BIRLA INSTITUTE OF TECHNOLOGY
MESRA
RANCHI, INDIA

CHOICE BASED CURRICULUM

Computer Science and Engineering

P.G Programme

(Master of Computer Applications)

Department of Computer Science & Engineering

Birla Institute of Technology, Mesra, Ranchi - 835215 (India)

Institute Vision

To become a Globally Recognized Academic Institution in consonance with the social, economic and ecological environment, striving continuously for excellence in education, research and technological service to the National needs.

Institute Mission

- To educate students at Undergraduate, Postgraduate Doctoral and Post-Doctoral levels to perform challenging engineering and managerial jobs in industry.
- To provide excellent research and development facilities to take up Ph.D. programmes and research projects.
- To develop effective teaching and learning skills and state of art research potential of the faculty.
- To build national capabilities in technology, education and research in emerging areas.
- To provide excellent technological services to satisfy the requirements of the industry and overall academic needs of society.

Department Vision

The department strives to be recognized for outstanding education and research, leading to excellent professionals and innovators in the field of Computer Science and Engineering, who can positively contribute to the society.

Department Mission

- To impart quality education and equip the students with strong foundation that could make them capable of handling challenges of the new century.
- To maintain state of the art research facilities and facilitate interaction with world's leading universities, industries and research organization for constant improvement in the quality of education and research.

Program Educational Objectives (PEOs)

PEO 1: To excel in software development skills coveted in the IT industry.

PEO 2: To be well prepared for pursuing higher studies in related fields of teaching and research.

PEO 3: To be aware of the requirements of being an ethical and professional leader and inculcating team spirit.

PEO 4: To inculcate the ability to innovate and contribute towards the growth of the nation.

Programme Outcomes (POs)

PO 1: Attain problem solving attitude in systematic and timely manner.

PO 2: Apply knowledge of mathematics, algorithm and computing principles appropriately to solve real-world problems.

PO 3: Identify modern tools and techniques through critical thinking for solving complex problems.

PO 4: Use the computational resources efficiently to develop software for the industry need.

PO 5: Understand and assess societal, environmental, safety, legal and ethical norms for professional computing practices.

PO 6: Function as an individual or as a member in team in the software domain.

PO 7: Recognize the need for self-motivation, learning and unlearning to engage in life-long learning for continual development.

PO 8: Excel in descriptive oral, written communication and presentation skills required for documenting and delivering project artefacts effectively.

FRAMEWORK / CHOICE BASED CURRICULUM SYSTEM (CBCS)

PG PROGRAMME IN COMPUTER APPLICATION
CATEGORY WISE DISTRIBUTION

The structure of MCA programmes shall have Foundation Sciences (FS), Humanities & Social Sciences (HSS), Skill and Professional Development (SPD), Professional Core (PC), Professional Elective (PE) courses, Open Elective courses (OE), Project (P), Summer Industrial Training (SIT), Mandatory Courses (MC) and Massive Open Online Courses (MOOC). The category wise distribution shall be as follows:

S. No	Category	Credits	Broad Category
1	Foundation Sciences (FS) + Humanities & Social Sciences (HSS) + Skill and Professional Development(SPD)	30	Common Courses
2	Programme Core (PC)	64	Department Courses
3	Programme Electives (PE)	12	
4	Project (P)	12	
5	Open Electives (OE)	12	Other Department Courses -Interdisciplinary
6	MOOC	4	Mandatory/Audit
7	Summer Industrial Training (SIT) / Extra OE /Soft Skills course	6	Professional Training
	TOTAL	**140**	

SEMESTER	CATEGORY	COURSE CODE	COURSE NAME	CREDITS L – T– P	TOTAL CREDITS
I	FS		Discrete Mathematical Structure	3-0-0	3
	FS		Numerical and Statistical Methods	3-0-0	3
	HSS		Business English & Communication	3-0-0	3
	SPD		Principles Of Management	3-0-0	3
	PC	CA401	Programming with C	3-0-0	3
	PC	CA403	Computer Organization and Architecture	3-0-0	3
			Sessional		
	PC	CA402	Programming Lab in C	1.5	1.5
	PC		Numerical and Statistical Methods Lab	1.5	1.5
			Total	**21**	**21**
II	FS	CA455	Fundamentals of Data Structures	3-1-0	4
	FS		Bioinformatics	3-0-0	3
	PC	CA457	Operating System	3-0-0	3
	PC	CA459	Object Oriented Design and Programming	3-0-0	3
	PC	CA461	Database Management Systems	3-1-0	4
	HSS		Basics of Financial Accounting Management	3-0-0	3
			Sessional		
	PC	CA456	Data Structure Lab	1.5	1.5
	PC	CA458	Operating Systems Lab	1.5	1.5
	PC	CA460	C++ Programming Lab	1.5	1.5
	PC	CA412	RDBMS Lab	1.5	1.5
			Total	**26**	**26**
III	PC	CA501	Java Programming	3-0-0	3
	PC	CA503	Computer Algorithm Design	3-1-0	4
	PC	CA504	Automata Theory	3-1-0	4
	PC	CA505	Software Engineering	3-1-0	4
	HSS		Corporate Social Responsibility	2-0-0	2
	PE		Programme Elective-I	3-0-0	3
	PE		Programme Elective-I	3-0-0	3
			Sessional		
	PC	CA502	Java Programming Lab	1.5	1.5

	PC	CA506	Software Engineering Lab	1.5	1.5
			Total	**26**	**26**
SEMESTER	**CATEGORY**		**COURSE NAME**	**CREDITS L – T– P**	**TOTAL CREDITS**
IV	PC	CA557	Front end Design	3-1-0	4
	PC	CA559	Data Communication and Computer Network	3-1-0	4
	PC	CA561	Software Project Management	3-0-0	3
	PE		Programme Elective- II	3-0-0	3
	PE		Programme Elective- II	3-0-0	3
	MOOC		Massive Online Courses and Assignments	4-0-0	4
			Sessional		
	PC	CA558	Front end Design Lab	1.5	1.5
	PC	CA560	Data Communication and Computer Networks Lab	1.5	1.5
			Total	**24**	**24**
V	HSS		Quantitative methods for Business Decision	3-0-0	3
	PC	CA601	Computer Graphics	3-0-0	3
	PC	CA603	System Simulation and Modeling	3-0-0	3
	PC	CA605	Optimization Techniques	3-0-0	3
	PE III		Programme Elective-III	3-0-0	3
	PE IV		Programme Elective-IV	3-1-0	4
	SIT / Soft Skill Course / Extra OE		Small Industrial Training/ Small Project /	6	6
			Sessional		
	PC	CA602	Computer Graphics Lab	1.5	1.5
	PC	CA604	System Simulation and Modeling Lab	1.5	1.5
			Total	**28**	**28**
VI	P	CA656	Project	**15**	**15**
			Total	**15**	**15**

List of Program Electives:

PE I:		
	CA430	Distributed Databases
	CA431	Decision Support Systems
	CA432	Data Mining and Warehousing
	CA433	Multimedia Databases
PE II:		
	CA580	Advanced Java Programming
	CA581	Systems Programming
	CA582	Compiler Design
	CA583	Programming Language Design and Concepts
	CA584	Web Programming
PE III:		
	CA535	Natural Language Processing
	CA536	Artificial Intelligence
	CA537	Image Processing
	CA538	Soft Computing
	CA539	Cloud Computing
	CA540	Machine Learning
	CA541	In-Memory Computing
PE IV:		
	CA630	Network Security and Cryptography
	CA631	Internet of Things(IoT)

	CA632	Mobile Computing
	CA633	Bioinformatics
	CA634	Multimedia and Animation

COURSE INFORMATION SHEET

Course code: MA430
Course title: DISCRETE MATHEMATICAL STRUCTURE
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Gain an understanding of the basic principles of sets and operations in sets.
2.	Demonstrate an understanding of relations and functions and be able to determine their properties.
3.	Demonstrate different traversal methods for trees and graphs.
4.	Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
5.	Model problems in Computer Science using graphs and trees.

Course Outcomes

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

CO1	Simplify and evaluate basic logic statements including compound statements, implications, inverses, converses, and contrapositives using truth tables and the properties of logic.
CO2	Apply counting principles to determine probabilities.
CO3	Solve discrete probability problems and use sets to solve problems in combinatorics and probability theory.
CO4	Apply algorithms to problems including searching algorithms, base conversion algorithms, and the Euclidean algorithm.
CO5	Model and implement problems in Computer Science using graphs and trees.

SYLLABUS

Module I:
Mathematical logic and Mathematical Reasoning, Compound Statements, Propositional Equivalences, Predicates and Quantifiers, Methods of Proof, Mathematical Induction, Well-ordering principle, Recursive Definition and Algorithms.

(8L)

Module II:
Relations, Properties/Classification of Relations, Closure operations on Relations, Matrix representation of Relations, Digraphs, Partial ordered set, Linearly Ordered Set, Hasse Diagram, Isomorphism, Isomorphic Ordered Sets, Supremum, Infimum, Well ordered set.

(8L)

Module III:
Recurrence Relations, Classification of Recurrence Relations and their solutions by Characteristic Root method, Generating function and their various aspects, Utility of Generating function in solving Recurrence Relations

(8L)

Module IV:
Binary Operations, Groups, Product and Quotients of Groups, Semi group, Products and Quotients of Semi groups, Permutation Group, Composition of Permutation, Inverse Permutation, Cyclic Permutation, Transposition, Even and Odd Permutation, Coding of Binary Information and Error Correction, Decoding and Error Correction.

(8L)

Module V:
Introduction to Graph, Graph Terminologies and their representation, Connected & Disconnected graphs, Isomorphic Graph, Euler & Hamilton graphs.
Introduction to Trees, Versatility of Trees, Tree traversal, Spanning Trees, Minimum Spanning Tree.

(8L)

Books recommended:

TEXT BOOK

1. Mott, Abraham & Baker, "Discrete Mathematics for computer scientist & mathematicians", PHI, 2nd Edition, 2002. **(T1)**
2. ROSS & WRIGHT, "Discrete Mathematics", PHI, 2nd Edition, 1988. **(T2)**
3. Swapan Kumar Chakraborty and BikashKantiSarkar, "Discrete Mathematics", Oxford Univ. Publication, 2010. **(T3)**
4. Kolman, Rusby, Ross, "Discrete Mathematics Structures", PHI, 5th Edition, 2005. **(T4)**

REFERENCE BOOK

1. Bikash Kanti Sarkar and Swapan Kumar Chakraborty, "Combinatorics and Graph Theory", PHI, 2016. **(R1)**
2. Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", Shaum's outlines, 2003. **(R2)**
3. C. L. LIU, "Elements of Discrete Maths", McGraw Hill, 2nd Edition, 2001. **(R3)**

4. Johnsonbaugh, R., "Discrete Mathematics", 6th Edition, Maxwell, Macmillan International. **(R4)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):
Design of real-time industrial projects.
POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:
Design optimization for industrial projects, Fractional order controller
POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

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

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: MA428
Course title: NUMERICAL AND STATISTICAL METHODS
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Derive appropriate numerical methods to solve algebraic, transcendental equations and linear system of equations
2.	Approximate a function using various interpolation techniques, to find the numerical solution of initial value problems
3.	Apply concepts in probability theory, the properties of probability distributions
4.	Estimation of mean, variance and proportion, the concepts of statistical hypothesis

Course Outcomes

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

CO1	Solve algebraic, transcendental equation and linear system of equations using an appropriate numerical method arising in various engineering problems
CO2	Evaluate derivative at a value using an appropriate numerical method in various research problems, solve differential equation numerically
CO3	Learn basic probability axioms, rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
CO4	Find the point and interval estimates, analyze data statistically and interpretation of the results
CO5	Implement Numerical techniques using computers.

SYLLABUS

Module I:
Errors and their computation: absolute, relative and percentage. Solution of algebraic & transcendental equations: Bisection method, False position method, Secant method, Newton's Raphson method, Iterative method, Error analysis and convergence study.

(8L)

Module II:
Interpolation with equal & unequal intervals: Introduction, finite differences-forward, backward & central difference tables, Newton's formula for interpolation, Gauss's central difference interpolation formula, divided difference and their properties- Newton's divided differences formula, Lagrange's interpolation formula, Inverse interpolation. Numerical solution of linear system of equations: Direct Method-Gauss elimination, Gauss-Jordan, LU decomposition methods. Iterative Methods-Gauss-Jacobi and Gauss Seidel methods.

(8L)

Module III:
Numerical differential & integration: Introduction, derivatives using forward and backward difference formula, Numerical Integration-Trapezoidal rule, Simpson's 1/3 & 3/8 rules, Weddle's rule. Numerical solution of ordinary differential equations: Taylor Series method, Euler's method, Modified Euler's method, Runge-Kutta methods of 2nd and 4th order.

(8L)

Module IV:
Concepts of Probability: Experiment and Sample Space, Events and Operations with Events, Probability of an Event, Basic Probability Rules, Applications of Probability Rules, Conditional Probability, random variable: continuous and discrete**,** Mean, Variance and Standard Deviation of a Random Variable. Binomial Experiments: Structure of a Binomial Experiment, Binomial Probability Distribution, Use of Binomial Probability Table. Properties of a Normal Curve, Normal Probability Distribution, Areas Under a Normal Curve. Approximating a Binomial Probability, The Normal Theorem and the Central Limit Theorem.

(8L)

Module V:
Estimation of Population Parameters: Parameter and Statistic, Point and Interval Estimation, Interval Estimation of Three Common Parameters. Hypothesis Testing for a Single Population: Concept of a Hypothesis, Tests Involving a Population Mean, Tests Involving a Population Proportion, Tests Involving a Population Standard Deviation. Concepts of a Bivariate Data Set, Correlation Coefficient, The Regression line.

(8L)

Books recommended:

TEXT BOOK

1. S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI, Private Ltd., New Delhi. **(T1)**
2. N.Pal & S. Sarkar, "Statistics: Concepts and Applications", PHI, New Delhi, 2005. **(T2)**

REFERENCE BOOK

1. R.V.Hogg et.al, "Probability and Statistical Inpane", 7th Edition, Pearson Education, New Delhi, 2006. **(R1)**
2. R.L.Burden & J.D.Faires, "Numerical Analysis", Thomson Learning-Brooks/Cole, Indian Reprint, 2005. **(R2)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

Design of real-time industrial projects.

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Design optimization for industrial projects, Fractional order controller

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

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

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: MT123
Course title: BUSINESS COMMUNICATION
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/1
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Analyze and demonstrate writing and speaking processes through invention, organization, drafting, revision, editing, and presentation.
2.	Understand the importance of specifying audience and purpose and to select appropriate communication choices.
3.	Interpret and appropriately apply modes of expression, i.e., descriptive, expositive, Narrative, scientific, and self-expressive, in written, visual, and oral communication
4.	Participate effectively in groups with emphasis on listening, critical and reflective thinking, and responding.
5.	Develop the ability to research and write a documented paper and/or to give an oral presentation.

Course Outcomes

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

CO1	Apply business communication strategies and principles to prepare effective communication for domestic and international business situations.
CO2	Utilize analytical and problem-solving skills appropriate to business communication.
CO3	Participate in team activities that lead to the development of collaborative work skills.
CO4	Select appropriate organizational formats and channels used in developing and presenting business messages
CO5	Communicate via electronic mail, Internet, and other technologies and deliver an effective oral business presentation.

SYLLABUS

Module I:

Introduction to Business Communication:

Importance and Objectives of Business communication, Process of communication, Barriers to effective communication, Techniques of effective communication. Forms of communication (Written, Oral, audio-visual communication).

(8L)

Module II:

Managing Business Communication:

Formal and Informal communication, Non- verbal communication (Body language, Gestures, Postures, Facial expressions). The cross-cultural dimensions of business communication. Techniques to effective listening, methods and styles of reading.

(8L)

Module III:

Other aspects of communication:

Vocabulary:

Single word substitution, Idioms and phrases, Precis writing, Comprehension.

Group Discussions, Extempore, Principles of effective speech and presentations, Role-playing.

(8L)

Module IV:

Introduction to managerial writing:

Business letters: Inquiries, Circulars, Quotations, Orders, Acknowledgement, Claims & adjustments, Collection letters, Sales letters, Drafting of different resumes, Covering letters Applying for a job, Social correspondence, Invitation to speak.

Official Correspondence: Memorandum, Notice, Agenda, Minutes, Circular letters.

(8L)

Module V:

Report writing and Technical Proposals:

Business reports, Types, Characteristics, Importance, Elements of structure, Process of writing, Order of writing, the final draft, checklists for reports.

Technical proposals, Definitions, types and format.

(8L)

Books recommended:

TEXT BOOK

1. "Communication Skills", Sanjay Kumar & Pushp Lata, Oxford University Press. **(T1)**
2. "Business Correspondence and Report Writing", R.C.Sharma, Krishna Mohan, McGraw Hill. **(T2)**
3. "Communication for Business", Shirley Taylor, V. Chandra, Pearson. **(T3)**

REFERENCE BOOK

1. "Business Communication", HorySankar Mukherjee, Oxford University Press. **(R1)**
2. "Basic Business Communication", Lesikar I Flatley, McGraw Hill. **(R2)**
3. "Business Communication Today", Bovee, Thill and Chaterjee, Pearson. **(R3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations
Gaps in the syllabus (to meet Industry/Profession requirements):
Design of real-time industrial projects.
POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:
Design optimization for industrial projects, Fractional order controller
POs met through Topics beyond syllabus/Advanced topics/Design:

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

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

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1,CD2,CD3
CD2	Tutorials/Assignments	CO2	CD1,CD2,CD3
CD3	Seminars	CO3	CD1,CD2,CD3
CD4	Mini projects/Projects	CO4	CD1,CD2,CD3,CO4 CD5
CD5	Laboratory experiments/teaching aids	CO5	CD1,CD2,CO5
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

COURSE INFORMATION SHEET

Course code: MT114
Course title: FUNDAMENTALS OF MANAGEMENT & ORGANIZATION BEHAVIOUR
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/1
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	To understand the concept of management principles and practices, as a discipline, as an art or a science, management and administration, managerial skills, roles of a manager and levels of management .
2.	To compare and contrast various development of management thought such as early classical approaches, administrative management, neo-classical approaches, behavioural approaches, modern approaches, business ethics and social responsibility.
3.	To classify the type of plans and to critically examine different types of planning and select the types of decisions for further growth of the organization.
4.	To create an organizational structure-formal and informal organization to point out span of control, authority, responsibility, accountability, delegation of authority, Departmentation, decentralization and can design a plan for manpower planning, job design, recruitment and selection, training and development and performance appraisal.
5.	To develop the core of leadership, directing function, motivational theories, communication process and different types of control system to facilitate change for the development of the organization.

Course Outcomes

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

CO1	To Debate management principles and practices as an art or a science, classify managerial skills and roles being played by a manager and recommend appropriate organisational structure.
CO2	To identify factors affecting Decision-making and Planning activity at all levels in an organization.
CO3	To Explain the key decisions related to the various Staffing functions in an organisation.
CO4	To analyse leadership styles, Communication and Motivation strategies adopted by managers and comment on their appropriateness. vis a vis nature of the organisation.
CO5	To examine different types of planning and select the types of decisions for further growth of the organization.

SYLLABUS

Module I:

Introduction: Concepts, Function or Process, Management Discipline, as an Arts or Science, Understanding Management and Administration, Managerial Skills, Roles of a Manager, Levels of Management.

Development of Management Thought: Classical Approaches- Scientific Management, Administrative Management: Bureaucracy, Behavioural Approach.

(8L)

Module II:

Planning: Nature and significance of Planning, Types of plans, Process of Planning, **Organizing:** Process of Organizing, Forms of Organizational Structure, Formal and informal organization

(8L)

Module III:

Staffing: Concept, Manpower Planning, Process of Manpower planning, Recruitment & Selection, Training & Development, Performance Appraisal.

Motivating: Significance of Motivation**,** Motivation process, Theories of Motivation and their application

(8L)

Module IV:

Leading: Concept of Leadership, Leadership Style, Theories of Leadership

Communication: Process, Importance of Communication, Communication Channels, Barriers to Communication.

(8L)

Module V:

Controlling: Definition, Importance of controlling, Characteristics of control, Control process, Types of Control System, Introduction to CSR and Sustainable Development.

(8L)

Books recommended:

TEXT BOOK

1. "Management", Stoner and Freeman, Prentice Hall of India. **(T1)**
2. "Essentials of Management", Koontz and Heinz Weihrich, McGraw Hill. **(T2)**
3. "Management", Robbins &Coulter, Prentice Hall of India. **(T3)**

REFERENCE BOOK

1. "Principles of Management", Gilbert, Mc Graw Hill. **(R1)**
2. "Principles and Practices", T. N. Chhabra, Dhanpat Rai and Sons Pvt. Ltd. **(R2)**
3. "Management: A Global and Entrepreneurial Perspective", Weihrich Heinz &Koontz Harold, Mc Graw Hill. **(R3)**
4. "Principles of Management", P.C.Tripathi and P.N.Reddy, Mc Graw Hill. **(R4)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):
Design of real-time industrial projects.
POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:
Design optimization for industrial projects, Fractional order controller
POs met through Topics beyond syllabus/Advanced topics/Design:

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

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

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CD	Course Delivery methods	Course Outcome	Course Delivery Method
CD1	Lecture by use of boards/LCD projectors/OHP projectors	CO1	CD1
CD2	Tutorials/Assignments	CO2	CD1 and CD2
CD3	Seminars	CO3	CD1 and CD2
CD4	Mini projects/Projects	CO4	CD 1,CD2
CD5	Laboratory experiments/teaching aids		
CD6	Industrial/guest lectures		
CD7	Industrial visits/in-plant training		
CD8	Self- learning such as use of NPTEL materials and internets		
CD9	Simulation		

COURSE INFORMATION SHEET

Course code: CA401
Course title: PROGRAMMING WITH C
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students to:

1.	Understand how they can solve real life problems using computers.
2.	Analyze real life problems for finding solutions to them.
3.	Design mechanisms for developing the solution in computer understandable form.
4.	Implement the solution with C programming language
5.	Able to implement the algorithms designed by them using C-programming language

Course Outcomes

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

CO1	Develop basic understanding of computers, the concept of algorithm and algorithmic thinking.
CO2	Develop efficient algorithms for solving a problem. .
CO3	Use the basic C language for solving engineering or other real-life problems.
CO4	Design an algorithmic solution for a given problem.
CO5	Implement the algorithms designed by them using C-programming language and shall be capable of explaining the various concepts like decision making, looping, branching, arrays, functions, recursion, structures, pointers, unions and files of C language .

SYLLABUS

Module I:

Problem Solving and Programming Concepts: Problem Solving in Everyday Life, Types of Problem, Problem Solving with Computers- Algorithms & Flow-Charts, Data Storage and Communication with Computer, Organizing the Problem, Computer Software and Software Development Method.

(8L)

Module II:

Overview of C: C Language Elements, Variable Declaration, Data Types, Expressions, Data Files.

Top-Down Design with Functions: Top-Down Design and Structure Charts, Functions without Arguments, Functions with Input Arguments.

Selection Structures: Problem Solving with Decisions, Control Structures, Conditions, All kinds of if statements, Switch statement.

Repetition and Loop Statements: Problem Solving with Loops, Repetition in Programs, while Statement, for Statement, Conditional Loops, Loop Design, Nested Loops, do-while Statement and Flag Controlled Loops.

(8L)

Module III:

Modular Programming: Functions with Simple Output Parameters, Multiple Calls to a Function with Input/Output Parameters, Scope of Names, Formal Output Parameters as Actual Arguments.

Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Using Array Elements as Function Arguments, Array Arguments, Multidimensional Arrays.

(8L)

Module IV:

Strings: String Basics, String Comparison, Arrays and Pointers, Arrays of Pointers, Character Operations, String-to-Number and Number-to-String Conversions.

Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Recursive Functions with Array and String Parameters, Problem Solving with Recursion.

(8L)

Module V:

Structure and Union Types: User-Defined Structure types, Structure Type Data as Input and Output Parameters, Functions Whose Result Values are Structured, Problem Solving with Structure Types, Union types.

File Processing and Programming in the Large: Input and Output Files, Binary Files, Using Abstraction to Manage Complexity, Header Files, Implementation Files, Storage Classes, Macros, Command Line Arguments.

(8L)

Books recommended:

TEXT BOOK

1. Sprankle M., "Problem Solving and Programming Concepts", 7th Edition, Pearson Education, New Delhi, 2006. **(T1)**
2. Hanly J.R., & Koffman E.B., "Problem Solving and Program Design in C", 4th Edition, Pearson Education, New Delhi, 2004. **(T2)**

REFERENCE BOOK

1. Venugopal K R, Prasad S R "Mastering C", Tata McGraw Hill, New Delhi,2007. **(R1)**
2. Balagurusamy E. "Programs in ANSI C", 3rd Edition, TMH, New Delhi-2004. **(R2)**
3. Frozen B.A. & Gilberg R.F. "Computer Science: A structured Programming Approach Using C", 2nd Edition, Brooks/Cole- Thomson Learning, Indian Reprint, 2003. **(R3)**

Course Evaluation:

Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):

Design of real-time industrial projects.

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Design optimization for industrial projects, Fractional order controller

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

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

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CA403
Course title: COMPUTER ORGANIZATION AND ARCHITECTURE
Pre-requisite(s):
Co- requisite(s):
Credits: 3 L: 3 T: 0 P: 0
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives
This course enables the students to:

1.	To provide knowledge of Computer Architecture
2.	Employ knowledge of various Digital Logic Circuits, Data Representation, Register and Processor level Design and Instruction Set architecture
3.	To develop the logical ability to Determine which hardware blocks and control lines are used for specific instructions
4.	Understand memory organization, I/O organization and its impact on computer cost/performance.
5.	Know merits and pitfalls in computer performance measurements.

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

CO1	Describe the merits and pitfalls in computer performance measurements and analyze the impact of instruction set architecture on cost-performance of computer design
CO2	Explain Digital Logic Circuits, Data Representation, Register and Processor level Design and Instruction Set architecture
CO3	Solve problems related to computer arithmetic and Determine which hardware blocks and control lines are used for specific instructions
CO4	Design a pipeline for consistent execution of instructions with minimum hazards
CO5	Explain memory organization, I/O organization and its impact on computer cost/performance.

SYLLABUS

Module I:
INTRODUCTION
Digital Logic Design: Axioms and laws of Boolean algebra, Reduction of Boolean expressions, conversion between canonical forms, Karnaugh map (4 variable), Half Adder, full adder, 4-bit parallel parity bit generator, checker circuit, Decoder, Encoder, Multiplexer, IC RAM, ROM, Memory Organization, Sequential Circuits, State transistors, Flip-flop, RS, JK, D-Latch, Master-slave.

(8L)

Module II:
INSTRUCTION SET ARCHITECTURE
Memory Locations and Addresses: Byte Addressability, Big-Endian and Little-Endian Assignments, Word Alignment, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Subroutines, Additional Instructions, dealing with 32-Bit Immediate Values.

(8L)

Module III:
BASIC PROCESSING UNIT & PIPELINING
Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors.
Pipelining: Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Pipeline Performance Evaluation.

(8L)

Module IV:
MEMORY ORGANIZATION
Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage

(8L)

Module V:
INPUT OUTPUT & PARALLEL PROCESSING
Basic Input Output: Accessing I/O Devices, Interrupts, Input Output Organization: Bus Structure, Bus Operation, Arbitration, Interface, Interconnection Standards.
Parallel Processing: Hardware Multithreading, Vector (SIMD) Processing, Shared-Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling.

(8L)

Books recommended:

TEXT BOOK

1. Hamacher Carl, et. al, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill, New Delhi, 2011. **(T1)**
2. Patterson David A., "Computer Organization and Design: The Hardware Software / Interface", 5th Edition, 1994. **(T2)**

3. Mano M. Morris, "Computer System Architecture", Revised 3rd Edition, Pearson Education. **(T3)**

Course Evaluation:
Individual assignment, Theory (Quiz and End semester) examinations

Gaps in the syllabus (to meet Industry/Profession requirements):
Design of real-time industrial projects.
POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:
Design optimization for industrial projects, Fractional order controller
POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

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

< 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,CD6,CD7
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD3,CD4,CD5,CD7

COURSE INFORMATION SHEET

Course code: CA402
Course title: PROGRAMMING LAB IN C
Pre-requisite(s):
Co- requisite(s): Programming for Problem Solving
Credits: 1.5 L: 0 T: 0 P: 3
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students:

1.	To learn computer language.
2.	To Learn coding for problems.
3.	To learn the problem-solving process through computer.
4.	To know the limitations of system during program execution.
5.	To know the practical application of various programming techniques.

Course Outcomes

After the completion of this course, students will be able:

CO1	To formulate simple algorithms for arithmetic and logical problems.
CO2	To translate the algorithms to programs.
CO3	To test and execute the programs and correct syntax and logical errors.
CO4	To apply programming to solve simple numerical method problems, differentiation of function and simple integration.
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

SYLLABUS

List of Programs as Assignments:

1. Write an interactive program that will read in a +ve integer value and determine the following

i) If the integer is a prime number ii) If the integer is a Fibonacci number

2. WAP in C to compute sinx = $x - x^3/3! + x^5/3! - x^7/7!$ ….. Continue adding successive terms in the series until the value of the next term becomes smaller (in magnitude) than 10^{-5}. Test the program for x = 1, x = 2, and x = 3. In each case display the number of terms used to obtain the final answer.

3. WAP to generate every 3rd integer beginning with I = 2 and continue for all integers that are less than 150. Calculate the sum of those integers that are evenly divisible by 5.

4. WAP to find whether a given year is a leap year or not. Modify it to generate a list of leap years between two year limits given by user.

5. WAP to display the following pattern:

```
                    11
               11   10   11
          11   10   9    10   11
     11   10   9    8    9    10   11
```

6. Using Ternary / Conditional operator find the greatest among 3 numbers.

7. WAP to convert a decimal number into an equivalent number of the input base. Test your program for base 2,8,10 & 16.

8. WAP to read a number n, and print it out digit-by-digit, as a series of words. For e.g. 123 would be printed as "one two three".

9. WAP to check whether any input +ve integer is palindrome or not.

10. WAP to simulate a simple calculator (+ - / * %) that takes two operands and an operator as input and displays the result.

11. WAP to find the GCD of two input +ve integer numbers.

12. WAP to swap the values of two variables without using a third variable.

13. Read a line of mixed text, and then write it out with all lower case and uppercase letters reversed, all digits replaced by 0s and all other characters (non-letters and non-digits) replaced by '*'.

14. WAP to find the product of two matrices A and B. Display the source matrices and product matrix C in matrix format.

15. WAP to find whether a given matrix is a triangular matrix or not.

16. WAP to find the transpose of a matrix. Display the source and the transposed matrix in matrix format.

17. Implement Prob. No. – 14 to 16 using functions for reading, manipulating and displaying the corresponding matrices in matrix form.

18. WAP to sort a list of strings alphabetically using a 2-dim. Character array.

19. WAP to display the row sum and the column – sum of an input 2- dim. Matrix. Display the source matrix with row and column sum.

20. Write a recursive function to calculate S = 2 + 4 + 6 + 8 + …… +2N. Implement the function in a complete C program.

21. Write a function that accepts two arguments an array and its size n. It performs Bubble up sort on the array elements. Using indirection operator '*' implement this in a complete C program. Display the source and the sorted array.

22. Using pointer, write a function that receives a character string and a character as argument. Delete all occurrences of this character in the string. The function should return corrected string with no holes.

23. Write a function for reading character string using pointer. Calculate the length of the string (without using strlen ()). Finally print the string in reverse order, using pointer.

24. Implement prob. No. 14 using pointers representation of 2 – dim. array.

25. Implement prob. No. 15 using pointer representation of 2 dim. array.

26. Implement prob. No. 16 using pointer representation of 2 dim. array.

27. WAP to sort a list of strings into alphabetical order using array of pointers.

28. Create records of 60 students, where each record has fields-name, roll, gpa and fees. Write a function update () to reduce the fees of those students who have obtained gpa greater than 8.5 by 25% of the original fees. Write a complete program to exercise this function in the main program and display all the records before and after updation.

29. Define a structure that describes a hotel. It should have members that include the name, address, grade, average room charge and number of rooms. Write a function to perform the following operations:

a) To print out hotels of a given grade in order of charges.

b) To print out hotels with room charges less than a given value.

30. WAP to concatenate the contents of two files into a third file.

31. WAP to copy the content of one file into another file. Names of both the files are to be input as command line arguments

Books recommended:

TEXT BOOK

1. Jery R Hanly, "Problem solving and Program design in C", Paerson Education, 7th Edition. **(T1)**
2. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw-Hill. **(T2)**
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill. **(T3)**

4. R.G.Dromey, How to Solve it by Computer, Pearson Education. **(T4)**

REFERENCE BOOK

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall India Learning Private Limited. **(R1)**

Course Evaluation:

Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):

Implementing of real world problems

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design: Teaching through research papers.

Course Delivery Methods

CD1	Lecture by use of boards/LCD projectors/OHP projectors
CD2	Assignments/Seminars
CD3	Laboratory experiments/teaching aids
CD4	Industrial/guest lectures
CD5	Industrial visits/in-plant training
CD6	Self- learning such as use of NPTEL materials and internets
CD7	Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

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

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1,CD6
CO2	CD1, CD6,CD7
CO3	CD1, CD2, CD3,
CO4	CD1, CD3,CD6,CD7
CO5	CD1,CD2,CD7

COURSE INFORMATION SHEET

Course code: MA429
Course title: NUMERICAL AND STATISTICAL METHODS LAB
Pre-requisite(s):
Co- requisite(s):
Credits: 1.5 L: 0 T: 0 P: 3
Class schedule per week: 03
Class: MCA
Semester / Level: I/4
Branch: Master of Computer Applications
Name of Teacher:

Course Objectives

This course enables the students:

1.	Derive appropriate numerical methods to solve algebraic, transcendental equations and linear system of equations
2.	Approximate a function using various interpolation techniques, to find the numerical solution of initial value problems
3.	Apply concepts in probability theory, the properties of probability distributions
4.	Estimation of mean, variance and proportion, the concepts of statistical hypothesis

Course Outcomes

After the completion of this course, students will be able:

CO1	Solve algebraic, transcendental equation and linear system of equations using an appropriate numerical method arising in various engineering problems
CO2	Evaluate derivative at a value using an appropriate numerical method in various research problems, solve differential equation numerically
CO3	Learn basic probability axioms, rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
CO4	Find the point and interval estimates, analyze data statistically and interpretation of the results
CO5	Implement Numerical techniques using computers.

SYLLABUS

List of Programs as Assignments:

1. Find a simple root of $f(x)=0$ using bisection method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
2. Find a simple root of $f(x)=0$ using Regula-Falsi method. Read the end points of the interval (a,b) in which the root lies, maximum number of iterations n and error tolerance eps.
3. Find a simple root of $f(x)=0$ using Newton Raphson method. Read any initial approximation x_0, maximum number of iterations n and error tolerance eps.
4. Solution of a system of $n\times n$ linear equations using Gauss elimination method with partial pivoting.
5. Matrix inversion and solution of $n\times n$ system of equations using Gauss-Jordan method.
6. Program to solve a system of equation using Gauss-Seidel iteration method. Order of the matrix is n, maximum number of iterations *niter*, error tolerance is eps and the initial approximation to the solution vector is x_0.
7. Program for Lagrange and Newton divided difference interpolation.
8. Program for Newton's forward and backward interpolation.
9. Program for Gauss's central difference interpolation (both backward and forward).
10. Program to evaluate the integral of $f(x)$ between the limits a to b using Trapezoidal rule of integration based on n subintervals or $n+1$ nodal points. The values of a,b and n are to be read. The program is tested for $f(x)=1/(1+x)$.
11. Program to evaluate the integral of $f(x)$ between the limits a to b using Simpson's rule of integration based on $2n$ subintervals or $2n+1$ nodal points. The values of a,b and n are to be read and the integrand is written as a function subprogram. The program is tested for $f(x)=1/(1+x)$.
12. Program to solve an IVP, $dy/dx=f(x), y(x_0)=y_0$ using Euler method. The initial value x_0, y_0 the final value x_f and the step size h are to be read. The program is tested for $f(x,y)=-2xy^2$.
13. Program to solve an IVP, $dy/dx=f(x), y(x_0)=y_0$ using the classical Runge-Kutta fourth order method with step size h, $h/2$ and also computes the estimate of the truncation error. Input parameters are: initial point, initial value, number of intervals and the step length h. Solutions with h, $h/2$ and the estimate of the truncation error are available as output. The right hand side The program is tested for $f(x,y)=-2xy^2$.

Books recommended:

TEXT BOOK

1. S.S. Sastry, "Introductory Methods of Numerical Analysis", PHI, Private Ltd., New Delhi. **(T1)**
2. N.Pal & S. Sarkar, "Statistics: Concepts and Applications", PHI, New Delhi, 2005. **(T2)**

REFERENCE BOOK

1. R.V.Hogg et.al, "Probability and Statistical Inpane", 7th Edition, Pearson Education, New Delhi, 2006. **(R1)**

2. R.L.Burden & J.D.Faires, "Numerical Analysis", Thomson Learning-Brooks/Cole, Indian Reprint, 2005. **(R2)**

Course Evaluation:
Day to day progressive evaluation, Lab Quizzes, Surprise Tests, Online Lab performance and Viva Voce

Gaps in the syllabus (to meet Industry/Profession requirements):
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POs met through Gaps in the Syllabus:

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Course Delivery Methods

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MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

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

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Course Outcomes	Course Delivery Method
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