

DEPARTMENT OF COMPUTER APPLICATIONS

MCA STRUCTURED SYLLABUS - SECOND YEAR AND FIRST SEMESTER OF MCA2025 ADMISSION BATCH

Course Code	Course Title	Total No. of Contact Hours				Total No. of Credits
		Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
3 rd Semester (Theory)						
MCA301	Operating Systems and Systems Software	4	1	0	5	4
MCA302	Software Engineering & TQM	4	1	0	5	4
MCA304	Statistics and Numerical Techniques	3	1	0	4	3
MCA305	Artificial Intelligence and Machine Learning	4	1	0	5	4
MCAGS301	General Studies & Current Affairs-III	2	0	0	2	0.5
Total of Theory					21	15.5
3 rd Semester (Practical)						
MCA391	Operating Systems Laboratory (Unix)	0	0	2	2	3
MCA392	Software Project Management Laboratory	0	0	2	2	3
MCA395	Artificial Intelligence and Machine Learning Laboratory (PYTHON)	0	0	2	2	3
Total of Practical					6	9
3 rd Semester (Sessional)						
MCA371	Sustainability, Climate Action and Environmental Sciences	2	1	0	3	2
MCA381	Industrial Training	0	0	0	0	2
MCA382	Minor Project	0	0	0	8	6
MCA373	Seminar	0	0	0	0	1
MCAGS381	Competitive Aptitude Training - III	2	0	0	2	0.5
IFC	Industry and Foreign Certification	0	0	0	0	0
MAR	Mandatory Additional Requirements	0	0	0	0	0
MOOCS	Massive Open Online Courses	0	0	0	0	0
Total of Sessional					13	11.5
Total of the Semester					40	36

Syllabus for MCA Admission Batch 2025, 3rd Semester

Subject Name: Operating System and System Software

Credit: 04

Subject Code: MCA301 & MCA391

Lecture Hours: 40 Hrs.

Name of the Course: Operating System and System Software & Operating Systems Laboratory (Unix)	
Course Code: MCA301 & MCA391	Semester: 3
Duration: 40 Hrs.	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 4	End Semester Exam: 100
Tutorial: 1	Continuous Assessment: 100
Practical: 2	Practical Sessional Internal continuous evaluation: 100
Credit: 4 +3	Practical Sessional external examination: 100

Aim:	
Sl. No.	
1	To understand the system architecture of an operating system
2	Ability to apply CPU scheduling algorithms to manage tasks.
3	Initiation into the process of applying memory management methods and allocation policies.
4	Knowledge of methods of prevention and recovery from a system deadlock.

Objective:	
Sl. No.	
1	To deliver a detailed knowledge of integral software in a computer system – Operating System.
2	To understand the workings of an operating system as a resource manager.
3	To familiarize the students with Process and Memory management.
4	To describe the problem of process synchronization and its solution.
Pre-Requisite:	
Sl. No.	
1.	You should know about Computer Architecture and Organization.
2	Proficiency in C or another programming language.
3	Familiarity with Assembly language.

Course Outcome:	
1.	Understand Operating System Concepts: Gain knowledge about operating system functions, generations, processes, and threads.
2.	Develop Process Scheduling Algorithms: Create algorithms for process scheduling, considering CPU utilization, throughput, turnaround time, waiting time, and response time.
3.	Identify the deadlock situation and provide an appropriate solution so that the protection and security of the operating system are also maintained.
4.	Learn File Handling and Process Control: Understand the basics of File, Device, and Disk Storage Management

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	0	0	1	1	0	3	2	0	1
CO2	3	3	3	2	2	1	0	0	1	1	0	2	3	1	1
CO3	3	3	2	2	2	2	1	2	1	1	0	2	3	1	1
CO4	3	2	3	1	2	1	0	0	1	1	0	3	3	0	1

Mod ule num ber	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Introduction	1. Introduction to Operating Systems 2. Hardware Support for Operating Systems 3. Resource Management 4. Operating System Architectures	International Academia: CS 372 Operating Systems Syllabus (utexas.edu); CS 140: Operating Systems (stanford.edu) AICTE-prescribed syllabus: mca degree.pdf (aict-india.org) Industry Mapping: The concepts delivered are in sync with the industry standards	4	Basic Unix Commands
2	Process Management	5. Fundamentals of Process Management 6. Process Scheduling 7. Process Communication and Synchronization 8. Deadlocks 9. Multi-threading	International Academia: CS 372 Operating Systems Syllabus (utexas.edu); CS 140: Operating Systems (stanford.edu) AICTE-prescribed syllabus: mca degree.pdf (aict-india.org) Industry Mapping: The concepts delivered are in sync with the industry standards	8	- C Programs for Process Scheduling - Implementation of Banker's Algorithm
3	Memory Management	10. Basic Memory Management 11. Virtual Memory	International Academia: CS 372 Operating Systems Syllabus (utexas.edu); CS 140: Operating Systems (stanford.edu)	8	- C programs to simulate contiguous memory allocation techniques - C programs to simulate the paging technique

			<i>AICTE-prescribed syllabus:</i> mcadegree.pdf (aict-india.org) <i>Industry Mapping:</i> The concepts delivered are in sync with the industry standards		
4	File Management	12. File Systems 13. File System Implementation	<i>International Academia:</i> CS 372 Operating Systems Syllabus (utexas.edu); CS 140: Operating Systems (stanford.edu) <i>AICTE-prescribed syllabus:</i> mcadegree.pdf (aict-india.org) <i>Industry Mapping:</i> The concepts delivered are in sync with the industry standards	7	• Unix commands on file operations • C program for file organization technique.
5	Input –Output Management	14. Basics of I/O Management 15. Disk Management	<i>International Academia:</i> CS 372 Operating Systems Syllabus (utexas.edu); CS 140: Operating Systems (stanford.edu) <i>AICTE-prescribed syllabus:</i> mcadegree.pdf (aict-india.org) <i>Industry Mapping:</i> The concepts delivered are in sync with the industry standards	7	• C programs to simulate disk scheduling algorithms

6	Security and Protection Advanced Operating System	16. Security Issues 17. Protection Mechanisms 18. Distributed Operating Systems	<i>International Academia:</i> CS 372 Operating Systems Syllabus (utexas.edu) ; CS 140: Operating Systems (stanford.edu) <i>AICTE-prescribed syllabus:</i> mcadegree.pdf (aikte-india.org) <i>Industry Mapping:</i> The concepts delivered are in sync with the industry standards	6	Advanced Unix commands
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List of Books Text Books:			
Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Naresh Chauhan	Principles of Operating Systems (Chapters 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18)	1st Ed/ 9780198082873	Oxford University Press
Reference Books:			
Abraham Silberschatz, Peter B. Galvin	Operating System Concept	9th Ed/ 9788126554270	WILEY
Andrew S. Tanenbaum	Modern Operating Systems	4th Ed/ 9789332575776	Pearson Education India
William Stallings	Operating Systems	9th Ed/ 9789352866717	Pearson Education
Sumitabha Das	UNIX: Concepts and Applications (Lab Reference)	4th Ed/ 9780070635463	McGraw Hill Education



University of Engineering and Management



Syllabus for MCA Admission Batch 2025, 3rd Semester

Subject Name: Software Engineering & TQM

Credit: 04

Subject Code: MCA302

Lecture Hours: 40 Hrs.

Name of the Course: Software Engineering & TQM	
Course Code: MCA302 & MCA392	Semester: 3rd
Duration: 40 Hrs.	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 4	End Semester Exam: 100
Tutorial: 1	Continuous Assessment: 100
Practical: 2	Practical Sessional internal continuous evaluation: 100
Credit: 4 + 3	Practical Sessional external examination: 100

Aim:	
Sl. No.	
1	To gain knowledge of various aspects of software engineering project management.
2	To enhance ability to identify qualities of a good solution
3	To implement learned algorithm/design techniques to solve problems

Objective:	
Sl. No.	
1	The fundamental knowledge of software engineering
2	The different basic models need to implement different project problems
3	The various design methods to develop the software system
4	The quality and other issues related to the software products and systems
Pre-Requisite:	
Sl. No.	
1.	Knowledge in fundamental theories of computer science and one programming language
Course Outcome:	
1.	On completion of this course students are expected to learn fundamentals and different models of software engineering.
2.	On completion of this course students are expected to learn different aspects of requirement analysis in software project management.
3.	On completion of this course students are expected to learn various types of software design and concepts of coding.
4.	On completion of this course students are expected to learn different types of testing and quality issues.

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

Module Number	Topic	Subtopics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Introduction and Software Process Models	Software, Software Engineering, Myths, Software Process, Work Products, Importance of Software Engineering, Standard for Software Process, Waterfall Model, Prototyping Model, Iterative Enhancement Model, Spiral Model, RAD model.	International Academia: (https://ocw.mit.edu/courses/16-355j-software-engineering-concepts-fall-2005/pages/lecture-notes/) AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/CS%20%28AI&ML%29.pdf) Industry Mapping: IEEE SRS standard, Rational Rose, Reqview, Jira software, Axosoft.	8	1. Make a comparative studies of different models of software development process.
2	Requirement Engineering and Software Project Management	Software Requirements, Types of Requirements, Requirement Engineering Cycle, Requirements Specification document, Characteristics of Requirements, Requirement verification and validation, Role of Management in Software Development, Project Estimation Techniques, Staffing, Scheduling, Earned Value Analysis, Software Risks, Software Configuration Management, Software Process and Project metrics.	International Standards https://ocw.mit.edu/courses/16-355j-software-engineering-concepts-fall-2005/pages/lecture-notes/) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/CS%20%28AI&ML%29.pdf) Industry Mapping: MSproject, ProjectLibre, FunctionPointmodeler.	12	1. Write an SRS. 2. Compute function points using the method of FPA to determine the cost of s/w project 3. Implement COCOMO using the different formulas 4. Implement Gantt Chart and determine milestones 5. Implement PERT-CPM method

3	Software Design and Coding	Process, Data and Behavioural Modelling, Design Concepts, Modularity, Architectural design, Coupling and Cohesion, Top-down and bottom-up design, Object-oriented Analysis, Function-oriented and Object-Oriented Design approach, Software Design Document, Coding styles and documentation,	International Standards : (https://ocw.mit.edu/course_s/16-355j-software-engineering-concepts-fall-2005/pages/lecture-notes/) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/CS%20%28AI&ML%29.pdf) Industry Mapping: IEEE SDD document. Smart draw, Visual Paradigm/Microsoft Visio/MS Project/Umbrello/Rational Rose.	8	1. Implement the Cyclomatic Complexity of coding 2. Implement and evaluate the Halstead's Metrics of Coding 3. Implement Dharma's metrics 4. Implement polymorphism factor formula. 5. Implement inheritance formula
4	Testing and Software Quality	Testing principles, testing strategies, Black-box and White-box Testing Techniques, Levels of testing -unit, integration, system, regression, Test Plan, Test Cases Specification, Software debugging, Software Maintenance, Software Quality Factors, ISO , SEI CMM, CMMI, Software Reliability, Software Availability.	International Standards: (https://ocw.mit.edu/courses/6-170-laboratory-in-software-engineering-fall-2005/pages/assignments/) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/CS%20%28AI&ML%29.pdf) Industry Mapping: Eclipse, Bugzilla, MantisBT, Jira Software.	12	1. Implement H-K information factor. 2. Implement EMV method

List of Books Text Books:			
Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Rajib Mall	Fundamentals of Software Engineering(Chapter No. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12)	4 th edn	PHI
Reference Books:			
Roger S. Pressman	Software Engineering, A Practitioners Approach(Chapter No. 8, 10, 14, 16, 26, 28)	7 th edn	MGH



University of Engineering and Management

Syllabus for MCA Admission Batch 2025, 3rd Semester



Subject Name: Statistics and Numerical Techniques

Credit: 04

Subject Code: MCA304

Lecture Hours: 48 Hrs.

Name of the Course: Statistics and Numerical Techniques	
Course Code: MCA304	Semester: 3rd
Duration: One Semester	Maximum Marks: 100
Teaching Scheme: Lecture method	Examination Scheme
Theory: 4	End Semester Exam: 100
Tutorial: 1	Continuous Assessment: 100
Credit: 4	
Aim:	
Sl. No.	
1	Equip students with the skills to collect, organize, and summarize data effectively, enabling them to understand the fundamentals of descriptive and inferential statistics.
2	Provide students with the knowledge of numerical techniques for solving complex mathematical problems, fostering proficiency in methods such as root finding, interpolation, and numerical integration.
3	Enable students to apply statistical and numerical methods to real-world scenarios across various disciplines, promoting critical thinking, problem-solving, and ethical data practices.

Objective:	
Sl. No.	
1	Develop students' understanding of different data types and the ability to collect, organize, and summarize data effectively, using descriptive statistics techniques.
2	Enable students to grasp the principles of statistical inference, including hypothesis testing, confidence intervals, and regression analysis, to draw meaningful conclusions from sample data about populations.
3	Equip students with proficiency in numerical techniques such as root finding, interpolation, and numerical integration, enabling them to solve complex mathematical problems encountered in various disciplines.
4	Foster the application of statistical and numerical methods in practical scenarios across diverse fields, through case studies and hands-on exercises, promoting critical thinking, problem-solving, and ethical data practices.
Pre-Requisite:	
Sl. No.	
1.	Basic knowledge of senior secondary and under graduate levels mathematics.
Course Outcome:	
1.	Upon completion of the course, students will demonstrate proficiency in collecting, analyzing, and interpreting data using appropriate statistical techniques, enhancing their ability to make informed decisions based on empirical evidence.
2.	Students will be able to apply numerical techniques like interpolation and numerical integration to solve complex mathematical problems encountered in engineering, science, and other disciplines, effectively utilizing computational tools to address real-world challenges.
3.	Students will be able to apply numerical techniques like solution of equation and system of linear equations to solve complex mathematical problems.
4.	At the end of the course, students will be able to apply numerical methods like numerical solution of ODE to solve complex mathematical problems encountered in engineering, science, and other disciplines to address day-to-day life critical problems.

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

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours
1	Statistics, Probability and Distribution	Statistics - measure of central tendency, dispersion (Moments, Skewness & Kurtosis). Least square curve fitting - linear & non-linear. Probability, introduction to mass function, density function, distribution function (Binomial, Poisson, Normal), estimation of parameters (unbiasedness-concept of noise/error, consistency).	Industry Mapping: https://www.sagemath.org/ , MATLAB International Academia: https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014/pages/lecture-notes/ , https://ocw.mit.edu/courses/2-993j-introduction-to-numerical-analysis-for-engineering-13-002j-spring-2005/pages/lecture-notes/	16
2	Interpolation and Numerical Integration	Interpolation-Newton's Forward, Backward, Sterling & Bessel's Interpolation formulae, Lagrange's Interpolation. Inverse Interpolation. Integration - Trapezoidal, Simpson's 1/3rd, Weddle's Rule, Romberg Integration, Gauss- Legendre two & three points formula, Newton Cotes Formula.	Industry Mapping: https://www.sagemath.org/ , MATLAB International Academia: https://ocw.mit.edu/courses/2-993j-introduction-to-numerical-analysis-for-engineering-13-002j-spring-2005/pages/lecture-notes/	12

3		Solution of any equation - Method of Iteration, Method of Bisection, Newton-Raphson Method, Regula-Falsi method and Secant Method. Solution of system of linear equations - Gauss Elimination Method, Gauss-Jacobi, Gauss-Seidel, LU factorization and Tri-diagonalization.	Industry Mapping: https://www.sagemath.org/, MATLAB International Academia: https://ocw.mit.edu/courses/2-993j-introduction-to-numerical-analysis-for-engineering-13-002j-spring-2005/pages/lecture-notes/	12
4		Solution of differential equations - Picard's method, Euler-modified method, Taylor's Series method, Runge-Kutta method, Milne's Predictor-Corrector method.	Industry Mapping: https://www.sagemath.org/, MATLAB International Academia: https://ocw.mit.edu/courses/2-993j-introduction-to-numerical-analysis-for-engineering-13-002j-spring-2005/pages/lecture-notes/	8

List of Books Text Books:			
Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
B. S. Grewal	Higher Engineering Mathematics	44th Edition	Khanna Publishers
Reference Books:			
Dr. Hari Arora	PROBABILITY AND STATISTICS	3 rd Edition	S.K. KATARIA & SONS
K. DAS	NUMERICAL METHODS	2 nd Edition	U.N.DHUR & SONS PRIVATE LTD.
B.K. PAL & K. DAS	ENGINEERING MATHEMATICS Volume - IIA	1 st Edition (2021)	U.N.DHUR & SONS PRIVATE LTD.
Madhumangal Pal	Numerical Analysis for Scientists and Engineers: Theory and C Programs	1 st Edition (2007)	Alpha Science International Ltd

Subject Name: Artificial Intelligence and Machine Learning

Credit: 04

Subject Code: MCA305 & MCA395

Lecture Hours: 40 Hrs.

Name of the Course: Artificial Intelligence and Machine Learning	
Course Code: MCA305 & MCA395	Semester: 3rd
Duration: 40 Hrs.	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 4	End Semester Exam:100
Tutorial: 1	Continuous Assessment:100
Practical: 2	Practical Sessional internal continuous evaluation:100
Credit:4+3	Practical Sessional external examination:100

Aim:	
Sl. No.	
1	To gain knowledge of various aspects of artificial intelligence
2	To enhance the ability to identify qualities of a good solution of AI, ML etc.
3	To implement learned analytical techniques and AI & ML to solve problems.
Objective:	
Sl. No.	
1	Provide you with the knowledge and expertise to become a machine learning expert.
2	Demonstrate an understanding of intelligence and machine learning concepts that are vital for real-life problems.
3	Produce Python code to analyze different problems.
4	Critically evaluate intelligent problems based on their design, development and use in real-time.
Pre-Requisite:	
Sl. No.	
1.	Proficiency in Mathematics, Algorithms and Programming related to AI, ML etc.

Course Outcome:	
CO1.	Explain how knowledge is collected, created and managed for intelligence.
CO2.	Understand the key concepts in AI including their real-world applications and the toolkit used by intelligent systems.
CO3.	Implement AI & ML techniques using knowledge and toolkits.
CO4.	To enable systems to solve complex problems and automate decision-making processes.

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

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Module I: Introduction to AI(2L)	Overview of Artificial Intelligence – Introduction–History of AI– Applications of AI– Objectives of AI- features of AI	International Academia: https://ocw.mit.edu/course/s/res-str-002-data-management-spring-2016/ AICTE-prescribed syllabus: https://makautexam.net/aicte_details/CourseStructure/MCA21.pdf Industry Mapping: The concepts delivered are in	4	1. Write a program for displaying reversal of a number. 2. Implement python script to read person's age from keyboard and display whether he is eligible for voting or not. 3. Implement python script to check the given year is leap year or not. 4. Implement Python Script to generate prime numbers series up to n. 5. To display elements of list in reverse order. 6. Implement python script to accept

			sync with the industry standards		line of text and find the number of characters, number of vowels and number of blank spaces in it. 7. Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between 1000 and 2000. 8. Implement a python script for factorial of number by using recursion.
2	Module II: Symbolic Logic(6L)	Normal Forms in Propositional Logic – Logical Consequences – Resolution Principal – Predicate Calculus – Well Formed Formulas – Clausal Form – Rules of Inference – Unification – Resolution	International Academia: https://ocw.mit.edu/course/s/15-062-data-mining-spring-2003/ AICTE-prescribed syllabus: https://makautexam.net/aicte_details/CourseStructure/MCA21.pdf Industry Mapping: The concepts delivered are in sync with the industry standards	4	1. Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number. Suppose the following input is supplied to the program: 34, 67, 55, 33, 12, 98. Then, the output should be: ['34', '67', '55', '33', '12', '98'] ('34', '67', '55', '33', '12', '98'). 2. Write Python script to copy file contents from one file to another. 3. Implement a python script to check the element is in the list or not by using Linear search & Binary search. 4. Implement a python script to arrange the elements in sorted order using Bubble, Selection, Insertion and Merge sorting techniques. 5. Write a python program by using exception handling mechanism. 6. Write a python program to perform various database operations (create, insert, delete, update).

3	Module III: Search Techniques (6L)	Different types of search techniques and comparison among them	International Academia: https://ocw.mit.edu/course/s/15-071-the-analytics-edge-spring-2017/pages/visualization/ AICTE-prescribed syllabus: https://makautexam.net/aicte_details/CourseStructure/MCA21.pdf Industry Mapping: The concepts delivered are in sync with the industry standards	6	1. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data. 2. Write a program to demonstrate Regression analysis with residual plots on a given data set.
4	Module IV: Knowledge Representation (8L)	Procedural versus declarative knowledge, forward versus backward reasoning, Structured Knowledge: Graphs, Frames, and Related Structures, Object-Oriented Representations, Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics	International Academia: https://prolearn.mit.edu/data-science-and-big-data-analytics-making-data-driven-decisions AICTE-prescribed syllabus: https://makautexam.net/aicte_details/CourseStructure/MCA21.pdf Industry Mapping: The concepts delivered are in sync with the industry standards	4	1. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data. 2. Write a program to demonstrate Regression analysis with residual plots on a given data set.
5	Module V: Expert systems(2L)	Characteristic features of expert systems Applications, importance of expert systems Rule based system architectures (the knowledge base, the inference process, explaining how or why, building a knowledge base, the I/O interface)	International Academia: AICTE-prescribed syllabus: https://makautexam.net/aicte_details/CourseStructure/MCA21.pdf Industry Mapping: The concepts delivered are in	4	

			sync with the industry standards		
6	Module VI: Machine Learning (10L)	Computational learning tasks for predictions, learning as function approximation, generalization concept. - Linear models and Nearest-Neighbors (learning algorithms and properties, regularization). - Neural Networks (MLP and deep models, SOM). - Probabilistic graphical models. - Principles of learning processes: elements of statistical learning theory, model validation. - Support Vector Machines and kernel-based models. To implement linear regression, Data classification, Data clustering – To learn how to create segments based on similarities using K-Means and Hierarchical clustering	International Academia: https://professionalprograms.mit.edu/online-program-internet-of-things/ AICTE-prescribed syllabus: https://makautexam.net/aicte_details/CourseStructure/MCA21.pdf Industry Mapping: The concepts delivered are in sync with the industry standards	4	1. Write a program to demonstrate the working of the decision tree-based ID3 algorithm. 2. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. 3. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. 4. Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file 5.
7.	Module VII: Introduction to Robotics(4L)	Definitions, illustration of application domains -Mechanics and kinematics of the robot- Sensors for robotics -Robot Control-Architectures for controlling behavior in robots- Robotic Navigation-Tactile Perception in humans and robots- Vision in humans and robots.	International Academia: https://ocw.mit.edu/course/s/6-034-artificial-intelligence-fall-2010/ AICTE-prescribed syllabus: https://makautexam.net/aicte_details/CourseStructure/MCA21.pdf Industry Mapping: The concepts delivered are in sync with the industry standards	4	Python lab for text analysis 1. Choose some book-length document and download it. 2. Count its characters, lines and words. 3. Count sentences, vocabulary, and the like. 4. Show collocations, common context, concordance, and similar relationships among the words. 5. Plot a lexical dispersion or two. 6. Plot a frequency distribution of the most common words.

List of Books Text Book			
Name of Author	Title of the Book	Edition	Name of the Publisher
Rich, Knight	Artificial Intelligence	3 rd edn	PHI
Patterson	Introduction to Artificial Intelligence and Expert Systems	2 nd edn	Pearson
Akerkar	Introduction to Artificial Intelligence	2 nd edn	PHI
Alpaydin	Introduction to Machine Learning	3 rd edn	PHI

Syllabus for MCA Admission Batch 2025, 3rd Semester

Subject Name: General Studies & Current Affairs - III

Credit: 0.5

Subject Code: MCAGS301

Lecture Hours: 48 Hrs.

Module number	Topic	Sub-topics	Mapping with International/ National/ State Level Exams	Lecture Hours	Corresponding Assignment
1	GK, Current Affairs and Economics	National income- Concept of GDP, GNP, NNP both in FC & MP, PCI Tax (BECC-103, Unit-1, Unit-2, Unit-3) http://egyankosh.ac.in/handle/123456789/67653 NCERT Textbook: (Chapter 2): https://ncert.nic.in/textbook.php?lecc1=2-6 Frank, ISC Economics (Chapter-14, 15, 16) https://books.google.co.in/books?id=4lGQISi9G7wC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false 2. Concept of tax, objective of tax, Direct & Indirect Tax, Progressive, Regressive & Proportional tax. 3. Textbook: Principles of Microeconomics: N Gregory Mankiw, Chapter 12) Textbook: FRANK Chapter-19 (class - 12) https://books.google.co.in/books?id=4lGQI	International Exams 1. GRE https://www.ets.org/pdfs/gre/gre-math-review.pdf) 2. GMAT https://downloads.mba.com/downloads/gmat-handbook.pdf) National Exams: 1. UPSC Civil Services Exam https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26 UPSC Combined Defence Services https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 3. RBI Grade B https://rbidocs.rbi.org.in/rdocs/Content/PDEs/DADVT/GRB09052023EA65E4FB1C2CE473396B4FD7E5F69	48	1. National Income: Write a report on the challenges and limitations in measuring national income, such as the informal sector, data collection issues, and non-market transactions. 2. Concept of Tax- Write a report on the difference between tax evasion and tax avoidance. Discuss the measures taken by the Indian government to combat tax evasion and promote tax compliance. 3. Inflation & Deflation Write a report on the causes of deflation and its consequences for the

	Si9G7wC&printsec=f rontcover&source=gb s_ge_summary_r&ca d=0#v=onepage&q&f=false 4. Inflation & Deflation - Inflation & its impact, Deflation & its impact, WPI, CPI, GDP deflator.(BECC-106, Block-2,Unit-6) http://egyankosh.ac.in/handle/123456789/75067 Textbook: M LJhingan 12th Edition. Macro-Economic Theory, Part-5,Chapter-37 Market structure-Perfect competition, monopoly,oligopoly, duopoly,monophony, duopoly, Oligopoly(BECC-101, Block-4, Unit-9,10,11,12) http://egyankosh.ac.in/handle/123456789/67491 Textbook: FRANKChapter-19 (Class-12) https://books.google.co.in/books?id=4lGQISi9G7wC&printsec=f rontcover&source=gb s_ge_summary_r&ca d=0#v=onepage&q&f=false GK and Current Affairs –Based on MonthlyMagazines provided andrecent news of national and international importance. Newspaper Reading: TheEconomic Times. Traditional GK and CA:Capitals of countries, the currency of countries, important dates, Sports football, hockey, recent events & awards etc. Important books &authors, ImportantHydropower dams, atomicpower plants, important national parks, Minister &portfolio &	CDDE.PDF), pg 22-23 4. IBPS Probationary officer(https://www.ibps.in/wp-content/uploads/Detailed-Advt.-CRP-PO-XII.pdf) ,Pg 7. 5. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22 6. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) 7. XAT (https://xat.org.in/xat-syllabus/) 8. GATE (https://gate2025.iisc.ac.in/papers-and-syllabus/) 9. CAT https://iimcat.ac.in/per/g01/pub/756/ASM/WebPortal/1/index.html?756@@1@@1 State Level Exams: 1. Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1	economy. 4. Market Structure. Analyze the impact of different market structures on consumers, focusing on factors like price, quality, and choice. Analyze their effectiveness and impact on the economy. ** All the assignments are in line with entrance exams for premier B-Schools and GS Paper-I of UPSC CSE.
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		constituencies,Population census, Persons in news -most famous,popular recent only, Important dances & festivals of Indian states,International Head Quarters & world organization, Importantpresident & pm electedfrom various countries, Important about banks likepayment banks, smallbanks & license system, Awards, Sports, Books & author, National & International affairs	2. Miscellaneous Services Recruitment Examination (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf),pg 1		
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References

1. Indian Economy-Ramesh Singh

Syllabus for MCA Admission Batch 2025, 3rd Semester

Subject Name: Sustainability, Climate Action and Environmental Sciences Credit: 03

Subject Code: MCA373

Lecture Hours: 36 Hrs.

Name of the Course: ENVIRONMENT AND ECOLOGY	
Course Code: MCA373	Semester: 3rd
Duration: 36	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 1	End Semester Exam: 100
Tutorial: 1	Continuous Assessment: 100
Credit: 2	
Aim:	
Sl. No.	
1	Imparting knowledge about the environment and ecosystem around us.
2	Imparting knowledge about the natural resources, biodiversity, and the importance of their conservation
3	Environmental Management and Pollution Control

Objective:	
Sl. No.	
1	Students will gain knowledge about the environment and ecosystem.
2	Students will learn about natural resources, biodiversity, and the importance of their conservation

3	To make students aware of problems of environmental pollution, its impact on humans and the ecosystem, and control measures.
4	At the end of the course, students will learn about waste disposal measures and environmental management.
Pre-Requisite: NA	
Course Outcome:	
1.	Define Environmental factors and the basic components of the ecosystem.
2.	Understand and explain the importance of Plantation.
3.	List the pollutants and analyze the importance of reducing/ controlling environmental pollution.
4.	Analyze the importance of Biohazards, Environmental and Social fety

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

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours
I	Overview	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship Mathematics of population growth and associated problems, Importance of population study in environmental engineering, the definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. Importance, scope and principles of EIA.	International Academia: https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future AICTE-prescribed syllabus: https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf Industry Mapping: https://cbs.umn.edu/populus/downloadplant(WWTP) .	6

II	Ecology	Elements of ecology: System, open system, closed system, the definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	International Academia: https://ocw.mit.edu/courses/1-020-ecology-ii-engineering-for-sustainability-spring-2008/ AICTE-prescribed syllabus: https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf Industry Mapping: https://vsni.co.uk/solutions/ecology https://www.helsinki.fi/en/researchgroups/statistical-ecology/software	6
III	Air Pollution	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)	International Academia: https://ocw.mit.edu/courses/1-84j-atmospheric-chemistry-fall-2013/pages/lecture-notes/ AICTE-prescribed syllabus: https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf Industry Mapping: https://www.who.int/europe/tools-and-toolkits/airq---software-tool-for-health-risk-assessment-of-air-pollution	6
IV	Water Pollution	Pollutants of water, their origin and effects: Oxygen demanding	International Academia:	6

		wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenating, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Waste water standard [BOD, COD], Water Treatment system, primary and secondary treatments, tertiary treatment definition. Water pollution due to the toxic elements. USEPA and WHO guidelines for drinking water.	https://online.stanford.edu/courses/cee270m-aquatic-and-organic-chemistry-environmental-engineering AICTE-prescribed syllabus: https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf Industry Mapping: Activated Sludge Simulation (ASIM), Sewage Treatment Operation and Analysis Over Time (STOAT), and GPS-X are the common softwares used for waste water treatment plant (WWTP).	
V	Lithosphere	Lithosphere; Internal structure of earth, rock and soil (1L). Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste). (2L)	International Academia: https://ocw.mit.edu/courses/1-34-waste-containment-and-remediation-technology-spring-2004/ AICTE-prescribed syllabus: https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf Industry Mapping: https://www.wasteworksonline.com/	6
VI	Noise pollution	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index), n Ld. Noise pollution control. (1L)	International Academia: No link found AICTE-prescribed syllabus: https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf Industry Mapping: No software found	3
VII	Environmental Management	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	International Academia: https://ocw.mit.edu/courses/11-601-introduction-to-environmental-policy-and-planning-fall-2016/ AICTE-prescribed syllabus: https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf Industry Mapping: https://www.intellex.com/products/environment/	3

List of Books Text Books:			
Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
MP Poonia, SC Sharma, S. Kumar	Environmental Studies (AICTE Textbook)	3 rd - 2021/ 978-9390779024	Khanna Book Publishing Co.
Reference Books:			
NA			

Subject Name: Competitive Aptitude Training – III

Credit: 0.5

Subject Code: MCAGS381

Lecture Hours: 48 Hrs.

Module number	Topic	Sub- topics	Mapping with International/National/ State Level Exams	Lecture Hours	Corresponding Assignment
1	Quantitative Aptitude	Textbook: Quantitative Aptitude for Competitive Examination Author: R.S Agarwal Publishing House: S. Chand - Simple & Compound Interest, - Number System, - Quadratic Equations	National Exams: UPSC Civil Services Exam https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26 UPSC Combined Defence Services https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 Combined Graduate Level conducted by SSC https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf) pg. 20-22 Intelligence Bureau ACIO https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) State Level Exams:	12	1. Simple & Compound Interest: Simple Interest Applications: - Calculate the total interest and amount payable on a loan with simple interest. - Determine the time required to double an investment with simple interest. - Compare the simple interest earned on different principal amounts or at different interest rates. Compound Interest Applications: - Calculate the compound interest and final amount of an investment over multiple years. - Compare the growth of an investment with different compounding frequencies (annual, semi-annual, quarterly, monthly). - Determine the time required to double or triple an investment with compound interest.
					Understand the concept of effective annual rate (EAR) and how it relates to nominal

			1. Civil Services Executive Exam (WBCS) https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1 2. Miscellaneous Services Recruitment Examination https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf) pg 1	interest rates and compounding frequencies. 2. Number System: • Divisibility Rules: ○ Test the divisibility of numbers by 2, 3, 4, 5, 6, 8, 9, 10, and 11. ○ Apply divisibility rules to simplify calculations and solve problems. • Prime and Composite Numbers: ○ Identify prime and composite numbers. ○ Find the prime factorization of composite numbers. ○ Use prime factorization to find the highest common factor (HCF) and least common multiple (LCM) of numbers. • Number Properties: ○ Understand the concepts of even and odd numbers, natural numbers, whole numbers, integers, rational and irrational numbers. ○ Solve problems involving the properties of these number types. 3. Quadratic Equations: • Solving Quadratic Equations: ○ Solve quadratic equations using factoring, completing the square, and the quadratic formula. ○ Determine the nature of roots (real, equal, imaginary) of a quadratic equation. • Word Problems: ○ Apply quadratic equations to solve real-world problems, such as finding the dimensions of a rectangle given its area and
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					perimeter, or determining the trajectory of a projectile. 4. Quadratic Functions and Graphs: - Graph quadratic functions and interpret the graph to find the vertex, axis of symmetry, and intercepts. - Use the graph to solve quadratic equations and inequalities.
2	Logical Reasoning	Textbook: Verbal and Non-Verbal reasoning Author: R.S Agarwal Publishing House: S. Chand - Puzzle - Classification Based Puzzle - Sequential Based Puzzle - Selection Based Puzzle - Ranking Based Puzzle - Blood Relation Based Puzzle Inequality	National Exams: UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26 UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf) pg. 20-22 Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) State Level Exams: Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1	12	1. Classification Based Puzzles: Grouping by Attributes: Provide a list of items (e.g., animals, fruits, professions) and ask students to classify them into groups based on shared characteristics (e.g., habitat, color, skill set). Identifying the Odd One Out: Present a group of items where one does not belong and have students explain why it is different from the others. Missing Item: Give a set of items with a pattern and have students determine the missing item that fits the pattern. 2. Sequential Based Puzzles: Logical Sequencing: Present a series of events or actions and have students arrange them in a logical order. Number Series: Give a series of numbers with a pattern and ask students to find the missing number or continue the series. Letter Series: Provide a series of letters with a pattern and have students determine the missing letter or continue the series. 3. Selection Based Puzzles: Team Selection: Provide a set of candidates with different skills and have students select the best team for a specific task. Item Selection: Give a list of items with

			2. Miscellaneous Services Recruitment Examination (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf) <i>pg1</i>		different attributes and ask students to choose the most suitable item for a given purpose. • Eligibility Criteria: Present a set of rules or conditions and have students determine which candidates are eligible or ineligible based on those criteria. 4. Ranking Based Puzzles: • Height/Weight Arrangement: Arrange a group of people in ascending or descending order based on their height or weight. • Marks/Scores: Order students or players based on their marks, scores, or performance in a competition. • Preferences: Determine the order of preference for a group of people based on their likes and dislikes. 5. Blood Relation Based Puzzles: • Family Tree: Present a family tree with missing information and have students deduce the relationships between different members. • Coded Relationships: Use codes or symbols to represent relationships and ask students to decode them. 6. Puzzles with Statements: Give a set of statements about the relationships between people and have students draw a family tree or answer questions based on those statements 7. Inequality Puzzles: • Coded form of Inequalities • Either-Or Case • Neither -Nor Case Single Statement Inequalities.
3	Verbal English	Textbook: Objective General English Author: R.S Agarwal Publishing house: S. Chand	National Exams: 1. UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl- 	12	1. Application of Adjectives and Determiners: • Identification of Errors • Comparative and Superlative Forms • Types of Adjectives

		1. Application of Adjectives and Determiners 2. Conjunction and Connectors 3. Rearrangement of Sentences. 4. Multiple Fillers-Level 1 5. Reading Comprehension 6. Precise Writing Notice Writing	010223.pdf), pg 25-26 2. <i>UPSC Combined Defence Services</i> (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 3. <i>Combined Graduate Level conducted by SSC</i> (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf) pg. 20-22 4. <i>Intelligence Bureau ACIO</i> (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) State Level Exams: 1. <i>Civil Services Executive Exam (WBCS)</i> (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1 Miscellaneous Services Recruitment Examination (https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf) pg 1		- Determiners in Context 2. Conjunctions and Connectors: - Sentence Combining - Coordinating vs. Subordinating Conjunctions - Transition Words and Phrases - Connectors for Cause and Effect 3. Rearrangement of Sentences: - Jumbled Sentences - Paragraph Sequencing 4. Multiple Fillers - Level 1: - Cloze Passages - Sentence Completion 5. Reading Comprehension: - Inference Questions - Vocabulary in Context - Main Idea and Supporting Details - Critical Thinking Questions 6. Precise Writing: - Summarizing - Paraphrasing 8. Editing for Conciseness
4	Data Interpretation	Textbook: Quantitative Aptitude for Competitive Examination	National Exams: 1. <i>UPSC Civil Services Exam</i> (https://upsc.gov.in/sites/default	12	7. Application of Data Analysis based on Bar Chart

		Author: R.S Agarwal Publishing House: S. Chand Advanced Level: Bar Graph	ult/files/Notif-CSP-23-engl-010223.pdf), pg 25-26 2. <i>UPSC Combined Defence Services</i> (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21 3. <i>Combined Graduate Level conducted by SSC</i> (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22 1. <i>Intelligence Bureau ACIO</i> (https://www.pw.live/exams/wp-content/uploads/2023/11/1B-ACIO-Recruitment-2023-Notification-Emp-News.pdf) 2. <i>RBI Grade B</i> (https://rbidocs.rbi.org.in/rdocs/Content/PDEs/DADV_TGRB09052023FA65E4FB1C2CF473396B4FD7E5F69CDDE.PDF), pg 22-23 <i>State Level Exams:</i> 1. <i>Civil Services Executive Exam(WBCS)</i> (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1		
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			2. Miscellaneous Services Recruitment Examination (https://adda247jobs-wp- assets- prod.adda247.com/jobs/wp- content/uploads/sites/7/2022/1 1/21142422/2707970_2019.pd f) <i>pg 1</i>		
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