Python Program to Find the GCD of Two Numbers Using Recursion	**CO3**	Home Assignment
3.22	3	Recursion	Python Program to Find the Power of a Number Using Recursion	**CO3**	Home Assignment
3.23	3	Recursion	WAP to compute the sum of all the elements of the list using reduce()	**CO3**	Lab Work

			function.		
3.24	3	Modules and Pacakges	A) Write a program to create a module and import the module in another python program.	**CO3**	Lab Work
3.25	3	Modules and Pacakges	Write a program program to import all objects from a modules, specific objects from module and provide custom import name to the imported object from the module.	**CO3**	Lab Work
3.26	3	Modules and Pacakges	Create a python package having atleast two modules in it.	**CO3**	Lab Work
3.27	3	Modules and Pacakges	Create a python package having atleast one subpackage in it.	**CO3**	Lab Work
4.1	4	String	Python program to check whether the string is Symmetrical or	**CO4**	Lab Work

			Palindrome		
4.2	4	String	Ways to remove i'th character from string in Python	**CO4**	Lab Work
4.3	4	String	Python program to Check if a Substring is Present in a Given String	**CO4**	Lab Work
4.4	4	String	Find length of a string in python (4 ways)	**CO4**	Lab Work
4.5	4	String	Python program to print even length words in a string	**CO4**	Lab Work
4.6	4	String	Python program to accept the strings which contains all vowels	**CO4**	Lab Work
4.7	4	String	Remove all duplicates from a given string in Python	**CO4**	Lab Work
4.8	4	String	Python program to Maximum frequency character in String	**CO4**	Lab Work
4.9	4	String	Python Program to Replace all Occurrences of 'a' with $ in a String	**CO4**	Lab Work
4.10	4	String	Python Program to Form a New String where the First Character and	**CO4**	Lab Work

			the Last Character have been Exchanged		
4.11	4	String	Python Program to Count the Number of Vowels in a String	**CO4**	Home Assignment
4.12	4	String	Python Program to Take in a String and Replace Every Blank Space with Hyphen	**CO4**	Home Assignment
4.13	4	String	Python Program to Calculate the Length of a String Without Using a Library Function	**CO4**	Home Assignment
4.14	4	String	Python Program to Remove the Characters of Odd Index Values in a String	**CO4**	Home Assignment
4.15	4	String	Python Program to Calculate the Number of Words and the Number of Characters Present in a String	**CO4**	Home Assignment
4.16	4	String	Python Program to Take in Two Strings and Display the Larger String without Using Built-in Functions	**CO4**	Lab Work
4.17	4	String	Python Program to Check if a String	**CO4**	Lab Work

			is a Pangram or Not (A pangram is a sentence that uses all 26 letters of the English alphabet at least once. like"The quick brown fox jumps over the lazy dog")		
4.18	4	String	Python Program to Accept a Hyphen Separated Sequence of Words as Input and Print the Words in a Hyphen-Separated Sequence after Sorting them Alphabetically	**CO4**	Lab Work
4.19	4	String	Python Program to Form a New String Made of the First 2 and Last 2 characters From a Given String	**CO4**	Lab Work
4.20	4	String	Python Program to Count the Occurrences of Each character in a Given String Sentence	**CO4**	Lab Work
4.21	4	String	Python Program to Check if a Substring is Present in a Given String	**CO4**	Lab Work
4.22	4	String	Python Program to Find the Most Repeated Word in a String.	**CO4**	Lab Work
4.23	4	Regular Expression	Write a python program to check the	**CO4**	Lab work

			validity of a password given by the user. The password should satisy the following criteria: i) Contain atleast 1 letter between a and z. ii) Contain atleast 1 number between 0 and 9. iii) Contain atleast 1 letter between A and Z. iv) Contain atleast 1 character from $,#,@. v) Maximum length of password 6. vi) Maximum length of password:12.		
4.24	4	Regular Expression	Write a python program to validate mobile number.	**CO4**	Lab Work
4.25	4	Regular Expression	Given an input file which contains a list of names and phone numbers separated by spaces in the following: i) Phone number contains a 3- or 2-digit area code and a	**CO4**	Home Assignment

			hyphen followed by an 8-digit number. **ii)** Find all names having phone number with a 3digit area code using regular expression.		
4.26	4	List	Program to interchange first and last elements in a list	**CO4**	Lab work
4.27	4	List	WAP to find min, max and average of elements of a list having numeric data	**CO4**	Lab work
4.28	4	List	Program to check if element exists in list	**CO4**	Lab work
4.29	4	List	Program for Reversing a List	**CO4**	Lab work
4.30	4	List	Program to Multiply all numbers in the list	**CO4**	Home Assignment
4.31	4	List	Program to find smallest and largest number in a list	**CO4**	Lab work
4.32	4	List	Program to find second largest number in a list	**CO4**	Home assignment

4.33	4	List	Program to print all even numbers in a range	**CO4**	Home assignment
4.34	4	List	Program to print all negative numbers in a range	**CO4**	Lab work
4.35	4	List	Program to Remove multiple elements from a list in Python	**CO4**	Lab work
4.36	4	List	Program to Cloning or Copying a list	**CO4**	Lab work
4.37	4	List	Program to Count occurrences of an element in a list	**CO4**	Home assignment
4.38	4	List	Program to find Cumulative sum of a list	**CO4**	Home assignment
4.39	4	List	Program to Break a list into chunks of size N in Python	**CO4**	Home assignment
4.40	4	List	Python Program to transpose of Matrix.	**CO4**	Lab Work
4.41	4	List	Python Program to Add Two Matrices.	**CO4**	Lab Work
4.42	4	List	Python Program to Multiply Two Matrices.	**CO4**	Home Assignment

4.43	4	List	Program to get K^{th} Column of Matrix	**CO4**	Lab Work
4.44	4	List	WAP to print all even numbers of a list using list comprehension.	**CO4**	Lab Work
4.45	4	List	WAP that prompts user to enter an alphabet and then print all the words that starts with that alphabet from the list of words.	**CO4**	Lab Work
4.46	4	List	WAP to transpose a given matrix using list comprehension.	**CO4**	Lab Work
4.47	4	List	Print All the characters of a string using list Comprehension	**CO4**	Lab Work
4.48	4	List	Write a program to calculate square of numbers upto n using list comprehension.	**CO4**	Lab Work
4.49	4	Tuple	Python program to Find the size of a Tuple	**CO4**	Lab Work
4.50	4	Tuple	Python – Maximum and Minimum K^{th} elements in Tuple	**CO4**	Lab Work
4.51	4	Tuple	Create a list of tuples from given list	**CO4**	Lab Work

			having number and its cube in each tuple		
4.52	4	Tuple	Python – Flatten tuple of List to tuple	**CO4**	Home Assignment
4.53	4	Set	Python Program to Count the Number of Vowels Present in a String using Sets	**CO4**	Lab Work
4.54	4	Set	Python Program to Check Common Letters in Two Input Strings	**CO4**	Lab Work
4.55	4	Set	Python Program that Displays which Letters are in the First String but not in the Second	**CO4**	Lab Work
4.56	4	Set	Python Program that Displays which Letters are Present in Both the Strings	**CO4**	Lab Work
4.57	4	Set	Python Program that Displays which Letters are in the Two Strings but not in Both	**CO4**	Home Assignment
4.58	4	Dictionary	Python Program to Add a Key-Value Pair to the Dictionary	**CO4**	Lab Work

4.59	4	Dictionary	Python Program to Concatenate Two Dictionaries into One.	**CO4**	Lab Work
4.60	4	Dictionary	Python Program to Check if a Given Key Exists in a Dictionary or Not	**CO4**	Lab Work
4.61	4	Dictionary	Python Program to Generate a Dictionary that Contains Numbers (between 1 and n) in the Form (x,x*x).	**CO4**	Lab Work
4.62	4	Dictionary	Python program to create an instance of an Ordered dict using a given dictionary. Sort the dictionary during the creation and print the members of the dictionary in reverse order.	**CO4**	Home Assignment
4.63	4	Dictionary	Python Program to Sum All the Items in a Dictionary	**CO4**	Lab Work
4.64	4	Dictionary	WAP to create dictionary which has characters of given string as keys and frequency of characters as values.	**CO4**	Lab Work
4.65	4	Dictionary	Python Program to Multiply All the Items in a Dictionary	**CO4**	Lab Work

4.66	4	Dictionary	Python Program to Remove the Given Key from a Dictionary	**CO4**	Lab Work
4.67	4	Dictionary	Python Program to Form a Dictionary from an Object of a Class	**CO4**	Home Assignment
4.68	4	Dictionary	Python Program to Map Two Lists into a Dictionary	**CO4**	Lab Work
4.69	4	Comprehension	Write a program Filtering even numbers from a list using tuple comprehension	**CO4**	Lab Work
4.70	4	Comprehension	Creating a list of tuples from two lists using comprehension function	**CO4**	Lab Work
4.71	4	Comprehension	Extracting the first character from each word in a list of strings	**CO4**	Lab Work
4.72	4	Comprehension	Swapping keys and values in a dictionary	**CO4**	Lab Work
4.73	4	Comprehension	Filtering even numbers from a dictionary:	**CO4**	Lab Work
4.74	4	Comprehension	Write a Program to calculate square of number using dictonary comprehension	**CO4**	Lab Work

5.1	5	File handling and Exceptional Handling	Python program to read file word by word	**CO5**	Lab Work
5.2	5	File handling and Exceptional Handling	Python program to read character by character from a file	**CO5**	Lab Work
5.3	5	File handling and Exceptional Handling	Python – Get number of characters, words, spaces and lines in a file	**CO5**	Lab Work
5.4	5	File handling and Exceptional Handling	Program to Find 'n' Character Words in a Text File	**CO5**	Lab Work
5.5	5	File handling and Exceptional Handling	Python Program to obtain the line number in which given word is present	**CO5**	Lab Work
5.6	5	File handling and Exceptional Handling	Count number of lines in a text file in Python	**CO5**	Lab Work
5.7	5	File handling and Exceptional Handling	Python Program to remove lines starting with any prefix	**CO5**	Lab Work
5.8	5	File handling and Exceptional Handling	Python Program to Eliminate repeated lines from a file	**CO5**	Home Assignment
5.9	5	File handling and Exceptional Handling	Python Program to read List of Dictionaries from File	**CO5**	Home Assignment
5.10	5	File handling and	Python – Append content of one text	**CO5**	Home Assignment

		Exceptional Handling	file to another		
5.11	5	File handling and Exceptional Handling	Python program to copy odd lines of one file to other	**CO5**	Lab Work
5.12	5	File handling and Exceptional Handling	Python Program to merge two files into a third file	**CO5**	Lab Work
5.13	5	File handling and Exceptional Handling	Python program to Reverse a single line of a text file	**CO5**	Lab Work
5.14	5	File handling and Exceptional Handling	Python program to reverse the content of a file and store it in another file	**CO5**	Lab Work
5.15	5	File handling and Exceptional Handling	Python Program to handle divide by zero exception.	**CO5**	Lab Work
5.16	5	File handling and Exceptional Handling	WAP to handle multiple exception.	**CO5**	Lab Work
5.17	5	File handling and Exceptional Handling	Python program to combine each line from first file with the corresponding line in second file.	**CO5**	Lab Work
5.18	5	File handling and Exceptional Handling	Write a program to copy the contents of one file to another.	**CO5**	Lab Work
5.19	5	File handling and	Write a program to print First 5 line	**CO5**	Home assignment

		Exceptional Handling	in a file		
5.20	5	File handling and Exceptional Handling	a) Write a program to catch the following exception: i) Value error ii) Index error iii) Name error iv) Type error v) Divide zero error b) Write a program to create user defined exceptions. c) Write a program to understand the use of else and finally block with try block. **d)** Write a python program that uses raise and exception class to throw an exception.	**CO5**	Lab Work

Semester: I **Branch: MCA**				
Subject Code- BMCA0153				**L T P** **0 0 4**
Subject Name- Operating Systems Lab				**Credit-2**
List of Practical				
Lab No.	**Unit**	**Topic**	**Program Logic Building**	**CO Mapping**
1.	**I**	CPU Scheduling Algorithms	Implement FCFS CPU Scheduling algorithm.	**CO1**
2.			Implement the given CPU Scheduling algorithm a) SJF b) Priority Based	**CO1**
3.			Implement Multi-level Queue CPU Scheduling algorithm.	**CO1**
4.			Implement PRIORITY CPU Scheduling Algorithm (For both Pre-emptive and non-pre-emptive).	**CO1**
5.			Implement Round-Robin CPU Scheduling Algorithm	**CO1**
6.			Implement Multilevel Queue CPU Scheduling Algorithm.	
7.	**II**	Process Synchronization	Execute the RACE Condition of Process Synchronization.	**CO2**
8.			Implement the Producer–consumer problem using semaphores.	**CO2**
9.			Design a code and implement the Dinning Philosopher problem	**CO2**
10.		Deadlock	Execute an algorithm for deadlock detection.	**CO2**
11.			Implement Banker's algorithm of Deadlock Avoidance	**CO2**
12.	III	Contiguous Memory Allocation Techniques	Implement Contiguous memory fixed size partition scheme.	**CO3**
13.			Implement Contiguous memory variable size partition scheme.	**CO3**
14.		Continuous Memory Allocation	Simulate the First-Fit contiguous memory allocation technique.	**CO3**
15.			Simulate the Best-Fit contiguous memory allocation	**CO3**

			technique.	
16.			Simulate the Worst-Fit contiguous memory allocation technique.	**CO3**
17.		Non Continuous Memory Allocation	Implement the Non Continuous Memory Allocation by using Paging.	
18.		Page Replacement Techniques	Write a Program to simulate the FIFO page replacement algorithm.	**CO3**
19.			Write a Program to simulate the LRU page replacement Algorithm.	**CO3**
20.			Write a Program to simulate the Optimal page replacement Algorithm.	**CO3**
21.		Disc Scheduling	Write a Program to simulate the FCFS Disk Scheduling Algorithm.	**CO3**
22.			Write a Program to simulate the SSTF Disk Scheduling Algorithm.	**CO3**
23.			Implement SCAN and C-SCAN Disk Scheduling Algorithms.	**CO3**
24.			Implement LOOK and C-LOOK Disk Scheduling Algorithms.	**CO3**
25.		File Management System	Design an algorithm and implement to organize the file using the single-level directory.	**CO3**
26.			Write a program to organize the file using two-level directories.	**CO3**
27.			Write a C program to Sequential files for processing the student information.	**CO3**
28.			Write a C program for random access files for processing the employee details.	**CO3**
29.	IV	Linux permissions for users, groups, and others	Execute Various types of Linux Commands (Miscellaneous, File oriented, Directory oriented)	**CO4**
30.			Execute a shell program, which accepts the name of a file from standard input and performs the File Readable test on it.	**CO4**

31.			Design and execute the code to accept the name of a file from standard input and performs the File Writable test on it.	**CO4**
32.			Implement a shell program, which accepts the name of a file from standard input and performs the File Writable test on it.	**CO4**
33.		Linux File Management	Case Study	**CO4**
34.			Case Study	**CO4**
35.		Linux Networking Commands	Implement Linux Networking Commands: ipconfig, traceroute, tracepath, ping, host, hostname, iwconfig.	**CO4**
36.		Linux System Admin Commands	Implement the following system admin commands in Linux: man, uptime, users, service, pkill, ps.	**CO4**
37.	V	Unix Commands	Implement the following in Unix: a) Process creation, b) Sleep Command c) Sleep command using getpid.	**CO5**
38.			Analyse system calls of unix operating system (fork and exit)	**CO5**
39.			Implement Unix commands for a) Signal handling using kil, b) Wait command, c)top	**CO5**
40.			Write a program to simulate UNIX commands like cp, ls, and grep.	**CO5**
41.		Unix Shell programming	Implement Unix Shell programming for concatenation of two strings.	**CO5**
42.			Implement Unix Shell programming for a) Comparison of two strings b) Maximum of three numbers.	**CO5**
43.			Implement Unix Shell programming for Fibonacci series	**CO5**
44.			Write a program in Unix to whether the given year is a) a leap year or not b) Arithmetic operation using cases.	**CO5**
45.			Write a program in Unix for factorial of a number.	**CO5**
46.			Write a program in Unix to swap the two integers	**CO5**
47.			Write a program in Unix to whether the given number is prime or not.	**CO5**

Lab Course Outcome: Upon the completion of the course, the student will be able to		
CO1	Analyse process management and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.	K3
CO2	Implement Process Synchronization and analyse deadlock handling techniques.	K4
CO3	Simulate the continuous and non-continuous memory allocation concepts and analyse disk scheduling algorithms.	K3
CO4	Deal with Linux commands to understand the concept of virtualization.	K3
CO5	Solve the real world problems using shell programming and shell scripting.	K3

Subject Code- BMCA0152	**L T P** **0 0 4**
Subject Name- Data Structures lab	**Credit: 2**

Course Objective:
Learn to implement linear and non-linear data structures.

List of Activities

Lab No.	**Unit**	**Topic**	**Programs**	**CO Mapping**
1-1	1	Array	Construct a Code to find the maximum element in an array.	**CO1**
1-2	1	Array	Construct a Code to calculate the sum of all elements in an array.	**CO1**
1-3	1	Array	Construct a Code to reverse the elements of an array.	**CO1**
1-4	1	Array	Construct a Code to check if an array is sorted in ascending order.	**CO1**
1-5	1	Array	Construct a Code to count the occurrence of a specific element in an array.	**CO1**
1-6	1	Array	Construct a Code creation and traversal of 2D Array in row major and column major order.	**CO1**
1-7	1	Array	Construct a code to print the transpose of a given matrix using function	**CO1**
1-8	1	Array	Program to find if a given matrix is Sparse or Not and print Sparse Matrix	**CO1**
1-9	1	Searching	Construct a code to Implement Linear Search	**CO1**
1-10	1	Searching	Construct a code to implement Binary Search	**CO1**
2-1	2	Stacks	Implementation of stack using a list	**CO2**
2-2	2	Stacks	Construct a python code to Infix to postfix conversion using a stack	**CO2**
2-3	2	Stacks	Construct a code for Balanced parentheses checker using a stack	**CO2**
2-4	2	Stacks	Implement Reverse a string using a stack.	**CO2**
2-5	2	Recursion	Implement Binary Search using Recursion.	**CO2**
2-6	2	Recursion	Construct a python program to print Fibonacci Series using Recursion.	**CO2**
2-7	2	Queue	Queue implementation using a list	**CO2**
2-8	2	Queue	Construct a code for Simulating a printer queue using a queue.	**CO2**
2-9	2	Queue	Construct a code for Implementing a circular queue.	**CO2**

2-10	2	Queue	Implement queue using stack	**CO2**
3-1	3	Linked List	Create a single linked list and perform basic operations (insertion, deletion, traversal).	**CO2**
3-2	3	Linked List	Create a double linked list and perform basic operations (insertion, deletion, traversal).	**CO2**
3-3	3	Linked List	Create a circular linked list and perform basic operations (insertion, deletion, traversal).	**CO2**
3-4	3	Linked List	Reverse a single linked list.	**CO2**
3-5	3	Linked List	Check if a linked list is palindrome.	**CO2**
3-6	3	Linked List	Reverse a double linked list.	**CO2**
3-7	3	Linked List	Find the middle element of a single linked list.	**CO2**
3-8	3	Linked List	Find the middle element of a double linked list.	**CO2**
3-9	3	Linked List	Merge two sorted single linked lists.	**CO2**
3-10	3	Linked List	Detect and remove a loop in a circular linked list.	**CO2**
4-1	4	Binary Tree	Construct a code to Insert, Delete and search and update a data in Binary Search Tree (BST)	**CO3**
4-2	4	Binary Tree	Construct a code for Tree Traversal (Preorder, Inorder, Postorder)	**CO3**
4-3	4	Binary Tree	Construct a code Count the number of Leaves in a Binary Tree	**CO3**
4-4	4	Binary Tree	Construct a code to find the Height of a Binary Tree	**CO3**
4-5	4	Binary Tree	Construct a code to print all Paths from the Root to Leaf Nodes in a Binary Tree	**CO3**
4-6	4	Binary Tree	Construct a code to convert a Binary Tree to its Mirror Tree	**CO3**
4-7	4	BST	Construct a code to find the Node with Minimum Value in a Binary Search Tree.	**CO3**
4-8	4	BST	Construct a code for Binary Search Tree (BST) Implementation	**CO3**
4-9	4	BST	A program to check if a Binary Tree is a Binary Search Tree (BST)	**CO3**
4-10	4	AVL Tree	Construct a code to check if a Binary Tree is a Balanced Binary Tree	**CO3**
5-1	5	Graph	Construct a code to represent graph using adjacency matrix and adjacency list.	**CO3**
5-2	5	Graph	Implement BFS and DFS algorithm.	**CO3**
5-3	5	Graph	Implement the minimum cost spanning tree.	**CO3**
5-4	5	Sorting	Implement bubble sort in a non-recursive way.	**CO3**
5-5	5	Sorting	Implement selection sort in a non-recursive way.	**CO3**
5-6	5	Sorting	Implement insertion sort in a non-recursive way.	**CO3**
5-7	5	Sorting	Implement Merge sort in a non-recursive way.	**CO3**
5-8	5	Sorting	Implement Merge sort in a recursive way.	**CO3**
5-9	5	Sorting	Implement Quick sort in a recursive way.	**CO3**
5-10	5	Sorting	Implement Heap sort in a non-recursive way	**CO3**
6-1	1	Project	Array-based Student Performance Analysis System	**CO1**

6-2	2	Project	Design a project based on stack data structure to create a web history checker.	**CO2**
6-3	3	Project	Design a dynamic Music Playlist using Linked List	**CO3**
-6-4	4	Project	Design Decision Tree Classifier for Disease Diagnosis using tree data structure.	**CO3**
6-5	5	Project	Design Road Network Navigation: Implementing a navigation system to find the shortest path between locations using road networks.	**CO3**

Lab Course outcome:

CO1	Operations on single and multi-dimensional array, and how to use them for implementation of matrix operations.
CO2	Implement Stack and Queue and linked list linked list.
CO3	Solve complex problems using non-linear data structures like tree and graph along with the understanding of searching and sorting

Subject Code- BMCA0151			**L T P** **0 0 4**	
Subject Name- Business Communication for Technical Students –Lab			**Credit: 2**	
Total No. of Activities: 24				
List of Activities				
Activity	**Module**	**Topic**	**Program Logic Building**	**CO Mapping**
Anubhava Activities	1	Getting rid of stage fright	Participants will gain confidence in expressing themselves through dance, overcome inhibitions, and develop a sense of freedom and creativity.	**CO1**
Dumb Charades	1	Enhancing communication skills and non-verbal expressions	Participants will improve their ability to communicate effectively using non-verbal cues, develop teamwork and collaboration skills, and enhance their creativity in conveying messages.	**CO3**
Chinese Whisper	2	Developing active listening and accurate communication skills	Participants will enhance their listening skills, practice conveying information accurately, and understand the importance of clear communication and active listening in avoiding miscommunication.	**CO2**
Communication Web	2	Practicing active listening and collaboration skills	Participants will learn to effectively communicate and listen to others' perspectives, build trust and collaboration within a group, and understand the significance of clear and	**CO3**

			concise communication in achieving common goals.	
Analysing a Case Study	1	Case Study: Badger Mining Corp Case Study	Participants will develop critical thinking skills, analyse the effectiveness of communication practices, and gain insights into real-world communication challenges and their solutions.	**CO4**
Narrating a Story	2	Story telling based on Video/Picture Prompts	Participants will enhance their ability to comprehend and interpret information from visual aids, develop storytelling skills, and engage in imaginative and creative thinking.	**CO3**
Reading Charts, Tables, Graphs, etc.	2	Infographics Activity	The students will become more proficient in reading and interpreting visual representations of data, enhancing their data literacy, and enabling them to make evidence-based decisions in various domains of life.	**CO4**
Reading Comprehension	2	Reading Comprehension Exercise	Participants will enhance their reading comprehension abilities, improve vocabulary and language skills, and develop strategies for efficient and effective reading.	**CO1**
Filling a Pro forma	2	Acquiring Form Filling Finesse	Participants will improve their ability to understand and follow instructions, enhance their attention to detail, and develop proficiency in accurately filling out forms.	**CO2**

Listening Comprehension	2	Musical Codebreaker: Deciphering the lyrics of English Songs	Participants will improve their overall English language proficiency by engaging with song lyrics.	**CO3**
Listening Comprehension	2	Developing Auditory Instructional Proficiency 1: Listening to instructions	The students will be able to improve listening skills, comprehension of verbal instructions, attention to detail, and ability to follow multi-step directions accurately.	**CO3**
Listening Comprehension	2	Developing Auditory Instructional Proficiency 2: Listening to directions	Participants will enhance their ability to listen and comprehend verbal directions, develop spatial awareness, and improve their navigational skills.	**CO3**
Listening Comprehension	2	Speech Analysis 1: A P J Abdul Kalam's Motivational Speech https://www.youtube.com/watch?v=7fIL5s_Kq68	The students will get an opportunity to engage with authentic spoken language, improve their listening skills, expand their vocabulary, enhance their grammar, and sentence structure knowledge, develop cultural understanding, and refine their speaking and communication abilities in the target language.	**CO4**
Improving Critical Thinking/Analytical	2	Views on News	The students will enhance their language skills, expand their vocabulary, practice speaking and writing, foster cultural understanding, and cultivate critical thinking skills within the context of news general awareness topics.	**CO3**
Improving Speaking Skills	1	Speed Networking Instructions: Set up a speed networking activity where students pair up and have a short	The students will get a dynamic and interactive environment to practice their language skills, enhance their vocabulary, improve their	**CO3**

		conversation with each other extracting specific information.	communication abilities, gain cultural understanding, build confidence, and foster social interaction within a language learning community.	
Spontaneous Speaking	2	Creating Podcasts	Participants will enhance their listening skills, develop the ability to extract key information from podcasts, and engage in reflective and analytical discussions based on podcast content.	**CO3**
Speaking in different situations	2	Role Play Activity 1	The learners will be provided with a valuable opportunity to apply theirlanguage skills in a practical business context. By engaging in realistic scenarios, learners will develop their communication abilities, cultural awareness, confidence, and proficiency in the target language.	**CO2**
Speaking in different situations	2	Role Play Activity 2	-do-	**CO2**
Sharing a Viewpoint Effectively	2	The Discussion Circle: Group Discussion 1	Participants will enhance their ability to express their opinions, actively listen to others, and engage in constructive discussions to develop well-rounded perspectives.	**CO5**
Reviewing Videos clips/Movies	2	Video/Movie Reviewing	The students will get a platform to practice listening comprehension, expand vocabulary, develop writing and speaking skills, enhance cultural awareness, foster critical thinking,	**CO4**

			encourage creativity and expression, promote media literacy, and create an enjoyable learning experience.	
Interview Handling Skills	4	Mock Interviews: Practising Behavioural and FAQs	The students will be able to respond to behavioural interview questions efficiently.	CO5
Presentation Skills	4	Articulating insights: Presentations	Participants will enhance their ability to deliver engaging presentations, effectively communicate their ideas, and exhibit confidence in public speaking.	CO5
Final Assessment	2	Writing Task for the Final Internal Assessment		
Final Assessment	2	Group Presentations for Final Internal Assessment		

Semester II

Semester: II **Branch: MCA**	
Subject Code- BMCA0202	**L - T – P** **3 - 1 - 0**
Subject Name- Database Systems	**Credit-4**

Course Objectives:

- The objective of the course is to introduce about database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information in relational & non-relational databases.

Course Outcomes:

After the completion of the course, the students will be able to

CO1- Understand ER and EER diagram to design the database for solving the real-world problems.

CO2- Apply and analyze the Structured Query Language (SQL) to solve the complex queries and implement normalization.

CO3- Implement the operators in complex queries and apply database connectivity for different applications.

CO4- Implement PL/SQL and analyze transaction and concurrency control in transaction management.

CO5- Design and implement relational and non-relational database for the need of the real-world project.

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P) (clearly mention the hours for theory and lab)**	**Practical/Assignment/Lab**	**CO Mapping**

I **Introduction of Database & Conceptual Designing**	Module 1.1Introduction about the DBMS Module1.2 - Design & Implement the ER Diagram Module 1.3 Introduction on SQL, Implements the DDL, DML, DCL & TCL Module 1.4 Introduction on Relational Algebra & relational Calculus	Basic Concept: - Introduction of SDLC, Data, Information, Database, DBMS, History of Database, Database system Vs File system, Data models & Types of Data Models Relational Database term: - Relation, Tuple, Attribute and Domain, Codd Rules Data Modelling using the Entity Relationship Model: ER model concepts, Degree of relationship, Notation for ER diagram, mapping constraints reduction of an ER diagrams to tables. Extended Entity Relationship Diagram & reduction of EER Introduction on SQL& Types of SQL commands: -DDL, DML, DCL, TCL Basic of Relation Algebra and Relational calculus	PPTs/ Lecture Notes /Smart Board T1, T2, T3, R2	8+8	Through the StarUml and Other ER Tools design the ER- Diagram for the real problem. Through the any relational database tool we implement the basic commands like DDL, DML, DCL and TCL Practical Approach/ Assignment	**CO1**
	Module2.1	Keys & Types of Keys: - Super key, Candidate Key, Primary Key, Alternative Key Composite Primary			Through the any relational database tool we implement the Data	

II **Basic of SQL & Normalization**	Implementation the Keys Module 2.2: Implementation of Data Constraint Module 2.3: Implementation of Aggregate function & clause Module 2.4: Understand & Implement the normalization and different types of functions in SQL.	key, Foreign Key, unique and Composite Unique key Data Constraint: - Null, Not Null, Default and check Constraint Use of Aggregate Function: -Min (), Max (), Count (), AVG (), Sum (). Uses of String Functions in SQL Uses of mathematical functions in SQL Uses of Advanced Functions in SQL Use of Clause: Where, Group by, Having and Order by Functional Dependencies, Normalization & Types of Normalization, Candidate Key, Minimal Cover of FD's	Chalk & Duster/ PPTs/ Lecture Notes /Smart Board T1, T2, T3	7+10	constraints, Aggregate function, String function, and different types of clauses. Understand &Implement the Concept of Database Normalization Practical Approach/ Assignment	**CO2**

III **Introduction of Complex Queries**	Module3.1: - operator & Predicates Module3.2: -Set Theory Operator Module3.3: - Binary Operator Module3.4: - Nested Query Module 3.5: - Understand& Implementation the database connectivity	Operator & Predicates: - Like, Between, Aliases, distinct, limit, Implementation of Logical operator: - And, Or, Not Set Theory Operator: - Union, Intersect, Minus. Binary Operator: - Cartesian Product, join: -Inner Join: - Natural Join, Equi Join & Non Equi Join Outer Join: - Left Outer Join, Right Outer Join and Full Outer Join, Division Operator Nested Query or Sub Query: -IN, NOT IN, Exists, Not Exists, All and Any Database connectivity with Java/Python and other Programming Languages	Chalk & Duster/ PPTs/ Lecture Notes /Smart Board T1, T2, T3,	7+10	Through the any relational database tool we implement the operators, Set Theory Operators, Join and Nested Queries Understand & Implement Database connectivity with SQL Database Practical Approach/ Assignment	**CO3**

IV **Introduction of PL/SQL and Transaction & Concurrency control**	Module 4.1: - Implementation index, Views and Array Module 4.2: - Implementation of PL/SQL Module 4.3:- Implementation of Transition management & concurrency control	Managing Indexes, Synonyms and Sequences, Managing Views, Managing Data in Different Time Zones, Array Function & Operators, Introduction of PL/SQL Implementation of PL/SQL Function, Procedure, Trigger, Cursor Transaction system: - Life cycle of transaction, ACID Properties Schedule & Types of Schedules Control Concurrency Techniques: Concurrency Control, Locking Techniques for concurrency control, 2-phase Locking protocol Transaction & Data Control: - Grant, Revoke, commit & Rollback	Chalk & Duster/ PPTs/ Lecture Notes /Smart Board T1, T2, T3,R2	6+8	Through the any relational database tools implement the Array operator and function, PL/SQL, and commit and rollback used win transaction Practical Approach/ Assignment	**CO4**

concept						
V **Introduction of NoSqlWith MongoDB**	Module 5.1. Understand NoSQL Concept and implement the CURD operations Module 5.2. Implement the MongoDB Cursor, relation and Aggregation in MongoDB. Module 5.3. Understand the concept of cloud database.	Introduction of NoSQL Data Models, Overview of NoSQL Databases With their Types, Uses& Features of NoSQL Document Databases, CAP theorem, BASE Vs ACID Introduction and Features of MongoDB, MongoDB Operators, MongoDB Collection & Document, CRUD operations, MongoDB Shell & their commands, MongoDB Compass, MongoDB Cursor & Methods, Relations in MongoDB, Aggregation in MongoDB Introduction of Cloud Database. MongoDB Cloud: -Stitch, Atlas, Cloud Manager.	Chalk & Duster/ PPTs/ Lecture Notes /Smart Board T4 ,R3	8+12	By Using MongoDB tool implement the Operators, CRUD operation, Shell Commands, Cursor Function, relation and MongoDB Cloud commands Practical Approach/ Assignment	**CO5**
Text Books:						
1.Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw - Hill.						
2.Elmasri, Navathe, "Fundamentals of Database Systems", Seventh Edition, Addison Wesley.						

3. Ivan Bayross “SQL, PL/SQL The programming language Oracle, Fourth Edition, BPB Publication. (December 1-2010)	
4. Brad Dayley “NoSQL with MongoDB in 24 Hours” **Sams Publishing; 1st edition (September 8, 2014)**	
Reference Books:	
1.Thomas Cannolly and Carolyn Begg, “Database Systems: A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.	
2.Raghu Ramakrishan and Johannes Gehrke “Database Management Systems” Third Edition, McGraw-Hill.	
3.NoSQL and SQL Data Modeling: Bringing Together Data, Semantics, and Software First Edition by Ted Hills.	
NPTEL/ YouTube/ Faculty Video Link	
Unit-1	**NPTEL Video Course : NOC:Data Base Management System** **https://www.youtube.com/watch?v=OWX4RvijwLw** **https://www.youtube.com/watch?v=OQanW4NVksY** **https://www.youtube.com/watch?v=pm_Tr3eZAac** **https://www.youtube.com/watch?v=pBGJYwR5rlM** **https://www.youtube.com/watch?v=H6iFrMYZFhU** **https://www.youtube.com/watch?v=c5HAwKX-suM** **https://www.youtube.com/watch?v=7S_tz1z_5bA**
Unit-2	**https://www.youtube.com/watch?v=_UZLrD_R0T4** **https://www.youtube.com/watch?v=kr4iTckAVUs** **https://www.youtube.com/watch?v=FToHXp-IX0g**

	https://www.youtube.com/watch?v=cwVegKAZO1k **https://www.youtube.com/watch?v=xHB4PeqLK8o** **https://www.youtube.com/watch?v=7S_tz1z_5bA**
Unit-3	**https://www.youtube.com/watch?v=xxBEPiUWGCg** **https://www.youtube.com/watch?v=bLL5NbBEg2I** **https://www.youtube.com/watch?v=FNYdBLwZ6cE** **https://www.youtube.com/watch?v=oRW3PyZi3GE** **https://www.youtube.com/watch?v=3aCErW7gMPU** **https://www.youtube.com/watch?v=y_YxwyYRJek** **https://www.youtube.com/watch?v=7S_tz1z_5bA**
Unit-4	**https://www.youtube.com/watch?v=X-1viE7QFtQ** **https://www.youtube.com/watch?v=5ammL5KU4mo** **https://www.youtube.com/watch?v=8yfEl0Yvxto** **https://www.youtube.com/watch?v=abLIS6BX964**

	https://www.youtube.com/watch?v=uuRf-VEFbco **https://www.youtube.com/watch?v=7S_tz1z_5bA**
Unit-5	**https://www.youtube.com/watch?v=2yQ9TGFpDuM** **https://www.youtube.com/watch?v=fbYExfeFsI0** **https://www.youtube.com/watch?v=-68k-JS_Y88** **https://www.youtube.com/watch?v=c2M-rlkkT5o**

Semester: II

Branch: MCA

Subject Code- BMCA0201	**L - T – P** **3 - 1 - 0**
Subject Name- Computer System & Organization	**Credit-4**

Course Objectives:

- The basic concepts and components of digital logic design, The different methods of data representation in computers, The different micro operations and data transfer methods, Design, functionality and taxonomy of CPU, Memory types and functionality with data transfer methods.

Course Outcomes:

After the completion of the course, the students will be able to

CO1- To explain the number systems including computer arithmetic, logic gates, Boolean algebra, Minimization techniques etc.

CO2- To discuss about the different binary codes and arithmetic operations.

CO3- To elaborate about the register transfer operations and construction of buses by using different digital components.

CO4- To analyze the functional units of the processor such as register file, arithmetic-logical unit and control unit.

CO5- To demonstrate cache subsystem, memory mapping techniques and Input-Output subsystem and protocols for data communication.

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required** **(T=L+P) (clearly mention the hours for theory and lab)**	**Practical/Assignment/Lab**	**CO Mapping**

I	Introduction	Digital Computers and Number System, Logic Gates, Boolean Algebra, Map Simplification upto five variables, Combinational Circuits, Sequential Circuits, Look ahead carry adders, Data types, Complements, Fixed point representation, Fixed Point Addition & Subtraction, floating point Representation, Booth's Multiplication, IEEE754 Floating point standards.	Chalk & Duster/ PPTs/ Lecture Notes /Smart Board	8+8	Practical Approach/ Assignment	**CO1**
II	Register Transfer & Microoperations	Register Transfer Language, Register Transfer, Bus and Memory Transfers, Common Bus System, Two Bus Organization, Three Bus Organization, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic & Logic unit design.	Chalk & Duster/ PPTs/ Lecture Notes /Smart Board	7+10	Practical Approach/ Assignment	**CO2**
	Central Processing Unit	Microprogrammed Control Unit, Hardwired Control Unit, General register Organization, Stack Organization, Instruction types,	Chalk & Duster/ PPTs/	7+10	Practical Approach/ Assignment	

III		formats, instruction cycles and sub cycles (Fetch, decode, execute etc.), execution of a complete instruction, Addressing Modes, Reduced Instruction set computer, Complex Instruction set Computer.	Lecture Notes /Smart Board			**CO3**
IV	Memory Management	Memory Hierarchy, Main Memory (RAM and ROM chips), Auxiliary Memory, and Associative memory, Cache Memory, Memory Mapping: Associative mapping, Direct mapping, Set associative mapping. 2D and 2.5Dmemoryorganization	Chalk & Duster/ PPTs/ Lecture Notes /Smart Board	6+8	Practical Approach/ Assignment	**CO4**
V	**Input/output**	I/O interface, I/O ports , Interrupts, Modes of data Transfer: Programmed I/O, Interrupt Initiated I/O, and Direct memory access (DMA), I/O channels and processors, Serial Communication, Standard communication interfaces. CaseStudy: Multicoreprocessing, Multithreading architecture	Chalk & Duster/ PPTs/ Lecture Notes /Smart Board T4 ,R3	8+12	Practical Approach/ Assignment	**CO5**

Semester: II

Branch: MCA

Subject Code- BMCA0204	**L - T - P** **3 – 0 – 0**
Subject Name- Design Thinking I	**Credit-3**

Course Objective- The objective of this course is to familiarize students with the design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite their minds to create innovative ideas as develop solutions for real-time problems.

Course Outcome – After completion of this course students will be able to:

CO1 - Develop a strong understanding of the design process and apply it in a variety of business settings

CO2-Analyze self, culture, and teamwork to work in a multidisciplinary environment and exhibit empathetic behaviour

CO3- Formulate specific problem statements of real-time issues and generate innovative ideas using design tools

CO4- Apply critical thinking skills in order to arrive at the root cause from a set of likely causes

CO5- Demonstrate an enhanced ability to apply design thinking skills for the evaluation of claims and arguments

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P)**	**Aligned Practical/Assignment/Lab**	**CO Mapping**
Unit 1	Introduction	An overview of future skills, introduction to design thinking, traditional problem solving versus design thinking, history of design thinking, wicked problems. Innovation and creativity, the role of innovation		10	Practical Approach (Discussion and Activities), Workshop at School of Future Skills Activity related to observation & team building	**CO1**

		and creativity in organizations, creativity in teams and their environments, design mindset. Introduction to elements and principles of design, 13 Musical Notes for Design Mindset, Examples of Great Design, Design Approaches across the world.	Smartboard/PPT/Text book/Reference book		exercise	
Unit 2	**Ethical Values and Empathy**	Understanding humans as a combination of I (self) and body, basic physical needs up to actualization, prosperity, the gap between desires and actualization. Understanding culture in family, society, institution, startup, socialization process. Ethical behaviour: effects on self,society, understanding core values and feelings, negative sentiments and how to overcome them,definite human conduct: universal human goal, developing human consciousness in values, policy,and character. Understand stakeholders, techniques to empathize, identify key user problems. Empathy tools- Interviews, empathy maps, emotional mapping, immersion and observations,	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment Activity related to Empathy Map and Journey Mapping	**CO2**

		Emotional Intelligence, customer journey maps, classifying insights after Observations, Classifying Stakeholders, Individual activity- 'Moccasin walk'				
Unit 3	**Problem Statement and Ideation**	Defining the problem statement, creating personas, Point of View (POV) statements. Research identifying drivers, information gathering, target groups, samples, and feedbacks. Idea Generation basic design directions, Themes of Thinking, inspirations and references, brainstorming, inclusion, sketching and presenting ideas, idea evaluation, double diamond approach, analyze – four W's, 5 why's, "How Might We", Defining the problem using Ice-Cream Sticks, Metaphor & Random Association Technique, Mind-Map, ideation activity games - six thinking hats, million-dollar idea, introduction to visual collaboration and brainstorming tools - Mural, JamBoard.	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment Activity related to Brainstorming and Six Thinking Hats	**CO3**

Unit 4	**Critical Thinking**	Fundamental concepts of critical thinking, the difference between critical and ordinary thinking, characteristics of critical thinkers, critical thinking skills- linking ideas, structuring arguments, recognizing incongruences, five pillars of critical thinking, argumentation versus rhetoric, cognitive bias, tribalism, and politics. Case study on applying critical thinking on different scenarios.	Smartboard/PPT/Text book/Reference book	6	Practical Approach (Discussion and Activities)/Assignment Activity related to identifying Biases	**CO4**
Unit 5	**Logic and**	The argument, claim, and statement, identifying premises and conclusion, truth and logic conditions, valid/invalid arguments, strong/weak arguments, deductive argument, argument diagrams, logical		8	Practical Approach (Discussion and Activities)/Assignment	**CO5**

	Argumentation	reasoning, scientific reasoning, logical fallacies, propositional logic, probability, and judgment, obstacles to critical thinking. Group activity/role plays on evaluating arguments.	Smartboard/PPT/Text book/Reference book			

Text Books:

1. Arun Jain, UnMukt : Science & Art of Design Thinking, 2020, Polaris

2. Jeanne Liedta, Andrew King and Kevin Benett, Solving Problems with Design Thinking – Ten Stories of What Works,2013,Columbia Business School Publishing

3. RR Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional

Ethics, First Edition, 2009, Excel Books: New Delhi

Reference Books:

1. Vijay Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2013, John Wiley and Sons Inc, New Jersey

2. Mootee, I. (2013). Design thinking for strategic innovation: What they can't teach you at business or design school. John Wiley & Sons.

3. Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, 2010, AVA Publishing SA

4. Roger L. Martin, Design of Business: Why Design Thinking is the Next Competitive Advantage, 2009, Harvard Business Press, Boston MA

Links:

Unit I

https://nptel.ac.in/courses/110/106/110106124/

https://nptel.ac.in/courses/109/104/109104109/

https://designthinking.ideo.com/

https://blog.hypeinnovation.com/an-introduction-to-design-thinking-for-innovation-managers

https://www.creativityatwork.com/design-thinking-strategy-for-innovation/

https://www.youtube.com/watch?v=GFffb2H-gK0

Unit II

https://aktu.ac.in/hvpe/

http://aktu.uhv.org.in/

https://nptel.ac.in/courses/110/106/110106124/

https://swayam.gov.in/nd1_noc19_mg60/preview

Unit III

https://nptel.ac.in/courses/110/106/110106124/

https://swayam.gov.in/nd1_noc19_mg60/preview

https://www.udemy.com/course/design-thinking-for-beginners/

https://www.designthinking-methods.com/en/

https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them

Unit IV

https://www.forbes.com/sites/sap/2016/08/25/innovation-with-design-thinking-demands-critical-thinking/#340511486908

https://www.criticalthinking.org/pages/defining-critical-thinking/766

Unit V

https://www.udemy.com/course/critical-thinker-academy/

https://swayam.gov.in/nd2_aic19_ma06/preview

List of Suggested projects: An indicative list of projects where you will have to be actively engaged in field work to interact with stakeholders & apply Design Tools, such as –

Institutional Projects

1. Improving canteen experience
2. Improving library usage by students
3. Facilitating interaction between students of diverse ethnic backgrounds
4. Making college campus plastic-free
5. Segregating different kind of domestic waste
6. Adopting to plastic-ban
7. How can we improve classroom experience of students?
8. How can we ensure better communication with our institution alumni?

Or

Social Projects

9. How can we ensure that clean drinking water is handled properly?
10. How might we feed everybody in the world?
11. How can we solve voters' dissatisfaction by changing the voting system?
12. How can we help the school drop-outs to continue the study?
13. How to solve issue of waste management?
14. How can we solve issue of insensitivity of peoples towards street animals?
15. How to solve the issue of gender inequality in society / college / schools?
16. How can we improve College Experiences and helping teachers?
17. How can we ensure secured financial transactions and minimize scams?
18. Facilitating Water Conservation in domestic households
19. Making the elderly adapt to mobiles/smartphones.
20. Use design thinking to use empty lot's in our neighborhood.

Or

A project on the theme: teens, human rights, water, privacy, violence, equity, immigration, change with growth, food waste and robotics.

Industrial Projects

21. Windsor Airline's consistent flight delays are hurting the company's bottom line. How might we ensure that Windsor Airlines flights leave on time.
22. Being part of an ever-connected society, many people in the Global North can barely fathom that still more than 1.5 billion people live off the grid. Instead of simply plugging in, they use kerosene lanterns that only illuminate spots in their home, walk miles to charge their mobile phones, or run a diesel genset for their business. How do you reinvent Solar Energy Supply for them?
23. NGO provides services and financial support to people with developmental disabilities. But for parents of children with disabilities, navigating the long and sometimes bewildering bureaucratic process required to get such services often challenges their patience and persistence. Before NGO can

determine which services, if any, are best for a child, staffers conduct a thorough assessment that entails meetings with parents, home visits by social workers, and evaluations by medical professionals including speech pathologists, psychologists, and nurses. Design a process to ensure Better and faster Service.

24. A company wish to provide internet access to everyone. Design a low cost, easily applicable model.
25. Use 'design thinking' can help lose weight, stop worrying, and change life of peoples.
26. Assume you are called in to help the struggling community bank, with around 40 employees and six branches. You immediately noticed that all banks offered the same lousy experience: bland, boring, forgettable. Most banks offer the same products at basically the same rates, too. If Xling was able to come up with a great product, it would be copied by the bigger banks within days. What could you do to make the bank better?
27. Your city metro train service is facing issues of troublesome experiences of travelers. The team has notices that the queues often built up at the service Counters because customers asked the same simple questions again and again. How would you improve the services.
28. Violent crime and the loss of young lives in assaults pose a frightening problem in many urban city districts. Use design thinking to find how to 'Designing Out Crime Research Center' as solution.
29. City Hospital simply wishes improving staff hand-washing habits could prevent these needless infections. While hospitals have plenty of communal sinks and hand-sanitizing dispensers, time-strapped caregivers simply don't use them, they noticed medical staff wiped their hands on their scrubs. Use design thinking to give solutions.
30. The Wiley produces traditionally crafted 'Dutch Wax Print' fabrics for Indian markets. Lately, the organization faces disrupted markets, competition, and Chinese counterfeit. Use design thinking to come up with a new vision to secure its future Or any of your Startup Idea as project

Semester: II

Branch: MCA

Subject Code- BMCA0211	**L - T – P** **3 – 0 – 0**
Subject Name- Fundamentals of Digital Marketing and Analytics	**Credit-3**

Course Objective- To help students understand digital marketing practices, inclination of digital consumers and role of content marketing , provide understanding of the concept of E-commerce and developing marketing strategies in the virtual world, impart learning on various digital channels and how to acquire and engage consumers online , provide insights on building organizational competency by way of digital marketing practices and cost considerations, develop understanding of the latest digital practices for marketing and promotion.

Course Outcome – After completion of this course students will be able to:

CO1 - It will develop proficiency in interpreting marketing strategies in the digital age and provide fundamental knowledge for working in an online team.
CO2- It will enable them to develop various online marketing strategies for various marketing-mix measures.
CO3- It will guide them to use various digital marketing channels for consumer acquisition and engagement.
CO4- It will help in evaluating the productivity of digital marketing channels for business success.
CO5- It will prepare candidates for global exposure of digital marketing practices to make them employable in a high growth industry

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P)**	**Aligned Practical/Assignment/Lab**	**CO Mapping**
Unit 1	Foundation Data Everywhere	Introducing data analytics and thinking - use data analytics and the tools of their trade to inform those decisions. All about analytical thinking- these roles	Smartboard/PPT/Text	10	Practical Approach (Discussion and Activities),	**CO1**

		and the key skills used by analysts. The wonderful world of data-how the data life cycle and data analysts 'work both relate to your progress through this program.	book/Reference book			
Unit 2	**Make Data Driven Decision**	Make Data Driven Decision Set up your toolbox:-spreadsheets, query languages, and data visualization tools. Endless career possibilities-data analysts, data analyst certificate. Effective questions-common analysis challenges and how analysts address them, guide your analysis	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment	**CO2**
Unit 3	Data-driven decisions and spreadsheets	Data-driven decisions and spreadsheets - data of all kinds and its impact on real-life choices and strategies, reports and dashboards. Spreadsheet basics-data analysts use, spreadsheets work, structured thinking, analysts understand problems, problems solutions.	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment	**CO3**

Unit 4	**Prepare Data for Exploration and Stakeholder**	Prepare Data for Exploration and Stakeholder- data analysts, balance needs and expectations, managing stakeholder expectations, communication with your team. Datatypes and structures-generate data, Collection of data, analysis for data, Bias, credibility, privacy, ethics, and access-data analysts work, data is unbiased and credible, different types of bias in data, importance of data ethics and data privacy.	Smartboard/PPT/Text book/Reference book	6	Practical Approach (Discussion and Activities)/Assignment Activity related to identifying Biases	**CO4**
Unit 5	**Organizing and protecting your data**	Organizing and protecting your data Databases: Where data lives-databases, access them and extract, filter, and sort the data, metadata and its different types and how analysts use them. Organizing and protecting your data- organizing data and keeping it secure, analysts use file naming conventions. Engaging in the data	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/Assignment	**CO5**

		community-how to manage your online presence, benefits of networking with other data analytics professionals				

Text Books:

(1)Vandana,Ahuja;DigitalMarketing,OxfordUniversityPressIndia(November,2015)

(2)EricGreenberg,andKates,Alexander;StrategicDigitalMarketing:TopDigitalExpertsSharethe FormulaforTangibleReturnsonYourMarketingInvestment;McGraw-HillProfessional(October, 2013).

(3)DavidWhiteley; E-Commerce:Strategy,Technologiesand Applications, McGraw HillEducation

Links:

Unit I

https://www.youtube.com/watch?v=68B3N0x3cPI&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=1

Unit II

https://www.youtube.com/watch?v=3iSKFCKLUsI&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=2

Unit III

https://www.youtube.com/watch?v=67lO4HtJitg&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=8

Unit IV

https://www.youtube.com/watch?v=fYSvrZD4G38&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=14

Unit V

https://www.youtube.com/watch?v=GauClv1HsZA&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=19

Semester: II

Branch: MCA

Subject Code- BMCA0212	**L - T – P** **3 – 0 - 0**
Subject Name- Fundamentals of Digital Marketing and Optimization	**Credit-3**

Course Objective- To introduce students to Understand how digital and social media have disrupted the way businesses sell to consumers , help students to Recognize how marketers use the customer journey model to influence purchase decisions on digital platforms using digital content and tools , identify the benefits and advantages to a business of using social media to engage an audience, Build, manage, and sustain an active social media community.

Course Outcome – After completion of this course students will be able to:

CO1 – Understand important concepts of digital and social media.
CO2- Understand to Recognize how marketers use the customer journey model to influence purchase decisions on digital platforms.
CO3- Understand the benefits of integrating traditional and digital marketing.
CO4- Understand the benefits and advantages to a business of using social media to engage an audience.
CO5- Understand the use of an active social media community.

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P)**	**Aligned Practical/Assignment/Lab**	**CO Mapping**
Unit 1	Social Media and Digital Marketing Fundamental	Digital Marketing Landscape: Digital Consumer Behavior, The Digital Customer Journey, The Digital Opportunity, Digital and Your Organization, Business Growth and Digital.	Smartboard/PPT/Text book/Reference book	10	Practical Approach (Discussion and Activities),	**CO1**

		Digital Marketing Principles: Key Digital Marketing Concepts, Traditional and Digital Marketing, 3i Principles, Integrating Traditional and Digital Marketing, Tools for Digital Marketing.				
Unit 2	**Social Media and Social Content Strategy**	Content Marketing for Social: Content Marketing, Content Types, Social Media Platforms, Content Creation Tools, Influencer Marketing, eBook and Whitepapers Social Media and Business Strategy: Social Media Platforms, Key Concepts of Social Media, Types and Primary Uses of Social Media Platforms, Benefits of Social Media to Business, Role of Social Media , Social Media Platforms for Business: Social Media Marketing Concepts, Key Social Media Platforms, Setting up Social on Key Platforms, The Value of Building a Social Media Community	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment	**CO2**
Unit 3	Social Content Strategy and Promotion	Social Content Strategy: Content Seeding, Social Media Formats, Content Promotion, Content Optimization, Influencer Marketing, Word of Mouth	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment	

		Marketing, Measurement and Tracking, Content Promotion Strategy, Audience Segmentation Facebook Marketing Fundamentals: Introduction to Facebook, The Value to Marketers, Page Management, Facebook Live, Messenger Facebook Ads and Marketing: Facebook Ads, Ads Manager, Strategy Process, Buying Channels and Ad Auctions				**CO3**
Unit 4	**Instagram and Snapchat Marketing**	Instagram and Snapchat - Social Apps: Introduction to Social Apps, Differentiating Social Apps, Basic Features, Instagram: Video, stories ,live, Instagram Posts, Snapchat Meanings, Snapchat Story, Basic Features Instagram and Snapchat Marketing: Instagram Account Overview, Audience Development, Advertising Overview, 3V Advertising, Ads Manager, Snap Ads, Instagram Analysis, Snapchat Analysis, Campaign Setup, Snapchat	Smartboard/PPT/Text book/Reference book	6	Practical Approach (Discussion and Activities)/Assignment Activity related to identifying Biases	**CO4**

		Geo filters				
Unit 5	**Twitter LinkedIn and YouTube Marketing**	Twitter Marketing: Twitter Concepts, Platform Features, Profile Promotion and management, Hashtags, Analysis and Reporting. LinkedIn and Social Selling: Social Selling and Personal Branding, The Benefits of Personal Branding, LinkedIn Concepts, Features and Functions, LinkedIn Social Plugins, LinkedIn Analytics. YouTube and Social Video Marketing: Misconceptions and Benefits, Platform Features, Channel Setup, Channel Promotion, Channel Management, YouTube Native Formats.	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/Assignment	**CO5**

Text Books:

(1) Digital Marketing for Dummie s,Author:RyanDeiss&RussHenneberry,Publisher: JohnWiley&Sons, Inc
(2)Youtility,Author:JayBaer,Publisher:Gildan Media, LLC
(3)Epic Content Marketing,Author:JoePulizzi,Publication:McGraw HillEducation

Links:

Unit I

https://www.coursera.org/learn/social-media-digital-marketing-fundamentals

Unit II

https://www.coursera.org/learn/social-media-social-content-strategy

Unit III

https://www.coursera.org/learn/facebook-instagram-snapchat-marketing

Unit IV

https://www.coursera.org/learn/facebook-instagram-snapchat-marketing

Unit V

https://www.coursera.org/learn/twitter-linkedin-youtube-marketing

Semester: II

Branch: MCA

Subject Code- BMCA0213	**L - T – P** **3 – 0 - 0**
Subject Name- CRM Administration	**Credit-3**

Course Objective- Understand the concepts of Sales force App. Understand the concepts of Lightning Experience. Familiarize with concepts administration. Learn Admin Essentials in Lightning Experience

Course Outcome – After completion of this course students will be able to:

CO1 – Understand the basic working environment of Salesforce

CO2- Understand the Customization concepts of Lightning & Sales force App Experience

CO3- Familiarize with concepts reports chatter administration

CO4- Understand the concepts of Lightning Experience.

CO5- Learn Admin Essentials in Lightning Experience

Course Content

Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P)**	**Aligned Practical/Assignment/Lab**	**CO Mapping**
Unit 1	Introduction	Salesforce Platform Basics, User Management, Data Modeling, Data Management, Identity Basic, Data Security, Lightning Experience Customization,	Smartboard/PPT/Text	10	Practical Approach (Discussion and Activities),	**CO1**

		Lightning APP Builder Salesforce Mobile App Customization, User Engagement, Formulas and Validation, Data Security, Pick list Administration.	book/Reference book			
Unit 2	Lightning & Sales force App Experience Customization	Formula and Validation, Accounts and Contacts for Lightning Experience, Lead and Opportunity for Lightning Experience, Product Quotes and Contracts, Campaign Basic	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment	**CO2**
Unit 3	Salesforce Administration	Service Cloud for lightning Experience, Sales force mobile app customization, App Exchange basic Duplicate Management Lightning Experience for Salesforce Classic Users, Chatter Administration for Lightning Experience, Reports and Dashboards for lightning experience, Lightning experience customization, Lightning experience rollout, Salesforce flow, Lightning experience report dashboard Specialist	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment	**CO3**

Unit 4	Lightning Experience	Prepare Your Salesforce Org for Users, Customize an Org to Support a New Business Unit, Protect Your Data in Salesforce, Customize a Sales Path for Your Team, Customize a Salesforce Object, Import and Export with Data Management Tools	Smartboard/PPT/Text book/Reference book	6	Practical Approach (Discussion and Activities)/Assignment Activity related to identifying Biases	**CO4**
Unit 5	Learn Admin Essentials in Lightning Experience	Prepare Your Salesforce Org for Users, Customize an Org to Support a New Business Unit, Protect Your Data in Salesforce, Customize a Sales Path for Your Team, Customize a Salesforce Object, Import and Export with Data Management Tools	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/Assignment	**CO5**
Text Books: (1) Digital Marketing for Dummies,Author:RyanDeiss&RussHenneberry,Publisher:JohnWiley&Sons, Inc						

(2) Youtility, Author: JayBaer, Publisher: Gildan Media, LLC
(3) Epic Content Marketing, Author: JoePulizzi, Publication: McGraw Hill Education

Links:

Unit I

https://www.youtube.com/watch?v=bxtqhfyoTjY&list=PLaGX-30v1lh1BaUKgXa05gqrOP0vUg_6i&index=1

Unit II

https://www.youtube.com/watch?v=ZkQwm-6lsIw&list=PLaGX-30v1lh1BaUKgXa05gqrOP0vUg_6i&index=3

Unit III

https://www.youtube.com/watch?v=iWbVm_o9Z0Q&list=PLaGX-30v1lh1BaUKgXa05gqrOP0vUg_6i&index=8

Unit IV

https://www.youtube.com/watch?v=oG5y-ynaREY&list=PLaGX-30v1lh1BaUKgXa05gqrOP0vUg_6i&index=11

Unit V

https://www.youtube.com/watch?v=hKQTJ3L3opg&list=PLaGX-30v1lh1BaUKgXa05gqrOP0vUg_6i&index=12

Semester: II **Branch: MCA**						
Subject Code- BMCA0214					**L - T – P** **3 – 0 – 0**	
Subject Name- Software Testing					**Credit-3**	
Course Objective- Give examples of why testing is necessary. Identify typical objectives of testing. Distinguish between error, defect, and failure. Explain the impact of context on the test process.						
Course Outcome – After completion of this course students will be able to: **CO1 –** Understand fundamental concepts of software testing **CO2-** Demonstrate understanding of how different development and testing practices, and different constraints on testing, may apply in optimizing testing to different contexts **CO3-** Understand test management principles for resources, strategies, planning, project control, and risk management **CO4-** Understand the project factors that drive the test priorities and test approach **CO5-** Appreciate how testing activities and work products align with project objectives, measures, and targets						
Course Content						
Unit	**Module**	**Topics Covered**	**Pedagogy**	**Lecture Required (T=L+P)**	**Aligned Practical/Assignment/Lab**	**CO Mapping**
Unit 1	Introduction	Fundamentals of Testing: What is Testing, Typical Objectives of Testing, Testing and Debugging, Why is Testing Necessary? Quality Assurance and Testing, Errors, Defects, and Failures,	Smartboard/PPT/Text book/Reference book	10	Practical Approach (Discussion and Activities),	**CO1**

		Defects, Root Causes and Effects, Seven Testing Principles, Test Process, Traceability between the Test Basis and Test Work Products, The Psychology of Testing-Human Psychology and Testing, Tester's and Developer's Mindsets				
Unit 2	Testing Through out the Software Development Life cycle	Software Development Life cycle Models, Software Development and Software Testing, Software Development Life cycle Models in Context, Test Levels—Component Testing, Integration Testing, System Testing, Acceptance Testing, Test Types-Functional Testing, Non-functional Testing, White-box Testing, Change-related Testing,	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment	**CO2**
Unit 3	Static Testing	Static Testing Basics--Work Products that Can Be Examined by Static Testing, Benefits of Static Testing, Differences between Static and Dynamic Testing, Review Process--Work Product Review Process, Roles and responsibilities in a formal review, Review Types, Applying Review Techniques, Success Factors for Reviews	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/ Assignment	**CO3**

Unit 4	Test Techniques	Categories of Test Techniques-Categories of Test Techniques and Their Characteristics, Black-box Test Techniques, Equivalence Partitioning, Boundary Value Analysis, Decision Table Testing, State transition Testing, Use Case Testing, White-box Test Techniques, Statement Testing and Coverage, Decision Testing and Coverage, The Value of Statement and Decision Testing, Checklist-based Testing.	Smartboard/PPT/Text book/Reference book	6	Practical Approach (Discussion and Activities)/Assignment Activity related to identifying Biases	**CO4**
Unit 5	Test Management	Test Organization, Independent Testing, Tasks of a Test Manager and Tester, Test Planning and Estimation, Purpose and Content of a Test Plan, Test Strategy and	Smartboard/PPT/Text book/Reference book	8	Practical Approach (Discussion and Activities)/Assignm	**CO5**

		Test Approach , Test Execution Schedule, Factors Influencing the Test Effort, Test Estimation Techniques, Test Monitoring and Control, Metrics Used in Testing, Configuration Management, Risks and Testing, Defect Management, Tool Support for Testing			ent	

Text Books:

(1)LessonsLearnedinSoftwareTesting,byBretPettichord,CemKaner,andJamesMarcusBach

(2)Foundations ofSoftwareTesting:ISTQBCertification,byDorothyGrahamandErikP.W.M. Veenendaal

(3)SoftwareTesting: A Craftsman's Approach,FourthEdition,byPaulC.Jorgensen

Links:

Unit I

https://www.youtube.com/watch?v=KMj49syT8JM&list=PLyqSpQzTE6M-sBjDcT21Gpnj8grR2fDgc

Unit II

https://www.youtube.com/watch?v=Ln_LP7c23WM&list=PL9gSnSOLPFTAoJPbLSSdeXQE5cjP44Pki

Unit III

https://www.youtube.com/watch?v=Ln_LP7c23WM&list=PLbRMhDVUMngf8oZR3DpKMvYhZKga90JVt

Unit IV

https://www.youtube.com/watch?v=TSoLUKgnG_8&list=PLJ5C_6qdAvBHiqw9Yc7-_vyfbBG1Bmfg_&index=15

Unit V

https://www.youtube.com/watch?v=PIz7ust0bWE&list=PLJ5C_6qdAvBHiqw9Yc7-_vyfbBG1Bmfg_&index=31

Semester: II **Branch: MCA**	
Subject Code- BMCA0253	**L - T – P** **0- 0 - 8**
Subject Name- Object Oriented Techniques using JAVA	**Credit-4**
Course Objective- The objective of this course is to understand the object-oriented methodology, and its techniques to design stand alone and GUI applications using hands-on engaging activities.	
Course Outcome – After completion of this course students will be able to: **CO1 -** Understand the concepts of object-oriented programming and relationships among them needed in modelling. **CO2-** Demonstrate the Java programs using OOP principles and implement the concepts of lambda expressions. **CO3-** Analyse packages with different protection level resolving namespace collision and implement the error handling concepts for uninterrupted execution of Java program. **CO4-** Implement Concurrency control, I/O Streams and Annotations concepts by using Java program. **CO5-** Design and develop the GUI based application, Generics and Collections in Java programming language to solve the real-world problem.	
Course Content	

Unit	Module	Topics Covered	Pedagogy	Lecture Required	Practical/Assignment/Lab	CO Mapping
Unit –1 Basics of Java Programming	Object Oriented Programming	Introduction and Pillars of OOP with real life example, JVM architecture and its components.	T1, R1, Smart Board/PPT/Online Programs	3 (1+2)	Setting class path variables, Compilation of java file and execute its byte code.	**CO1**
	Modelling Concepts	Introduction, Class Diagram and Object Diagram, UML concepts: Association, Composition, aggregation, realization, and Generalization	T1, R1, Smart Board/PPT/Online Programs	3 (1+2)	Designing object and class diagram with UML concepts	
	Control Statements	Decision Making, Looping and Branching, Argument Passing Mechanism: Command Line Argument, Console Input	T1, R1, Smart Board/PPT/Online Programs	4 (1+3)	Implementation of java programs on control statements	
	Class and Object	Object Oriented Concept in Java , Object Reference, Constructor, Abstraction: Abstract Class, Interface and its uses, Defining Methods, Use of “this” and “super” keyword, Garbage Collection and finalize()Method etc	T1, R1, Smart Board/PPT/Online Programs	8 (2+6)	Implementation of Java Basics, Class, Object, abstract class interface, garbage collection	**CO1**
Unit –2	Inheritance	Introduction and Types of Inheritance in Java, Implementing Multiple	T1, R1, Smart Board/PPT/Online Programs	4 (1+3)	Implementation of inheritance concept	**CO2**

OOPs features, arrays and lambda expressions		Inheritance, Access Modifiers, Constructors and super constructor in Inheritance				
	Polymorphism	Introduction and Types, Overloading and Overriding	T1, R1, Smart Board/PPT/Online Programs	4 (1+3)	Implementation of polymorphism concept	
	Lambda expression	Introduction and Working with Lambda Variables	T1, R1, Smart Board/PPT/Online Programs	2 (1+1)	Programs based on Lambda expression	
	Arrays	Introduction and its Types	T1, R1, Smart Board/PPT/Online Programs	4 (1+3)	Programs based on array concept	
Unit -3 Packages, Exception Handling and String Handling	Packages	Introduction and Types, Access Protection in Packages, Import and Execution of Packages	T1, R1, Smart Board/PPT/Online Programs	3 (1+2)	Implementation of java package, Exception handling, Assertion, Localization and String handling	**CO3**
	Exception Handling, Assertions and Localizations	Introduction and Types, Exceptions vs. Errors, Handling of Exception Finally, Throws and Throw keyword, Multiple Catch Block, Nested Try and Finally Block, Tokenizer Assertions and Localizations Concepts and its		5 (2+3)		

		working				
	String Handling	Introduction and Types, Operations, Immutable String, Method of String class, String Buffer and String Builder class		5(2+3)		
Unit -4 Concurrency in Java and I/O Stream	Threads	Introduction and Types, Creating Threads, Thread Life-Cycle, Thread Priorities, Daemon Thread, Runnable Class, Synchronizing Threads etc.	T2, R2, Smart Board/PPT/Online Programs	4 (2+2)	Implementation of Multi-threading, Annotation, Character and Byte Stream classes java.io package	**CO4**
	I/O Stream	Introduction and Types, Common I/O Stream Operations, Interaction with I/O Streams Classes		3 (1+2)		
	Annotations	Introduction, Custom Annotations and Applying Annotations		3 (1+2)		
Unit -5 GUI Programming, Generics and Collections	GUI Programming	Introduction and Types, Swing, Components and Containers ,Layout Managers and User- Defined Layout and Event Handling concept	T2, R2, R3 Smart Board/PPT/Online Programs	4 (2+2)	Implementation & Swing components, Layout Manager classes, Generic & Collection, and Wrapper classes	**CO5**
	Generics	Introduction to Generic Classes, Initializing a Generic Object, Generic Cell Driver Class, Generic Methods, Use enumerated type		5 (1+4)		

	Collections	Introduction, Using Method References, Using Wrapper Class, Using Lists, Sets, Maps and Queues, Collection using Generics, Iterators		6 (2+4)		
Total (T+P)				**70** **(23+47)**		

2.**List of Practical:**

Lab No.	**Unit**	**Topic**	**Program Logic Building**	**CO Mapping**
1.1	1	Setting class path variables, Compilation of java file and execute its byte code.	Understanding Text Editors to Write Programs Compile and run first java file Byte Code and class file	**CO1**
1.2	1	Designing object and class diagram with UML concepts.	Sketch a class and object diagram describing the sales order system of restaurant	**CO1**
1.3	1	Designing object and class diagram with UML concepts.	Sketch a class diagram describing the circle and rectangle class	**CO1**
1.4	1	Designing object and class diagram with UML concepts.	Sketch a class diagram for a college platform including, classroom, playground, chair, table, smart board, teaching staff etc.	**CO1**

1.5	1	Designing object and class diagram with UML concepts.	Sketch a class diagram containing class called Employee, which models an employee with an ID, name and salary. Add method raiseSalary(percent) that increases the salary by the given percentage.	**CO1**
1.6	1	Data Types	Program to display default value of all Primitive data types	**CO1**
1.7	1	Command Line Arguments	Implement the code using main() method to calculate and print the Total and Average marks scored by a student from the input given through the command line arguments. Assume that four command line arguments name, marks1, marks2, marks3 will be passed to the main() method in the below class with name TotalAndAvgMarks.	**CO1**
1.8	1	Conditional Statement	Write code which uses if-then-else statement to check if a given account balance is greater or lesser than the minimum balance. Write a class BalanceCheck with public method checkBalance that takes one parameter balance of type double. Use if-then-else statement and print Balance is low if balance is less than 1000. Otherwise, print Sufficient balance.	**CO1**
1.9	1	Conditional Statement and Loops	A class NumberPalindrome with a public method isNumberPalindrome that takes one parameter number of type int. Write a code to check whether the given number is palindrome or not. For example, CmdArgs : 333 333 is a palindrome	**CO1**
1.10	1	Conditional Statement and Loops	Write a class FibonacciSeries with a main method. The method receives one command line argument. Write a program to display Fibonacci series i.e. 0 1 1 2 3 5 8 13 21	**CO1**
1.11	1	Conditional Statement and	Write a Java Program to find the Factorial of a given number.	**CO1**

		Loops		
1.12	1	Class and Object	Java Program to create a class, methods and invoke them inside main method.	**CO1**
1.13	1	abstract class	Write a Java program to illustrate the abstract class concept. Create an abstract class Shape, which contains an empty method numberOfSides(). Define three classes named Trapezoid, Triangle and Hexagon extends the class Shape, such that each one of the classes contains only the method numberOfSides(), that contains the number of sides in the given geometrical figure. Write a class Abstract Example with the main() method, declare an object to the class Shape, create instances of each class and call numberOfSides() methods of each class.	**CO1**
1.14	1	'static' keyword	Java program to illustrate the static field in the class.	**CO1**
1.15	1	'static' keyword	Java Program to illustrate static class.	**CO1**
1.16	1	'super' keyword	Write a java program to access the class members using super keyword	**CO1**
1.17	1	'this' keyword	Java program to access the class members using this keyword	**CO1**
1.18	1	Java interface	Implement an interface named MountainParts that has a constant named TERRAIN that will store the String value "off_road". The interface will define two methods that accept a String argument name newValue and two that will return the current value of an instance field. The methods are to be named: getSuspension, setSuspension, getType , setType.	**CO1**
1.19	1	Java Interface	Java program to demonstrate nested interface inside a interface.	**CO1**

1.20	1	Java Interface	Java program to demonstrate nested interface inside a class.	**CO1**
1.21	1	Garbage Collection and finalize() method	Java program to explicit implementation of garbage collection by using finalize() method	**CO1**
2.1	2	Concepts of inheritance	JAVA program to implement Single Inheritance	**CO2**
2.2	2	Concepts of inheritance	JAVA program to implement multi-level Inheritance	**CO2**
2.3	2	Constructor and Inheritance	JAVA program to implement constructor and constructor overloading.	**CO2**
2.4	2	Overloading and Overriding	JAVA program implement method overloading.	**CO2**
2.5	2	Overloading and Overriding	JAVA program to implement method overriding.	**CO2**
2.6	2	Lambda Expression	Java program to implement lambda expression without parameter.	**CO2**
2.7	2	Lambda Expression	Java program to implement lambda expression with single parameter.	**CO2**
2.8	2	Lambda Expression	Java program to implement lambda expression with multi parameter.	**CO2**
2.9	2	Lambda Expression	Java program to implement lambda expression that iterate list of objects	**CO2**

2.10	2	Lambda Expression	Java program to define lambda expressions as method parameters	**CO2**
2.11	2	Arrays	Write a class CountOfTwoNumbers with a **public** method compareCountOf that takes three parameters one is arr of type int[] and other two are arg1 and arg2 are of type int and returns true if count of arg1 is greater than arg2 in arr. The return type of compareCountOf should be boolean. Assummptions: • arr is never null • arg1 and arg2 may be same	**CO2**
2.12	2	Arrays	JAVA program to show the multiplication of two matrices using arrays.	**CO2**
2.13	2	Array Searching	Java Program to search an element using Linear Search	**CO2**
2.14	2	Array Searching	Java program to search an element using Binary Search	**CO2**
2.15	2	Array Sorting	Java Program to sort element using Insertion Sort	**CO2**
2.16	2	Array Sorting	Java Program to sort element using Selection Sort – Largest element Method	**CO2**
2.17	2	Array Sorting	java program to Sort elements using Bubble Sort	**CO2**

3.1	3	Java Package	Java program to create user defined package.	**CO3**
3.2	3	Java Package	Java Program to create a sub- classing of package	**CO3**
3.3	3	Java Package	Implement the following: 1. Import package.*; 2. import package.classname; 3. Using fully qualified name.	**CO3**
3.4	3	Java Package	Implement and demonstrate package names collision in java	**CO3**
3.5	3	Exception Handling	Java program to handle and Arithmetic Exception Divided by zero	**CO3**
3.6	3	Exception Handling	Java Program to implement User Defined Exception in Java	**CO3**
3.7	3	Exception Handling	Java program to illustrate finally block	**CO3**
3.8	3	Exception Handling	Java program to illustrate Multiple catch blocks	**CO3**
3.9	3	Exception Handling	Java program for creation of illustrating throw	**CO3**
3.10	3	Assertions Concepts	Implement the concept of Assertion in Java Programming Language	**CO3**
3.11	3	Localization Concepts	Implement the concept of Localization in Java Programming Language.	**CO3**

3.12	3	String Handling	Java program to print the output by appending all the capital letters in the input string.	**CO3**
3.13	3	String Handling	Java program that prints the duplicate characters from the string with its count.	**CO3**
3.14	3	String Handling	Java program to check if two strings are anagrams of each other	**CO3**
3.15	3	String Handling	Java Program to count the total number of characters in a string	**CO3**
3.16	3	String Handling	Java Program to count the total number of punctuation characters exists in a String	**CO3**
3.17	3	String Handling	Java Program to count the total number of vowels and consonants in a string	**CO3**
3.18	3	String Handling	Java Program to show .equals method and == in java	**CO3**
3.19	3	String Handling	Given a string, return a new string made of n copies of the first 2 chars of the original string where n is the length of the string. The string may be any length. If there are fewer than 2 chars, use whatever is there. If input is "Wipped" then output should be "WiWiWiWiWi".	**CO3**
3.20	3	String Handling	Given two strings, a and b, create a bigger string made of the first char of a, the first char of b, the second char of a, the second char of b, and so on. Any leftover chars go at the end of the result. If the inputs are "Hello" and "World", then the output is "HWeolrllod".	**CO3**

3.21	3	String Handling	JAVA program to show the usage of string builder.	**CO3**
3.22	3	String Handling	JAVA program to show the usage of string buffer.	**CO3**
4.1	4	Threads	Creating and Running a Thread	**CO4**
4.2	4	Threads	Implementing Runnable Interface	**CO4**
4.3	4	Threads	Synchronizing Threads with lock	**CO4**
4.4	4	Threads	Synchronizing Threads without lock	**CO4**
4.5	4	Multithreading	JAVA program to implement even and odd threads by using Thread class .	**CO4**
4.6	4	Multithreading	JAVA program to implement even and odd threads by using Runnable interface.	**CO4**
4.7	4	Multithreading	JAVA program to synchronize the threads by using Synchronize statements and Synchronize block.	**CO4**
4.8	4	Annotation Concepts	Demonstrate the concept of type annotations in the JAVA programming language.	**CO4**
4.9	4	Custom Annotation Concepts	Demonstrate the concept of user-defined annotations in the JAVA	**CO4**

			programming language.	
4.10	4	Character Stream	JAVA program to implement that read a character stream from input file and print it into output file.	**CO4**
4.11	4	Byte Stream	JAVA program to implement that merge the content of two files (file1.txt, file2.txt) into file3.txt.	**CO4**
4.12	4	IO Stream	Write a Java program that reads the contents of one file and copies them to another file.	**CO4**
4.13	4	IO Stream	Write a Java program that reads a text file and counts the number of words in it.	**CO4**
4.14	4	IO Stream	Write a Java program that reads a text file and counts the frequency of each word in it.	**CO4**
4.15	4	Character Stream	Write a Java program that reads a text file and adds line numbers to each line. The program should create a new file with the line numbers added to the beginning of each line.	**CO4**
4.16	4	Byte Stream	Write a Java program that reads two binary files and compares them byte by byte to determine if they are identical. Display a message indicating whether the files are the same or different.	**CO4**
5.1	5	AWT& Swing	Program to create a frame with three button in AWT and swing	**CO5**
5.2	5	AWT& Swing	Program to display message with radio buttons in swing	**CO5**
5.3	5	AWT& Swing	Program to display "All The Best" in 5 different colors on screen. (Using AWT/Swing)	**CO5**

5.4	5	AWT& Swing	Program to implement event handling in a button “OK”	**CO5**
5.5	5	Layout Manager	Java Program to implement BorderLayout	**CO5**
5.6	5	Layout Manager	Java Program to implement GridLayout	**CO5**
5.7	5	Layout Manager	Java Program to implement BoxLayout	**CO5**
5.8	5	Layout Manager	Java Program to implement CardLayout	**CO5**
5.9	5	Generic & Collection	Java program to implement Generic class	**CO5**
5.10	5	Generic & Collection	Java program to illustrate Generic methods	**CO5**
5.11	5	Generic & Collection	Java program to implement wildcard in generics	**CO5**
5.12	5	Generic & Collection	Java program to implement of methods of HashSet	**CO5**
5/13	5	Generic & Collection	Java Program to implement methods available in HashMap class	**CO5**
5.14	5	Generic & Collection	Program to add, retrieve, and remove element from ArrayList	**CO5**
5.15	5	Generic & Collection	Create a method which can accept a collection of country	**CO5**

			names and add it to Array List with generic defined as String and return the List.	
5.16	5	Generic & Collection	Create a method which can create a HashSet containing values 1-10. The Set should be declared with the generic type Integer. The method should return the Set.	**CO5**
5.17	5	Wrapper Class	Java program to implement autoboxing	**CO5**
5.18	5	Wrapper Class	Java program to implement unboxing	**CO5**
5.19	5	Generic & Collection	Develop a java class with a method *storeEvenNumbers(int N)* using ArrayList to store even numbers from 2 to N, where N is a integer which is passed as a parameter to the method *storeEvenNumbers().* The method should return the ArrayList (A1) created.	**CO5**
5.20	5	Generic & Collection	Create a method that accepts the names of five countries and loads them to an array list and returns the list.	**CO5**
5.21	5	Generic & Collection	Create a method which can accept a collection of country names and add it to ArrayList with generic defined as String and return the List.	**CO5**

Text Books:

(T1) Herbert Schildt," Java: A Beginner's Guide", McGraw-Hill Education 2nd edition

(T2) E Balagurusamy, "Programming with Java A Primer", TMH, 4th edition.

Reference Books:

(R1) Cay S. Horstmann, “Core Java Volume I – Fundamentals”, Prentice Hall

(R2) Joshua Bloch,” Effective Java”, Addison Wesley.

(R3) Herbert Schildt,” Java - The Complete Reference”, McGraw Hill Education 12th edition

Links:

Unit 1 https://www.youtube.com/watch?v=r59xYe3Vyks&list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-Al

Unit 2 https://www.youtube.com/watch?v=ZHLdVRXIuC8&list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-Al&index=18

Unit 3 https://www.youtube.com/watch?v=hBh_CC5y8-s

Unit 4 https://www.youtube.com/watch?v=qQVqfvs3p48

Unit 5 https://www.youtube.com/watch?v=2qWPpgALJyw

Semester: II

Branch: MCA

Subject Code- BMCA0251	**L T P** **0 0 4**
Subject Name- Computer & Organization Lab	**Credit-2**

Course Objective:

Students will gain practical experience with designing and implementing concepts of gates , Multiplexer, Implement a simple instruction set computer

List of Activities:

Lab No.	**Topic**	**CO Mapping**
L1	Verification of the functionality of all logic gates.	**CO1**
L2	Implementing HALF ADDER, FULL ADDER using basic logic gates.	**CO1**
L3	Implementing Binary -to -Gray, Gray -to -Binary code conversions.	**CO1**
L4	Implementing 3-8 line DECODER.	**CO1**
L5	Implementing 4x1 and 8x1 MULTIPLEXERS.	**CO1**
L6	Verify the excitation tables of various FLIP-FLOPS.	**CO1**
L7	Design of an 8-bit Input/ Output system with four 8-bit Internal Registers.	**CO2**
L8	Design of an 8-bit ARITHMETIC LOGIC UNIT using simulator	**CO2**
L9	Design the data path of a computer from its register transfer language description	**CO2**

L10	Implement a simple instruction set computer with a control unit and a data path	**CO3**
Lab Outcome: After completion of this course students will be able to		
CO 1	Design and verify combinational circuits (adder, code converter, decoder, multiplexer) using basic gates.	K1,K2
CO 2	Design and verify various flip-flops.	K2,K3
CO 3	Demonstrate combinational circuit using simulator	K1,K3

Text Books:

1. Computer System Architecture, M.Mano (PHI)
2. Logic and Digital Design, Morris Mano and Kimi Charles 4th Edition, Prentice Hall.

Reference Books:

1. Structured Computer Organization, Tannenbaum (PHI)
2. Computer Organization, Stallings (PHI)

Semester: II

Branch: MCA

Subject Code- BMCA0252	**L T P** **0 0 4**
Subject Name- Database Systems Lab	**Credit-2**

Course Objective:

The objective of the course is to introduce about database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information in relational & non-relational databases

List of Activities:

Lab No.	**Unit**	**Topic**	**Program Logic Building**	**CO Mapping**
L1	I	ER Diagram Notation	Understand and implement the different ER diagram notation with their relationship and Cardinalities.	**CO1**
L2	I	Create ER Diagram-1	Creating ER Diagram for company Database. Company databases have entities like employee, departments, projects and dependents also implement the relationship and cardinalities between the entities with their relevant attribute.	**CO1**
L3	I	Create ER Diagram-2	Design an ER diagram for a travel agency that includes entities such as travellers, bookings, destinations, and itineraries. also implement the relationship and cardinalities between the entities with their relevant attribute.	**CO1**
L4	I	Reduction of ER Diagram1 & 2	Converting Company & Travel Agency ER Model to Relational Model (Represent entities and relationships in tabular form, represent attributes as columns, identifying keys).	**CO1**
L5	I	Exercise -1	Each students create at least one ER & EER diagram from real world problem and convert in tabular from with all needed constraint.	**CO1**
L6	I	DDL, DML Commands	Implement DDL and DML commands	**CO1**

L7	I	DCL, TCL Commands	Implement DCL &TCL commands	**CO1**
L8	I	Exercise-2	1. Create Database, Rename Database, Delete Database in relational database tool. 2. Create table employee with attributes Emp_no<datatype><size> E_name<datatype><size> JOB <datatype><size> Address <datatype><size> Salary<datatype><Size> 3. Insert data into the table 4. Implementation of select command 5. Implementation of update command 6. Implementation of alter command 7. Implementation of delete command 8. Implementation of rename command. 9.Implementation of rollback command 10. Implementation of commit Command 11.Implemenation of Truncate Command 12. Implementation of Drop Command	**CO1**
L9	II	Key Constraints	Implementation of I/O Constraint: Primary Key, composite primary key, Foreign Key with on delete set null and on delete set null constraint	**CO2**
L10	II	Key Constraints	Implementation of constraint: Unique Key and Composite unique key and uses Unique key as foreign key.	**CO2**
L13	II	Case Study-1	Reduction & Implementation in SQL for ER Diagram of Company Database: - **A.** Create table for EMPLOYEE, DEPARTMET, PROJECT, DEPENDENTS and WORK_ON with all needed keys and other constraints. **B.** Populated all table with atleast Ten records in each table as per as applied constraints.	**CO2**

L14	II	Predicate & Operators	Practicing Queries using Like, Between, Aliases, distinct Operator & Predicate.	**CO2**
L15	II	Aggregate Functions	Implementation of Aggregate Functions.	**CO2**
L16	II	String and Advanced Functions	Implementation of Scalar, Mathematical and Advanced functions	**CO2**
L17	II	Clause	Implementation of Queries using Where, Group by, Having and Order by Clause.	**CO2**
L18	II	Exercise: -3	Implementation and uses of clause and operators on Company/ Travel Agency or Other database. A. Find the name of employee whose name start with A. B. Find the name of employee where 'hi' in any position. C. Find the name of employee whose 'r' have in second position. D. Find the details of employee whose salary is less than 70000. E. Find the name of employee whose name start with V and end with l. F. Find the average salary of each department G. Find the max salary of each department H. Find the sum of salary of department that have more than three employees in ascending order. I. Find the empid of Employee who work in more than 3 project. J. Find the empid who have more than one dependent. K. Implement the concept of rollback and commit on Employee Table	**CO2**

L19	II	Execrise-4	Create a table EMPLOYEE with following schema:-(Emp_no, E_name, E_address, E_ph_no, Dept_no, Dept_name,Job_id, Designation, Salary) Write SQL statements for the following query. 1. List the E_no, E_name, Salary of all employees working for MANAGER. 2. Display all the details of the employee whose salary is more than the Salary of any IT Professor. 3. List the employees in the ascending order of Designations of those joined after 1981. 4. List the employees along with their Experience and Daily Salary. 5. List the employees who are either 'CLERK' or 'ANALYST' 6. List the employees who joined on 1-MAY-81, 3-DEC-81, 17-DEC-81,19-JAN-80. 7. List the employees who are working for the Deptno 10 or 20. 8. List the Enames those are starting with 'S'. 9. Display the name as well as the first five characters of name(s) starting with 'H' 10. List all the emps except 'PRESIDENT' & 'MGR" in ASC order of Salaries. 11. Display total salary spent for each job category. 12. Display lowest paid employee details under each manager. 13. Display number of employees working in each department and their department name. 14. Display the details of employees sorting the salary in increasing order. 15. Show the record of employee earning salary greater than 16000 in each department. 16. Add constraints to check, while entering the empno value (i.e) empno> 100. 17. Define the field DEPTNO as unique. 18. Create a primary key constraint for the column (EMPNO).	
L20	III	Set Theory	Implementation of Queries using set theory operators UNION,	**CO3**

		Operators	INTERSECT, MINUS.	
L21	III	Join Operators	Implementation of Queries using Inner Join: - Natural Join, Equi Join & Non Equi Join	**CO3**
L22	III	Join Operators	Implementation of Queries using Outer Join: - Left Outer Join, Right Outer Join and Full Outer Join	**CO3**
L23	III	Nested Queries	Implementation of Queries nested Queries or Sub Queries: - IN, NOT IN, Exists, Not Exists, All and Any.	**CO3**
L24	III	Exercise -5	Apply the set theory operators, join's and nested queries on company database(Case Study-1) Write the SQL Queries for the following statement (a) Retrieve the names of employees in department 5 who work more than 10 hours per week on the 'ProductX' project. (b) List the names of employees who have a dependent with the same first name as themselves. (c) Find the names of employees that are directly supervised by 'Franklin Wong'. (d) For each project, list the project name and the total hours per week (by all employees) spent on that project. (e) Retrieve the names of all employees who work on every project controlled by department 5. (f) Retrieve the names of all employees who do not work on any project. (f') Retrieve the names of all employees who do not work on every project (g) For each department, retrieve the department name, and the average salary of employees working in that department. (h) Retrieve the average salary of all female employees. (i) Find the names and addresses of all employees who work on at least one project located in Houston but whose department has no location in Houston. (j) List the last names of department managers who have no dependents. (k) Retrieve the names of all employees who work in the department that has the employee with the highest salary among all employees.	**CO3**

			(l) Retrieve the names of all employees whose supervisor's supervisor has '888665555' for Ssn. (m) For each department that has more than 5 employees retrieve the dno and no. of its employees who are making more than 6,00,000 (n)Find the sum of salaries of all employees of 'ACCOUNTS' department as well as the MAX(SAL), MIN(SAL), AVG(SAL) in this department (o)Show the resulting salary for employee working on IOT project is given a 10% raise	
L25		Exercise -6	**Requirement: -** A college consists of number of employees working in different departments. In this context, create two tables' employee and department. Employee consists of columns empno, empname, basic, hra, da, deductions, gross, net, date-of-birth. The calculation of hra,da are as per the rules of the college. Initially only empno, empname, basic have valid values. Other values are to be computed and updated later. Department containsdeptno, deptname, and description columns. Deptno is the primary key in department table and referential integrity constraint exists between employee and department tables. Perform the following operations on the database: 1. Create tables department and employee with required constraints. 2. Initially only the few columns (essential) are to be added. Add the remaining columns separately by using appropriate SQL command 3. Basic column should not be null. 4. The default value for date-of-birth is 1 jan, 1990. 5. When the employees called daily wagers are to be added the constraint that salary should be greater than or equal to 5000 should be dropped. 6. Display the information of the employees and departments with description of the fields. 7. Display the average salary of all the departments. 8. Display the average salary department wise. 9. Display the maximum salary of each department and also all departments put together. 9. Commit the changes whenever required and rollback if necessary. 10. Find the employees whose salary is between 5000 and 10000 but not exactly 7500.	

			11. Find the employees whose name contains 'en'. 12. Create alias for columns and use them in queries. 13. List the employees according to ascending order of salary. 14. List the employees according to ascending order of salary in each department. 15. Find the employees who are born on Feb 29. 16. Find the departments where the salary of at-least one employee is more than 20000. 17. Find the departments where the salary of all the employees is less than 20000. 18. Add the column deptlocation in department table.	
L26	III	Database Connectivity	Understand & implement the Database Connectivity with Java/Python etc programming language	**CO3**
L27	III	Exercise -7	1. Implementation and apply all the set theory operators, join and nested queries concept on Case study -1. A. Make a list of all project members for projects that involve an employee whose name is SCOTT either as a worker or as a manager of the department that controls the project. B. To retrieve the Social Security numbers of all employees who either work in department 5 or directly supervise an employee who works in department 5. C. To retrieve the SSN of all employees who work as a supervisor not a manager. D To retrieve the SSN of all employees who work as a supervisor and also manage the department. E. We want to retrieve a list of names of each female employee's dependents F. We want a list of all employee names as well as the name of the departments they manage if they happen to manage a department; if they do not manage one, we can indicate it with a NULL value. G. Retrieve the names of employees who have no dependents. H. List the names of all employees with two or more dependents. I. List the names of managers who have at least one dependent. J. Retrieve the names of all employees who do not have supervisors.	**CO3**

			K. Retrieve the name of each employee who has a dependent with the same first name and is the same sex as the employee. 2. Create Standalone Application/Web application with populated the data by any database.	
L28	IV	Array Functions	Implementation of Array Function	**CO4**
L29	IV	Array Functions	Implementation of Array Operators	**CO4**
L30	IV	Index, Views	Implementation of Indexing, Views and sequence	**CO4**
L31	IV	PL/SQL Basic	1. Write a PL/SQL Program to Add Two Numbers 2. Write PL/SQL Program for Fibonacci Series 3. Write PL/SQL Program to Find Greatest of Three Numbers	**CO4**
L32	IV	PL/SQL Procedure	Write a Pl/SQL code block to calculate the area of a circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an empty table named Areas, consisting of two columns Radius and Area.	**CO4**
L30	IV	PL/SQL Procedure	Write a PL/SQL code block that will accept an account number from the user, check if the users balance is less than the minimum balance, only then deduct Rs.100/- from the balance.	**CO4**
L33	IV	PL/SQL Trigger	Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values:	**CO4**
L34	IV	Transaction	Implementation of commit and rollback statement with amount transfer example.	**CO4**
L35	IV	Execrise-8	Implementation array, indexing, transaction concept on Case study 1. **1.** Implementation of Array Functions & Operators **2.** Implementation of Sequence -Creating Sequences -Modifying a Sequence Definition -Removing Sequences **3.** Implementation of Views -Creating Simple and Complex Views -Modifying Views -Removing Views	**CO4**

			4. Implementation of Indexes -Manual and Automatic Indexes -Creating Indexes - Removing Indexes	
L36	IV	Execrise-09	A. Write a PL/SQL block to calculate the incentive of an employee whose ID is 110. B. Grant and revoke DCL command used on Employee table -GRANT SELECT ON Employee TO emp_name; -Granting multiple privileges on Employee table -Granting all privileges on Employee table; -Granting privilege to a role in Employee table -Granting the WITH GRANT OPTION on Employee table. -Revoke all the permission applied on Employee table. C Create the CUSTOMERS table having the following attributes: - - (ID, NAME, AGE, ADDRESS, SALARY) - Insert ten records in customer table. -In Customer table delete those records which have age = 25 and then COMMIT the changes in the database. -In Customer table delete those records which have age = 30 and then Rollback the changes in the database. - Create three save point for customer table in that the three deletions have taken place. - Apply the save point 2 with rollback on customer table and display the table record. - Apply the SET Transnation command.	
L37	V	Installation of MongoDB	Study of Open Source NOSQL Database and installation of MongoDB	**CO5**
L38	V	MongoDB Database	Create, drop, rename the database in MongoDB	**CO5**
L39	V	MongoDB Operators	Implementation the MongoDB Operators.	**CO5**
L40	V	MongoDB	Implementation the CRUD Operation in MongoDB	**CO5**

		CRUD Operations		
L41	V	MongoDB Shell Commands	Implementation of the MongoDB Shell commands	**CO5**
L42	V	MongoDB Cloud Commands	Implementation of MongoDB Cursor and their methods	**CO5**
L43	V	Relation in MongoDB	Implementation of relation in MongoDB	**CO5**
L44	V	Aggregate in MongoDB	Implementation of Aggregate in MongoDB	**CO5**
L45	V	Exercise -10	Implementation of all CRUD operation, Cursor and aggregate etc on real world problem. Connect to MongoDB (by using mongo shell) A. Create database with name (ems) - use ems; B. Create collection with following fields: - {"name",age",gender","exp",subjects,"type""qualification"}, C. Insert the Ten documents into "faculty" collection (Use insertMany()) Write the following queries: - 1. Get the details of all the faculty. 2. Get the count of all faculty members. 3. Get all the faculty members whose qualification is “Ph.D”. 4. Get all the faculty members whose experience is between 8 to 12 years. 5. Get all the faculty members who teach “MATHS” or “NETWORKING”. 6. Get all the faculty members who teach “MATHS” and whose age is more than 30 years and qualification must be “Ph.D”. 7. Get all the faculty members who are working part-time or who teach “JAVA”.	**CO5**

			8. Add the following new faculty members: { "name":"Ankita ", "age":34,"gender":"F","exp":25,subjects:["MATHS","DE"],"type":" Full Time", "qualification":"Ph.D"} 9. Update the data of all faculty members by incrementing their age and exp by one year. 10. Update the faculty “Sivani” with the following data: update qualification to “Ph.D” and type to “Full Time”. 11. Update all faculty members who are teaching “DBMS” such that they should now also teach “Java Programming”. 12. Delete all faculty members whose age is more than 55 years. 13. Get only the name and qualification of all faculty members. 14. Get the name, qualification and exp of all faculty members and display the same in ascending order of exp. 15. Sort the faculty details by their age (descending order) and get the details of the first five faculty members only.	
L46	V	Mini Project & applications	Mini project (Design & Development of Data and Application) for following: - 1. Analyzing Sales Data 2. Customer Segmentation 3. International Debt Statistics Analysis 4. Analyze the World Population 5. House Property Sales Analysis 6. Sentiment Analysis 7. Health care organization database 8. Blood donation system database 9. Art gallery management database 10. ATM management system database 11. Face detection 12. Evaluation of academic performance 13. Mobile wallet with merchant payment 14. Public news droid	**CO1,CO2,CO3,CO4,CO5**

			15. Crime rate prediction 16. Twitter Sentiment Analysis 17. Election Analysis 18. Smart Farming used whether forecasting 19. Speech to Text 20. Automated Patient and Doctor Handling System 21. Web Scraping Using Beautiful Soup 22. Movie recommendation system 23. Online examination and evaluation system 24. Book Publishing Company	
L47		Case Study on domain wise	Implementation of case Study on different domain 1. E-commerce Platform 2. Inventory Management 3. Railway System 4. Hospital Data Management 5. Voice-based Transport Enquiry System 6. SMS-based Remote Server Monitor system 7. Banking System	**CO1.CO2,CO3,CO4,CO5**

Lab Outcome: After completion of this course students will be able to

CO 1	Understand ER and EER diagram to design the database for solving the real-world problems.	K3
CO 2	Apply and analyze the Structured Query Language (SQL) to solve the complex queries and implement normalization.	K4
CO 3	Implement the operators in complex queries and apply database connectivity for different applications.	K4
CO4	Implement PL/SQL and analyze transaction and concurrency control in transaction management.	K4
CO5	Design and implement relational and non-relational database for the need of the real-world project.	K5

Text Books:		
1.Korth, Silbertz, Sudarshan," Database System Concepts", Seventh Edition, McGraw - Hill.		
2.Elmasri, Navathe, "Fundamentals of Database Systems", Seventh Edition, Addison Wesley.		
3. Ivan Bayross "SQL, PL/SQL The programming language Oracle, Fourth Edition, BPB Publication. (December 1-2010)		
4. Brad Dayley "NoSQL with MongoDB in 24 Hours" **Sams Publishing; 1st edition (September 8, 2014)**		
Reference Books:		
1.Thomas Cannolly and Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.		
2.Raghu Ramakrishan and Johannes Gehrke "Database Management Systems" Third Edition, McGraw-Hill.		
3.NoSQL and SQL Data Modeling: Bringing Together Data, Semantics, and Software First Edition by Ted Hills.		
NPTEL/ YouTube/ Faculty Video Link		
Unit- 1	**NPTEL Video Course : NOC:Data Base Management System** **https://www.youtube.com/watch?v=OWX4RvijwLw** **https://www.youtube.com/watch?v=OQanW4NVksY** **https://www.youtube.com/watch?v=pm_Tr3eZAac** **https://www.youtube.com/watch?v=pBGJYwR5rlM** **https://www.youtube.com/watch?v=H6iFrMYZFhU** **https://www.youtube.com/watch?v=c5HAwKX-suM** **https://www.youtube.com/watch?v=7S_tz1z_5bA**	

Unit- 2	**https://www.youtube.com/watch?v=_UZLrD_R0T4** **https://www.youtube.com/watch?v=kr4iTckAVUs** **https://www.youtube.com/watch?v=FToHXp-IX0g** **https://www.youtube.com/watch?v=cwVegKAZO1k** **https://www.youtube.com/watch?v=xHB4PeqLK8o** **https://www.youtube.com/watch?v=7S_tz1z_5bA**
Unit- 3	**https://www.youtube.com/watch?v=xxBEPiUWGCg** **https://www.youtube.com/watch?v=bLL5NbBEg2I** **https://www.youtube.com/watch?v=FNYdBLw6cE** **https://www.youtube.com/watch?v=oRW3PyZi3GE** **https://www.youtube.com/watch?v=3aCErW7gMPU** **https://www.youtube.com/watch?v=y_YxwyYRJek** **https://www.youtube.com/watch?v=7S_tz1z_5bA**

Unit- 4	**https://www.youtube.com/watch?v=X-1viE7QFtQ** **https://www.youtube.com/watch?v=5ammL5KU4mo** **https://www.youtube.com/watch?v=8yfEl0Yvxto** **https://www.youtube.com/watch?v=abLIS6BX964** **https://www.youtube.com/watch?v=uuRf-VEFbco** **https://www.youtube.com/watch?v=7S_tz1z_5bA**
Unit- 5	**https://www.youtube.com/watch?v=2yQ9TGFpDuM** **https://www.youtube.com/watch?v=fbYExfeFsI0** **https://www.youtube.com/watch?v=-68k-JS_Y88** **https://www.youtube.com/watch?v=c2M-rlkkT5o**

MCA - FIRST YEAR SECOND SEMESTER			
Course Code	BMCA0211P	**L T P**	**Credit**
Course Title	Fundamentals of Digital Marketing and Analytics Lab	**0 0 2**	**1**

Course objectives:

Review key trends within the Digital Marketing landscape. Explain the holistic impact of all Digital Marketing channels. Examine an example of each Digital Marketing channel.

Pre-requisites: Students are expected to be able to open command prompt window or terminal window, edit a text file, download and install software, and understand basic programming concepts.

The programs in Digital Marketing and Analytics Lab will cover the following concepts:

1. Create a Chart with a spreadsheet
2. Create and edit a Google Sheet
3. Share the Google Sheet
4. Create Custom Data Table and Sort It.
5. Use COUNTIF, MIN, MAX, AVERAGE, SUM functions
6. Handling FORMULAS in Spreadsheet
7. Find Errors in functions
8. Clean data by Sorting and Filtering
9. Create your custom table with Big Query
10. Query Your Dataset using Big Query

Course outcomes: After completing this course student will be able to :

CO 1	Gain experience in developing a 'Digital marketing plan'	K6
CO 2	Gain experience with time management around meeting project deadlines	K2, K6

CO 3	Develop their own presentation/speaking styles and learn effective methods of doing so through feedback on their own presentation aswell as observation of other students' presentations	K6

Text books:

1. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).

2. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional(October, 2013).

Reference book:

1. Menon, Arpita; Media Planning and Buying; McGraw Hill (1st Edition, 2010)

2. Arnold, George; Media Writer's Handbook: A Guide to Common Writing and Editing Problems;McGraw-Hill Education; (5thedition, 2008)

MCA - FIRST YEAR SECOND SEMESTER			
Course Code	BMCA0212P	**L T P**	**Credit**
Course Title	Fundamentals of Digital Marketing and Optimization Lab	**0 0 2**	**1**

Course objectives:

Fundamentals of Digital Marketing and Optimization. Develop a basic display campaign and allocate ad dollars for success. Examine the pricing models for display and evaluate the best possible choice for your campaign.

Pre-requisites: Students are expected to be able to open command prompt window or terminal window, edit a text file, download and install software, and understand basic programming concepts.

The programs in Digital Marketing and Optimization Lab will cover the following concepts :

1. Basic Explanation and Setups:
   a. Name servers, theme & plugins setup
   b. Basic SEO, How Search Engine Works?
   c. Crawling, Indexing, Ranking
   d. GSC, Google Analytics, GTM, Google Alerts
2. Content Frameworks:
   a. Keyword (Explanation, Research, Ranking factor)
   b. Keyword Classification, Finding Right Keyword
   c. Competitive Keyword Research Content framework
3. On Page:
   a. Element Explanation
   b. Title Tag, Header Tags
   c. Meta Description, The Body
   d. URL Structure, Images

4. Technical SEO Part – I
   a. Elements Explanation
   b. Site Architecture, Website Structure
   c. Understand Google Crawlability
   d. Robots.txt, Sitemaps, Mobile SEO, AMP

5. Technical SEO Part –II
   a. WordPress Speed Optimization
   b. CDN
   c. Structured Data
   d. Security

Course outcomes: After completing this course student will be able to :

CO 1	Analyze the role that social marketing plays in the digital landscape and marketing mix.	K6
CO 2	Explain the differences between, and the convergence of, paid, earned, and owned media.	K2, K6
CO 3	Identify and incorporate individual social and mobile platforms into a digital marketing strategy.	K6

Text books:

1) Digital Marketing for Dummies, Author: Ryan Deiss& Russ Henneberry, Publisher: John Wiley & Sons, Inc.
2) Youtility, Author: Jay Baer, Publisher: Gildan Media, LLC
3) Epic Content Marketing, Author: Joe Pulizzi, Publication: McGraw Hill Education

Reference book:

1) New Rules of Marketing and PR, Author: David Meerman Scott, Latest Edition: 6th Edition, Publication: John Wiley & Sons
2) Social Media Marketing All-in-one Dummies, Author: Jan Zimmerman, Deborah Ng, and Latest Edition: 4th Edition, Publication: John Wiley & Sons Inc.,

MCA - FIRST YEAR SECOND SEMESTER			
Course Code	BMCA0213P	**L TP**	**Credit**
Course Title	CRM Administration Lab	**0 02**	**1**

Course objectives:

To make the students understand the organizational need, benefits and process of creating long-term value for individual customers. To disseminate knowledge regarding the concept of e-CRM and e- CRM technologies. To enable the students, understand the technological and human issues relating to implementation of Customer Relationship Management in the organizations.

Pre-requisites: Creative thinking and which is being used by the creative talent in your businessareas.

The programs in lab will cover the following concepts:

1. Quick Start: Lightning App Builder
2. Prepare Your Salesforce Org for Users
3. Customize an Org to Support a New Business Unit
4. Protect Your Data in Salesforce
5. Customize a Sales Path for Your Team
6. Setup the service Console
7. Build a discount approval process
8. Quick start process builder
9. Build a simple flow
10. Build a battle station App
11. Customize a Salesforce Object
12. Create Reports and Dashboards for Sales and Marketing Managers

13. Improve Data Quality for Your Sales and Support Teams		
14. Create a Process for Managing Support Cases		
Course outcomes: After completing this course student will be able to:		
CO 1	Understand the basic concepts of Customer relationship management.	K6
CO 2	To understand marketing aspects of Customer relationship management.	K2, K6
CO 3	Understand basics of operational Customer relationship management.	K6

Text books:

1. Alok Kumar Rai : Customer Relationship Management : Concepts and Cases(Second Edition), PHI Learning, 2018
2. Bhasin- Customer Relationship Management (Wiley Dreamtech) ,2019
3. Salesforce for beginners by Shaarif Sahaalane book by Amazon (Online edition)

Reference book:

1. Salesforce Essentials for Administrators , By ShrivasthavaMohith, Edition Ist ,2018
2. Salesforce : A quick Study laminated Reference Guide by Christopher Mathew Spencer eBookby Amazon (Online)
3. Mastering Salesforce CRM Administration By Gupta Rakesh Edition IInd 2018

ReferenceLinks:

1.	www. Trailhead.salesforce.com
2.	www.mindmajix.com/salesforce-tutorial
3.	www,youtube.com/watch?v=7K42geizQCI

MCA - FIRST YEAR SECOND SEMESTER			
Course Code	**BMCA0214P**	**L T P**	**Credit**
Course Title	**Software Testing Lab**	**0 0 2**	**1**

Course objectives:

Understand UML and how to create class diagram. Understanding how to create use case diagram, sequence diagram, collaboration diagram. Understand how to create Activity diagram, Component diagram, and deployment diagram

Pre-requisites: Basic knowledge about software and its types.

The programs in Software Testing lab will cover the following concepts:

1. Introduction to UML
2. Class Diagram for ATM.
3. Use Case Diagram for ATM
4. Sequence Diagram for ATM
5. Collaboration Diagram for ATM
6. State chart Diagram for ATM.
7. Activity Diagram for ATM.
8. Component Diagram for ATM
9. Deployment Diagram for ATM
10. Write a program in C language in demonstration the working of the following constructs i) do. While ii)while.do iii) if…else iv) switch v) for
11. A program for written in C language for Matrix Multiplication fails‖ introspect the causes for its failure and write down the possible reasons for its failure
12. Take ATM system and study its system specifications and report various bugs.
13. Write the test cases for banking application.

Course outcomes: After completing this course student will be able to:

CO 1	Understand UML and how to create class diagram	K6

CO 2	Understanding how to create use case diagram, sequence diagram, collaboration diagram.	K2, K6
CO 3	Understand how to create Activity diagram, Component diagram, and deployment diagram.	K6

Text books:

1. Lessons Learned in Software Testing, by Bret Pettichord, CemKaner, and James Marcus Bach1
2. Foundations of Software Testing: ISTQB Certification, by Dorothy Graham and Erik P.W.M. Veenendaa2
3. Software Testing: A Craftsman's Approach, Fourth Edition, by Paul C. Jorgensen

Reference book:

1. The Art of Software Testing, by Glenford Myers
2. Software Test Automation, by Dorothy Graham and Mark Fewster
3. Software Testing and Quality Assurance: Theory and Practice, by Kshirasagar Naik and Priyadarshi Tripathy

ReferenceLinks:

1. https://www.youtube.com/watch?v=_jb0cyGbdbk
2. https://www.youtube.com/watch?v=7wo9PHfkyik
3. https://www.youtube.com/watch?v=UI6lqHOVHic
4. https://www.youtube.com/watch?v=gUEizau0UQ&list=PLWPirh4EWFpF9Gbnu4_DdF4ITHSN6MSsk