Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CA451	**Title of the Course**	DISCRETE MATHEMATICS	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• Know the basic principle of set theory, relations, function and its operations. • Able to Understand the concepts of groups, and elementary properties of Rings and Fields. • Learn the logical notation and determine if the argument is or is not valid in preposition and predicate logic. • Learn the representation of lattices with POSET. • Learn the concepts of graphs, trees and its traversal, and recurrence relations.						

Course Outcomes	
CO1	To understand the basic principle of set theory, relations, function and its operations.
CO2	Understand the algebraic structure related to the groups, and elementary properties of Rings and Fields.
CO3	Write an argument using logical notation and determine if the argument is or is not valid.
CO4	To understanding and representation of lattices and be able to determine their properties with Boolean algebra.
CO5	Demonstrate the problem using graphs and represent the trees traversal, and also basics of recurrence relations.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Set Theory	Set Theory: Introduction, Basic concepts, Terminology and notation, Sub set, Operation on sets, Algebra of sets, Combination of sets, Multi-sets, Ordered pairs and Cartesian product. Relations: Definition, Relation on Sets, Operations on relations, Properties of relations, Composite relations, Equality of relations, Closure of relations. Functions: Definition, Classification of functions, Operations on functions, recursively definedfunctions. Mathematical Induction: Mathematical Induction.	8	CO1
2	Algebraic Structures	Algebraic Structures: Monoid, Semigroup and Groups, Subgroups, Cyclic groups, Cosets, Normal subgroups, Permutation and Symmetric groups, Group homeomorphisms, Type of homeomorphisms, Rings, and Fields.	8	CO2
3	Propositional Logic	Propositional Logic: Proposition, Truth tables, Converse, Contrapositive and Inverse, Tautology, Contradiction, Well Formed Formula (WFF), Algebra of proposition, Normal forms Disjunctive normal form and Conjunctive normal form. Predicate Logic: First order predicate, well-formed formula of predicate, quantifiers, Inference theory of predicate.	8	CO3
4	Lattices	Lattices: Definition, Posets, Hasse diagram, Properties of lattices, Sub-lattices, Special lattices – Bounded, Complemented, Distributed, Modular and Complete lattice. Boolean algebra: Introduction, Theorems of Boolean algebra, Boolean expressions. Simplification of Boolean functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra.	8	CO4
5	Graphs	Graphs: Definition and terminology, Representation of graphs, Multi-graphs, Bipartite graphs, planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring. Trees: Definition, Binary tree, Binary tree traversal, Binary search tree. Recurrence Relation & Generating function: Recurrence Relation, Method of Characteristic Roots, Generating Function, and Solution of linear recurrence relations using generating functions.	8	CO5

Reference Books:

1. S. K. Sarkar, "A Text Book of Discrete Mathematics", S. Chand Publication, New Delhi, 2014.
2. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", 6th edition, McGraw-Hill, 2006.
3. B. Colman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, 5th edition, Prentice Hall, 2004.
4. J. P. Tremblay, J.P and R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", McGraw Hill.
5. Deo Narsingh, "Graph Theory With application to Engineering and Computer. Science", PHI. Private Limited, New Delhi, 2012.
6. Seymour Lipschutz, "Schaum's Outline of Discrete Mathematics", 3rd edition, McGraw Hill, 2010.
7. C.L.Liu, "Elements of Discrete Mathematics", 2nd edition, McGraw Hill Computer Science Series, 1985.

e-Learning Source:

1. https://onlinecourses.nptel.ac.in/noc20_cs82/
2. https://nptel.ac.in/courses/106108227

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	3	1		1		2	1						2	1				
CO2	3	1		2	1	1	2		1				2	1				
CO3	1	2	3	2	2	1	2	1			1		1	2				
CO4	2	1		2		2	2	1			1		2	1				
CO5	1	3	3	2	2	2	1	2			1		1	2				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CA452	**Title of the Course**	COMPUTER ORGANIZATION AND ARCHITECTURE	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	CA457				
Course Objectives	• To introduce students to the foundations of computer organization and architecture. • To develop the ability to perform programming in an assembly language. • Explain different types of addressing modes, Instruction Formats, CPU organization. and memory organization. • Learn the concepts of parallel processing, pipelining and inter-processor communication. • Exemplify in a better way the I/O, Pipelined Processors and SIMD Network						

Course Outcomes	
CO1	Perform basic operations with different number systems and Understand concepts of register transfer Language.
CO2	Understand the architecture and functionality of CPU and memory Organization
CO3	Understand the concept of I/O organization and Implement assembly language program for given task for 8085/8086 microprocessor
CO4	Understand the Concept of Parallel computing and its applications
CO5	Learn the concepts of pipelined processors and inter-processor communication

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Digital Logic Circuits	Digital Logic Circuits: Number System: Binary, Decimal, Octal & Hexadecimal, Logic Gates, K-Map Simplification, Combinational Logic & Sequential Logic circuits: Basic Processing: Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Instruction code, Instruction set, Micro instruction.	8	CO1
2	Basic Organization	Basic Organization: Instruction Cycle, Organization of Central Processing Unit, Hardwired & Micro Programmed Control Unit, General Register Organization, Stack Organization, Addressing Modes, Instruction Formats Memory Organization: Memory Hierarchy, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory	8	CO2
3	I/O Organization	I/O Organization: Peripheral Devices, I/O Interface, Asynchronous Data Transfer, Strobe Control, Handshaking, Modes of Data Transfer: Programmed I/O, Interrupt Driven I/O, Priority Interrupt Programming: Assembly Language Programming Based on Intel 8085/8086, Instructions, Data Transfer Programming Techniques, Conditional Call and Return Instructions.	8	CO3
4	Parallel Computing	Parallel Computing: Introduction, Parallelism in Uniprocessor Systems, Parallel Computer Structures, Architectural Classification Schemes, Parallel Processing Applications. Pipelining Processing: An Overlapped Parallelism, Instruction and Arithmetic Pipelines.	8	CO4
5	Principles of Designing Pipelined Processors	Principles of Designing Pipelined Processors: Internal Forwarding and Register Tagging, Hazard Detection and Resolution, Job Sequencing and Collision Prevention, Characteristics of Vector Processing, SIMD Array Processors, Masking and Data Routing. SIMD Interconnection Network: Cube Interconnection Network, Shuffle-Exchange and Omega Network.	8	CO5

Reference Books:

1. Mano Morris, "Computer System Architecture", PHI, Third Edition, 2017
2. Kai Hwang, FayéAlayé Briggs," Computer Architecture and Parallel Processing", TMH, 2nd Edition 2017
3. William Stallings; "Computer Organization and Architecture", Pearson, Tenth Edition, 2016
4. Kai Hwang,"Advanced Computer Architecture"TMH, Eighteenth Reprint 2008

e-Learning Source:

1. https://nptel.ac.in/courses/106106166
2. https://nptel.ac.in/courses/106105163

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	3	1		3	1	1	2						2	1				
CO2	3	1		2		2	2	1					1	2				
CO3	2	2	3	1	3	1	1	2			1		1	1				
CO4	3	1		2	1	1	2						2	1				
CO5	1	2	1	1		2	2				1		1	2				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CA453	**Title of the Course**	FUNDAMENTALS OF COMPUTER AND C PROGRAMMING	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	CA458				
Course Objectives	• To learn the basic concepts of Computer fundamentals. • To learn the basic concepts and syntax of C programming. • To be able to develop logics which help them to create programs and applications using C language. • To learn the use of C libraries functions in C language. • To learn the file handling and basic memory allocation concepts in C language.						

Course Outcomes	
CO1	Able to understand the basic knowledge of Computer fundamental and its application in computers.
CO2	Able to understand the basic concepts of C programming language.
CO3	Able to design and develop various programming problems using C programming concepts.
CO4	Able to Implement advance C programming concepts like function, pointer, structure and union etc.
CO5	Able to understand the file handling using C Programming language.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Computers	Introduction to Computers: History, Generation, Classification, Characteristics. Input/ Output Devices: Keyboard, Mouse, Printer, Storage Units: Primary Memory and Secondary Memory. Basic Software Concepts: Definition, Classification: System Software, Application Software and Utilities. Introduction to DOS: Basics, Internal and External Commands. Basics of Networks: Network Types and Topologies. Introduction to Internet: Basic Terminologies: URL, Search Engine, Internet Service Provider (ISP), TCP/IP	8	CO1
2	Overview of C language	Overview of C language: History, Features of C language, Structure of C Programs, Compilation and Execution of C Programs, Type of Errors, Debugging Techniques. C Language Fundamentals: C Character Set, Identifiers and Keywords, Modifiers, Data Types and Sizes, Variables: Declaration and Initialization, Scope of Variables, Constants, Types of Constants, Typedef (), Type Conversion. Operators: Types of Operators (Unary and Binary Operators): Assignment, Arithmetic, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operators, Size of() Operator, Comma Operator, Conditional Operator And Bitwise Operators. Expressions: Type of Expression, Precedence and order of Evaluation.	8	CO2
3	Decision Control Statements	Decision Control Statements: if, if-else, Nested if-else, switch, break, continue, goto statement. Loops: for, while, do-while. Arrays: Defining Array, Types of Arrays, Declaration and Initialization of Linear and Multidimensional Arrays. String: Character Array, Arrays and Strings, String Manipulation, String Functions.	8	CO3
4	Functions	Functions: Built-in And user-defined, Function Declaration, Definition And Function Call, Nesting of Functions, Parameter Passing, Recursive Functions, Multifile Programs. Pointers: Introduction, Pointer Operators (&,*), Pointer Arithmetic, Call by Value and Call by Reference, Dynamic Memory Allocation, calloc() and malloc() Functions.	8	CO4
5	Structure and Union	Structure and Union: Definition and Concept, Declaration and Initialization of Structure and Union Variables, Difference Between Structure And Union, Enumeration, Macros and C Preprocessors. File Handling in C: Definition of Files, Creating a Data File, Opening Modes of Files. Standard Function: fopen(), fclose(), feof(), fseek(), frewind(), Using Text Files: fgetc(), fputc(), fscanf() etc.	8	CO5

Reference Books:

1. V. Rajaraman, "Fundamentals of Computers", PHI.
2. Pater Norton's "Introduction to Computer", TMH.
3. Hahn, “The Internet complete reference", TMH.
4. Peter Nortton's, "DOS Guide", Prentice Hall of India
5. Gottfried, "Programming in C”, Schaum's Series Tata McGraw Hill.
6. Kernigham, Ritchie, “The C Programming Language", PHI.

e-Learning Source:
1. https://onlinecourses.nptel.ac.in/noc22_cs40/
2. https://onlinecourses.nptel.ac.in/noc19_cs42/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	3	1	2	2		1	2						2	1				
CO2	3	2	1	1	2	1	3	1					2	1				
CO3	1	2	3	2	3	1	2	1			1		1	2				
CO4	1	2	3	2	2	2	1	1			1		2	1				
CO5	3	1	1			2	2	1					2	1				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CA454	**Title of the Course**	UNIX AND SHELL PROGRAMMING	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	CA459				
Course Objectives	• To learn basic structure and various commands of UNIX system. • To learn and implement various concepts of shell programming. • To learn basic concepts of process, Inter process communication in UNIX system. • To learn basics concepts and commands of UNIX system Administration. • To learn various Filter and Tools of UNIX system.						

Course Outcomes	
CO1	Able to understand the basic Unix architecture, commands and utilities of the UNIX operating system and to work confidently in Unix/Linux environment and open systems
CO2	Able to write simple and complex shell scripts to automate various tasks using shell programming
CO3	Understand various concepts of process, IPC and process related command in UNIX.
CO4	Able to understand UNIX system administration.
CO5	Master the students in the art of usage of simple advanced filters and tools.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	Introduction: Introduction to Unix, Unix System Organization (The Kernel and the Shell), Files and Directories, Library Functions and System Calls, Editors (vi and ed).	8	CO1
2	Unix Shell Programming	Unix Shell Programming: Types of Shells, Shell Meta characters, Shell Variables, Shell scripts, Shell Commands, Unix Environment, Integer Arithmetic and String Manipulation, Special Command Line Characters, Decision Making and Loop Control, Controlling Terminal Input, Trapping Signals, Arrays.	8	CO2
3	Portability with C	Portability with C: Command Line Argument, Background Processes, Process synchronization, Sharing of Data, User-ID, Group-ID, Pipes, Fifos, Message Queues, Semaphores Shared, Variables, Introduction to Socket Programming.	8	CO3
4	Unix System Administration	Unix System Administration: File System, Mounting and Un-mounting File System, SystemBooting, Shutting Down, Handling User Account, Backup, Recovery, Security, Creating Files, Storage of Files, Disk Related Commands.	8	CO4
5	Different Tools and Debugger	Different Tools and Debugger: System Development Tools: Lint, Make, SCCS (Source Code Control system), Language Development Tools: YACC, LEX, M4, Text Formatting Tools: nroff, troff, tbl, eqn, pic, Debugger tools: Dbx, Adb, Sdb, Strip and Ctrace.	8	CO5

Reference Books:

1. Parata, "Advanced Unix Programming guide", BPB.
2. Yashwant Kanitkar, "Unix Shell Programming", BPB.
3. Meeta Handhi, Tilak Shetty, Rajiv Shah "The 'C' Odyssey Unix-the open boundless C", BPB.
4. Sumitabh Das, "Unix Concepts and applications". TMH.
5. Mike Joy, Stephen Jarvis, Michael Luck, 'Introducing Unix and Linux", Palgrave Macmillan.
6. Rachel Morgan, HaneryMcGilton, "Introducing Unix System V", TMH.

e-Learning Source:

1. https://onlinecourses.swayam2.ac.in/aic20_sp05/
2. https://www.udemy.com/course/linux-unix-essentials-and-introduction-to-shell-scripting/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	3	1		1		2	2						2	1				
CO2	1	2	3	2	3	1	1	1			1		2	1				
CO3	3	1		2		2	2						2	1				
CO4	2	1	1	2	2	1	2	1					2	1				
CO5	1	2	2	1	3	2	2				1		1	2				

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CA455	**Title of the Course**	SOFTWARE ENGINEERING	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To provide the concepts of software crisis, issues, characteristics, evolution and application with respect to software engineering. • To give fundamental aspects of software development with respect to requirement engineering, requirement analysis, design, coding, testing and maintenance. • To give knowledge of practical implementation of software coding style and software testing strategies for software development. • To provide the practical knowledge in software design, object-oriented design and software development in terms of software implementation and maintenance. • To provide the practical knowledge for ensuring the quality and reliability of software during software development using models.						

Course Outcomes	
CO1	Learn the concepts of software crisis, issues, characteristics, evolution and application with respect to software engineering.
CO2	Know the fundamental aspects of software development with respect to requirement engineering, requirement analysis, design, coding, testing and maintenance.
CO3	Find the practical implementation of software coding style, design and software testing strategies.
CO4	Enhance the knowledge of management of software project from initial stage to final stage for software development.
CO5	Access the practical knowledge for ensuring the quality and reliability of software during software development using models.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Fundamental Concept on Software Engineering	Fundamental Concept on Software Engineering: Introduction to Software Engineering, Software Crisis, Software Problems, Software Engineering Problems, Characteristics of Software, Software Evaluation, Software Applications, Requirement Analysis and Requirement Specification Documents, Software Design, Coding, Testing, Maintenance, Validation and Verification, Monitoring and Control, Metrics and Measurement. Software Development Models: Waterfall Model, Prototyping Model, Interactive Enhancement Model, Spiral Model, Iterative Models, Evolutionary Process Models, Role of Management in Software Development and Problem Analysis.	8	CO1
2	Software Design	Software Design: Design Process, Design Concepts, Design Model, Problem Partitioning and Hierarchy, Abstraction, Modularity, Top Down and Bottom-Up Approach, Structure Design Methodology, Functional Approach, Object Oriented Approach, Coupling and Cohesion, Cyclomatic Complexity. Object Oriented Design: OO Analysis and OO Design, Classes and Objects, Relationship among Objects, Inheritance and Polymorphism, Design Concepts, Design Notation and Specification, Design Methodology, Dynamic Modeling, Functional Modeling.	8	CO2
3	Software Coding	Software Coding: Programming Practice, Top Down and Bottom-Up Structured Programming, Information Hiding, Programming Style, Internal Documentation, Size measures, Complexity Metrics, Style Metrics Software Testing: Testing Fundamentals, Top Down and Bottom-Up Approaches, Functional Testing, Structural Testing, Test Cases and Test Criteria, Software Testing Strategies, Testing Levels, Unit Testing, Integration Testing and System Testing, Alpha and Beta Testing, Test Plan, Test Case Specification, Test Case Execution and Analysis.	8	CO3
4	Software Maintenance and Software Project Management	Software Maintenance and Software Project Management: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering, Software Configuration Management Activities, Change Control Process, Software Version Control, Estimation of various Parameters, Project Scheduling Staffing and Personal Planning, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.	8	CO4
5	Software Reliability and Quality Assurance	Software Reliability and Quality Assurance: Software Reliability, Reliability Issues, Musa's Model, Software Quality, Reliability Growth, ISO 9000 Certification, SEI Capability Maturity Model, Comparison between ISO and CMM Model. CASE (Computer Aided Software Engineering): Various CASE Tools and their Usefulness, Role of Data Dictionary in CASE Tools, Architecture of CASE Environment, CASE Support in Software Life Cycle.	8	CO5

Reference Books:

1. PankajJalote, "Software Engineering", NarosaPublications.
2. Rajib Mall, "Fundamental of Software Engineering", PHI.
3. Roger S. Pressman, "Software Engineering: A practitioner's Approach", 7 Edition, McGraw Hill International Edition.

4.	Sommerville, “Software Engineering”, 7th edition, Pearson Education.
5.	K.K. Agarwal and Yogesh Singh, “Software Engineering”, New Age International Publishers.
6.	James F. Peters, Witold Pedrycz, “Software Engineering, an Engineering Approach”, John Wiley.
7.	Shely Cashman Rosenblatt, “Systems Analysis and Design”, Thomson Publications.
8.	Waman S Jawadekar, “Software Engineering Principles and Practice”, TMH.
e-Learning Source:	
1.	https://onlinecourses.nptel.ac.in/noc20_cs68/
2.	https://nptel.ac.in/courses/106105087

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	3	1		1		2	2						2	1				
CO2	3	1		2	1	1	1						1	2				
CO3	1	2	3	2	3	1	2	1			1		1	2				
CO4	2	1	1		1	1	2	3					2	1				
CO5	1	2	3	3	2	2	2	1			1		2	1				

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CA456	**Title of the Course**	OPERATING SYSTEM	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To study types of Operating System and Process Management. • To learn Scheduling and Process Synchronization. • To study Deadlock and Storage management. • To study about Virtual Memory and File Management. • To learn Disc Management.						

Course Outcomes	
CO1	Explain the types of operating system and ability to create threads and perform interposes communication.
CO2	Understand CPU scheduling and able to solve process synchronization problems.
CO3	Understand issues surrounding deadlock handling and memory management.
CO4	Explain paging and segmentation methods suitable for virtual memory. Ability to manage files and directory.
CO5	Be able to recovery and manage disk spaces. Knowledge of files systems and Android OS.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	Definition and Types of Operating Systems, Batch Systems, Multiprogramming, Time-Sharing, Parallel, Distributed and Real-Time Systems, Operating System Structure, Operating System Components and Services, System Calls, System Programs, Virtual Machines. Process Management: Process Concept, Process Scheduling, Cooperating Processes, Threads, Inter process Communication.	8	CO1
2	CPU Scheduling	CPU Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real Time Scheduling and Algorithm Evaluation. Process Synchronization: The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.	8	CO2
3	Deadlocks	Deadlocks System Model, Characterization, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock, Combined Approach to Deadlock Handling. Storage Management: Memory Management, Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with Paging.	8	CO3
4	Virtual Memory	Demand Paging and its Performance, Page Replacement Algorithms, Allocation of Frames, Thrashing, Page Size and other Considerations, Demand Segmentation. File Management: File Systems, Secondary Storage Structure, File Concept, Access Methods, Directory Implementation, Efficiency and Performance, Recovery.	8	CO4
5	Disk Management	Disk Structure, Disk Scheduling, Disk Management, Recovery, Disk Structure, Swap Space Management, Disk Reliability. Case Study: Windows NT-Design Principles, System Components, Environmental Subsystems, File System, Networking and Program Interface, Linux System Design Principles, Kernel Modules, Process Management, Scheduling Memory Management, File Systems, Input and Output, Interprocess Communication, Network Structure, Security. Android OS: Overview, Features, Platform and Android SDKs.	8	CO5

Reference Books:

1. Abraham Siberschatz and Peter Baer Galvin, "Operating System Concepts", WILEY.
2. Milan Milankovic, "Operating Systems, Concept and Design", Mcgraw Hill.
3. Harvey M Deital, "Operating System", Addison Wesley.

e-Learning Source:

1. https://nptel.ac.in/courses/106105214
2. https://nptel.ac.in/courses/106108101

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	2	1	3	1	1	2	1						2	1				
CO2	3	1		2		1	2	1					2	1				
CO3	3	2	1	1		2	1						2	1				
CO4	2	1	2	2	1	2	3	1			1		2	1				
CO5	1	2	1	3	2	2	2				1		2	2				

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2023 - 24							
Course Code	MT432	**Title of the Course**	Mathematical Methods	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The course is aimed to develop the skills in mathematics and statistics which is necessary for grooming them into successful graduate. The topics introduced will serve as basic tools for specialized studies in science field.						

Course Outcomes	
CO1	Able to calculate rank of matrix, inverse of the matrix & use the concept of matrix to find the solution of system of linear equations.
CO2	Able to understand the trigonometric functions and trigonometric identities.
CO3	Understand the Cartesian co ordinate system, basic formulae of plane geometry and different forms of equation of straight line.
CO4	Learn the limit, continuity, differentiability, basic properties of differentiation and integration.
CO5	Learn the measures of central tendency and basic concepts of probability.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit I**	Definition of different types of matrix, Algebraic operations, Symmetric & skew symmetric matrix, Transpose of matrix, Orthogonal matrices, Rank of matrix, Determinant of a square matrix, Inverse of a square matrix, Solution of Linear Equations by Cramer's Rule, Eigen values & Eigen vectors of a square matrix.	8	1
2	**Unit II**	Trigonometric functions of an acute angle, Application and solving right angle, Functions of angles of any magnitude, Basic trigonometric identities, Sum and difference formulas, Double and half angle formulas.	8	2
3	**Unit III**	Coordinates, Section formula, Distance formula, Slope or gradient of straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope-intercept form of a straight line, normal form of a straight line.	8	3
4	**Unit IV**	Limit, Continuity and differentiability of functions, Differentiation Rules, Differentiation of functions (Algebraic, Trigonometric, Logarithmic, Exponential), Indefinite integrals, Basic formulae, Integration by parts, Integration by substitution, Definite integrals, Properties of definite integrals.	8	4
5	**Unit V**	Measures of central Tendency – Mean, Median, Mode, Measures of Dispersion-Standard deviation and Coefficient of variance. Probability-Sample space and events, Definition of probability, Elementary properties of probability.	8	5

Reference Books:

1. 12 th N.C.E.R.T. Book
2. Probability theory and random process by S.P. Eugene Xavier, S. Chand & company Pvt. Ltd
3. Mathematics and statistics by Ajay Goyal, Taxman Allied Service Pvt. Ltd.
4. Differential calculus by Shanti Narayan, S. Chand.
5. Integral Calculus by M. Roy & S. S. Seth, Sivalal Agarwal & Company.

e-Learning Source:

https://nptel.ac.in/courses/122104018/

https://nptel.ac.in/courses/111104085

https://archive.nptel.ac.in/courses/110/107/110107114/

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1		2	2		1						1			
CO2	3	1		2	2		1						1			
CO3	3	1		1	2		1						1			
CO4	3	1		2	1		1						1			
CO5	3	1		2	2		1						1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session:2020-21							
Course Code	CA457	**Title of the Course**	COMPUTER ORGANIZATION AND ARCHITECTURE LAB	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	0	0	3	2
Pre-Requisite	NONE	**Co-requisite**	CA452				
Course Objectives	• To impart basic understanding of the internal organization of 808 Microprocessor. • To introduce the concepts of interfacing microprocessors with external devices • To develop Assembly language programming skills. • To Design and understand the behavior of digital circuits and flip-flop • To Design and understand the Adder, subtractor and decoder Multiplexers counter						

Course Outcomes	
CO1	Build a program on a microprocessor using instruction set of 8086.
CO2	Analyze the behavior of digital circuits
CO3	Design digital circuits for basic components of computer system and applications
CO4	Describe the internal architecture and different modes of operations of a typical micro controller
CO5	Understand different addressing modes and instructions of 8086, design and develop assembly language programs using software interrupts, subroutines and macros

Sr. No.	**List of Experiment**	**Contact Hrs.**	**Mapped CO**
1	Study of 8085 and 8086/8088.	2	CO1
2	Study and Bread Board Realization of Logic Gates, K-Map, Flip-Flop equation	2	CO1
3	Implementation of Half Adder, Full Adder and Subtractor	2	CO2
4	Implementation of Ripple Counters and Registers.	2	CO2
5	Implementation of Decoder and Encoder circuits.	2	CO3
6	Implementation of Multiplexer and De-Multiplexer circuits.	2	CO4
7	Assembly Language programs for 8086/8088	2	CO5
8	Address and data transfer, Arithmetic Operation, Block Transfer	2	CO5

Reference Books:

1. Mano Morris, "Computer System Architecture", PHI, Third Edition, 2017
2. Kai Hwang, FayéAlayé Briggs," Computer Architecture and Parallel Processing", TMH, 2nd Edition 2017

e-Learning Source:

1. https://nptel.ac.in/courses/106106166
2. https://nptel.ac.in/courses/106105163

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	1	2	3	2	3	2	1				1		2	2				
CO2	1	2	1	3	3	2	2	1					1	2				
CO3	1	2	3	2	2	1	2	1			1		2	1				
CO4	3	1	1	2		2	2						2	1				
CO5	1	2	3	3	3	2	2	2			1		2	1				

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CA458	**Title of the Course**	C PROGRAMMING LAB	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	0	0	3	2
Pre-Requisite	NONE	**Co-requisite**	CA453				
Course Objectives	• To understand basic concepts of C programming, operators and expressions. • To learn the Concept of Various Decision Control statements and loops. • To understand the Concept of Arrays and String Operations. • To understand Concept of Functions, Pointers, Structure, Union and Enumeration. • To understand Concept of File Handling						

Course Outcomes	
CO1	Simple programs to understand the concepts of data types, operations and expressions.
CO2	Familiarizing conditional and control statements.
CO3	Implementing Concept of array and String to solve problem.
CO4	Implementation of functions, pointers, operation on pointers and dynamic storage allocation.
CO5	Defining and handling structures, array of structures, union and processing data

Sr. No.	**List of Experiment**	**ContactHrs.**	**MappedCO**
1	Program to demonstrate the working of arithmetic operators. Program to demonstrate the working of Increment and Decrement Operators. Program to demonstrate the working of Assignment, Relational, Logicaland Conditional operators.	3	CO1
2	Program to find Largest of Three Integers. Program to check whether the Given Number Is Palindrome OrNot Program to find whether the given integers A Prime Number An ArmstrongNumber	3	CO1
3	Program for Pascal triangle. Program to find Sum of n Terms of Series n-n * 2/2! + n*3/3! – n* 4/4! + ……	3	CO2
4	Program to find Sum and Average of n integers using Linear Array. Program to perform Addition, Multiplication, Transpose on Matrices.	3	CO2
5	Program to perform following operations by using user defined functions Concatenation. Reverse. String Matching	3	CO3
6	Program to swap two values usingCall by value. Call by reference. Program to calculate the Factorial of a Given Number.	3	CO3
7	Program to Sort the List of Integers using Dynamic Memory Allocation.Program to Display Weekdays Using Enumeration.	3	CO4
8	Program to Display the Marksheet of a Student Using Structure.Implementing Concept of Enumeration and Unions. Program to Store the Information of Student Using Union.	3	CO5
9	Program to perform following operations on datafilesRead from data file. Write to datafile. Program to Copy the Content of One File to Another FileUsing CommandLine Argument.	3	CO5

Reference Books:

1. Gottfried, "Programming in C", Schaum's Series Tata McGraw Hill.
2. Kernigham, Ritchie, "The C Programming Language", PHI.

e-Learning Source:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/
2. https://onlinecourses.nptel.ac.in/noc19_cs42/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	2	1	3	2	3	2	1							2	1			
CO2	2	2	3	2	3	1	2	1						2	1			
CO3	1	3	3	2	2	1	1	1			1			2	2			
CO4	1	2	3	2	2	1	2	1			1			1	2			
CO5	3	1	2	2	2	1	2	1						2	1			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2020-2021							
Course Code	CA459	**Title of the Course**	UNIX/LINUX LAB	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	0	0	2	1
Pre-Requisite	None	**Co-requisite**	CA454				
Course Objectives	• To learn basic commands of UNIX system. • To learn various syntax of shell programming and implement various concepts of shell programming. • To learn basic commands of process management and implement system programming. • To learn basic commands of UNIX system Administration. • To learn various Filter and Tools of UNIX system.						

Course Outcomes	
CO1	Able to execute various commands and utilities of the UNIX operating system.
CO2	Able to implement shell scripts and automate various daily tasks using shell programming.
CO3	Able to implement system programming.
CO4	Able to execute UNIX system administration commands.
CO5	Develop applications using concepts of UNIX system.

Sr. No.	**List of Experiment**	**Contact Hrs.**	**Mapped CO**
1.	Miscellaneous Commands, File and Directory Related Commands, Communication and DiskRelated Commands, Basic Filters	2	CO1
2.	Shell Script to accept two numbers and perform all arithmetic operations on it.Menu Based Shell Script. Shell Script to calculate the Gross SalaryShell Script through case statement. Shell Script to find the largest among numbers using positional parameters.	2	CO2
3.	Use the fork() to create the Process. Use the fork() to create the Child Process. Implementation of exec System Call. Implementation of Pipe. Implementation of Semaphore and message queue.Implement of Socket Programming	2	CO3
4.	Shell Script to illustrate While, Until and For Loop.	2	CO4
5.	Shell Script to perform String operations.	2	CO5

Reference Books:

1. Parata, "Advanced Unix Programming guide", BPB.
2. YashwantKanitkar, "Unix Shell Programming", BPB.

e-Learning Source:

1. https://onlinecourses.swayam2.ac.in/aic20_sp05/
2. https://www.udemy.com/course/linux-unix-essentials-and-introduction-to-shell-scripting/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	2	1	2	2	3	2	2						2	2				
CO2	1	2	3	2	3	1	2						2	1				
CO3	1	2	3	1	3	2	2						2	1				
CO4	2	1	2	2	3	2	2						2	1				
CO5	1	3	3	2	3	1	2						2	1				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation