Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA208	**Title of the Course**	DISCRETE MATHEMATICS	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To study the concepts Relation and functions. • To learn Algebraic Structures and Propositional Logic and their application in computer science. • To learn Lattices: Ordered set, Posets and Introduction to Lattices, Properties of lattices. • To learn Introduction of the Language, Kleene closure and finite automata with output and Finite Automata without output. • To learn the concepts of Non-Regular language: Pumping lemma, Introduction to Pushdown Automata, Introduction to Turing Machine.						

Course Outcomes	
CO1	Understand the concepts of relations and functions and terminology.
CO2	Understand the concept Algebraic Structures and Propositional Logic and their application in computer science
CO3	Understand the concept of Lattices: Ordered set, Posets and Introduction to Lattices, Properties of lattices.
CO4	Understand the concepts of Introduction of the Language, Kleene closure and finite automata with output and Finite Automata with output.
CO5	To understand the concepts of Non-Regular language: Pumping lemma, Introduction to Pushdown Automata, Introduction to Turing Machine.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Relation	Relations on sets, Types of relations in a set, Properties of relations, Composition of relations, Representation of relations, Closures of relations. Function: Types of functions, Composition of functions, Recursively defined function.	7	CO1
2	Algebraic Structures	Properties, Semi Group, Monoid, Group, Abelian group, Properties of group, Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism, Isomorphism and Automorphism of groups. Propositional Logic: Preposition, Tautologies, Contradictions, Algebra of Proposition, Logical implication, Logical equivalence, Normal forms, Predicates and Quantifiers.	8	CO2
3	Lattices	Ordered set, Posets , Hasse diagram, Hasse diagram of partially ordered set, Consistent enumeration, Isomorphic ordered set, Well ordered set, Introduction to Lattices, Properties of lattices, Bounded lattices, Distributive lattices, and Complemented lattices.	7	CO3
4	Automata	Introduction of the Language, Kleene closure, Arithmetic expressions, Regular expressions, Generalized transition graph, Conversion of regular expression to Finite Automata, Non deterministic finite automata, Deterministic finite automata, Conversion of NFA to DFA, Optimization of DFA. Finite Automata with output: Moore machine, Mealy machine, Conversions (Moore machine to Mealy machine and vice-versa).	10	CO4
5	Non-Regular language	Pumping lemma, Introduction to Pushdown Automata, Introduction to Turing Machine, Introduction to Chomsky Normal Form (CNF), Chomsky Hierarchy.	8	CO5

Reference Books:

1. Liptschutz, Seymour, “Discrete Mathematics”, TMH. 2.
2. Trembley, J.P and R. Manohar, “Discrete Mathematical Structure with Application to Computer Science”, TMH
3. Hopcroft J.E, Ullman J.D., “Introduction to Automata theory, Languages and Computation”, Narosa Publishing House.
4. C.L.Liu, “Elements of Discrete Mathematics”, McGraw Hill.

e-Learning Source:

1. https://onlinecourses.nptel.ac.in/noc20_cs82/preview
2. https://nptel.ac.in/courses/106106183

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	1		1					3	1				
CO2	3	1	2			1	1						2	2				
CO3	2	2	1	1		2							3	1				
CO4	2	1	1			2	1						2	1				
CO5	2	1	1	1		1							3	1				

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

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA209	**Title of the Course**	DATA COMPRESSION	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• Explain digital audio, companding ,perceptual audio coding and MPEG audio compression standard • Describe different lossless and lossy image and video compression techniques and standards • Differentiate between symmetric and asymmetric cryptography and also describe different symmetric cryptographic techniques						

Course Outcomes	
CO1	Describe and apply various techniques for text compression and also evaluate performance of the coding techniques.
CO2	Understand the operation of scalar and vector quantizer.
CO3	Describe different lossless and lossy image and video compression techniques and standards
CO4	Summarize the concepts associated speech, image and video compression
CO5	Recognize the usage data compression in telecommunication engineering and to solve the corresponding problems.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to Compression Techniques	Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression. Introduction to Information Theory and Models: Physical models, Probability models, Markov models.	8	CO1
2	Huffman Coding Algorithms	Minimum variance Huffman codes. Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure, Applications of Hoffman coding.	8	CO2
3	Arithmetic Coding	Coding a sequence, Generating a Binary code, Comparison of Arithmetic and Huffman coding. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary: The LZ77 Approach, The LZ78 Approach. Applications: File Compression, Image Compression Lossless Image Compression: Multi-resolution Approaches. Context Based Compression: Dynamic Markov Compression.	8	CO3
4	Scalar Quantization	Mathematical Preliminaries for Lossy Coding, Distortion criteria, Models. The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.	8	CO4
5	Vector Quantization	Advantages of Vector Quantization over Scalar Quantization, The Linde-BuzoGray Algorithm, Tree structured Vector Quantizers, Structured Vector Quantizers.	8	CO5

Reference Books:

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kaufmann Publishers.
2. David Salomon, “Data Compression: The Complete Reference”, Springer.
3. Mark Nelson and Jean-loup Gailly, “The Data Compression Book”, M&T Books.

e-Learning Source:

1. https://in.coursera.org/lecture/algorithms-part2/introduction-to-data-compression-OtmHU
2. https://www.cs.cmu.edu/~guyb/realworld/compression.pdf

	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	1	3		1		2						3	1				
CO2	3	1	1			1							3	1				
CO3	2	2	1	1		2							3	1				
CO4		2	2	1	1	1	1						1	3				
CO5		3	1	2		1							2	2				

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

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA210	**Title of the Course**	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To develop knowledge of phases in software development • To develop good quality software and able to maintain quality of software • To know the team required for project management. • To develop knowledge of tools available for software development. • Knowledge of testing and maintain robustness of software						

Course Outcomes	
CO1	To understand about designing model and practical implementation.
CO2	To take decision of project planning on the basis of cost evaluation.
CO3	To understand risk identification and management.
CO4	To use various tools for software design development.
CO5	To understand importance of quality of software.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Software Product and SDLC	Software Engineering Fundamentals, Definition of Software Products, Phases of Software Development Life Cycle, Software Development Paradigm, Software Life Cycles Models: Build and Fix Model, Waterfall Model, Prototype Model, Iterative Model, Evolutionary Model, Spiral Model, Software Requirements Analysis and Specification: SRS, Characteristics of SRS.	8	CO1
2	Software Design Principles	Software Design, Design Process, Design Principles: Abstraction, Refinement, Modularity, Information Hiding, Modular Design: Effective Modular Design and Functional Independence, Cohesion, Coupling, Top down and Bottom up Strategies, Coding: Coding Standard and Guidelines, Testing: Black Box Testing and White Box Testing.	8	CO2
3	Software Configuration Management	Concept of Configuration Management. Software Maintenance: Categories of Maintenance, Software Reliability: Reliability, Reliability Metrics, Quality Concept: Quality Control, Quality Assurance, Software Quality, Scheduling Tools, Time Estimation, Resource Allocation, Differentiate Projects, Programs and Business Process, Elements of Proposal Process.	8	CO3
4	CASE Tools	Relevance of CASE Tool: Building block for CASE Tools, Integrated Case Tool Environment, Generation of CASE Tool, High End and Low End CASE Tools. Project Management Fundamentals: Definition of Project, Project Specification and Parameters, Principles of Project Management, Project Management Life Cycle, Program Management Plan: Concept, Elements, Planning Issues, Benefits of Program Management.	8	CO4
5	Software Project Management, Project Activities	Engineering Task, Management Task, Work Break down Structure: Concept of WBS, Meaning of Product Oriented Deliverable, Features of WBS, Comparison of Functional based vs. product Oriented Deliverability, Resource and Cost Requirements, Software Project Plans, Software Project Estimation, Project Monitoring and Progress Control, Risk Management: Risk Management Plan, Risk Mitigation Strategies, Software Measurement, Project Metrics, Project Audit: Data Collection, Analysis.	8	CO5

Reference Books:

1. R. Pressman, “Software Engineering”, TMH.
2. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Narosa.
3. Rajib Mall, “Fundamental of Software Engineering”, PHI.
4. Pankaj Jalote, “Software Project Management in Practice”, Person Education.

e-Learning Source:

1. https://nptel.ac.in/courses/106105182
2. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

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		1		1	1					3	1				
CO2	1	2	1	1		2		1					2	2				
CO3	3	2		1	1	1							3	1				
CO4		1	3		1	2	2	1					2	2				
CO5	2	1	1	1		2							2	1				

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

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA211	**Title of the Course**	SOFTWARE SECURITY	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To gives an overview of security issues for software, and provides programming methods for the development of secure applications. • To understand the Risk Management Framework (RMF) and risk involved in software development. • About different security policies and how they apply across a variety of application domains. • About mechanisms designed to enforce a given policy and attacks meant to thwart that same policy. • To understand the properties and security knowledge of a secure software.						

Course Outcomes	
CO1	Understands security issues relating to system development.
CO2	Knows software development techniques to avoid security problems after resolving the risk involved in software development.
CO3	Explain the most common weaknesses in software security and how such problems can be mitigated in software
CO4	Identify common security threats, risks, and attack vectors for software systems, and knows best practices to defend software systems.
CO5	Exchange opinions with other professionals and participate in developing best practices for secure software.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Security Fundamentals	The Security Problem, Security Problems in Software, Solving the Problem: The Three Pillars of Software Security, Rise of Security Engineering. Software Security Issue: The Problem, Software Assurance and Software Security, Threats to Software Security, Sources of Software Insecurity, Benefits of Detecting Software Security Defects Early, Managing Secure Software Development.	8	CO1
2	Root of Software Problem	A Brief History of Software, Bad Software is Ubiquitous, The Trinity of Problem, Future of Software. Risk Management Framework: Putting Risk Management into Practice, The Five Stage of Activity, RMF, Applying the RMF, The Importance of Measurement, Risk Management Framework for Software Security.	8	CO2
3	Seven Touch Point for Software Security	Seven Terrific Touch Point, Black & White: Two Threads Inextricably Intertwined, Touch Points as Best Practices, Software Security: Multidisciplinary effort, Touch points to success Secure Software Architecture and Design: Software Security practices for architecture and Design: Architectural Risk Analysis, Software Security Knowledge for Architecture and Design, Security Principles, Security Guidelines, Attack Patterns.	8	CO3
4	Making Software Secure	Defining Properties of Secure Software, Security Properties of Software, Assertion and Specification for Desired Security properties. Architecture Design Principles: Architectural Level of Design, Architecting with Design Operators, Functional Design Strategies.	8	CO4
5	Knowledge for Software Security	Experience, Expertise and Security, Security Knowledge: A Unified View, Security Knowledge and Touch Points, The Department of Homeland Security Build Security in Portal, Knowledge Management: Ongoing, Software Security recent issue. An Enterprise Software Security Program: The Business Climate, Building Blocks of Change, Building an Improvement Program, Establishing a Metrics Program, Continuous Improvement, COTS and existing applications, Adopting a Secure Development Lifecycle.	8	CO5

Reference Books:

1. Julia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, "Software Security Engineering: A guide for Project Mangers", Addison Wesley Professional.
2. Gary McGraw, "Software Security: Building Security In", Addison Wesley Professional.
3. Mark Dowd, John McDonald, Justin Schuh, "The Art of Software Security Assessment: Identifying and Preventing Software Vulnerabilities", Addison Wesley Professional
4. Julia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, "Software Security Engineering: A guide for Project Mangers", Addison Wesley Professional.

e-Learning Source:

1. https://onlinecourses.nptel.ac.in/noc21_cs30/preview
2. https://nptel.ac.in/courses/106106199

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	1							3	1				
CO2	1	3	1	2	1		1	1					3	1				
CO3	2	2		1	1	1		1					2	1				
CO4	1	3	2	2		2	1						1	2				
CO5		3	2	2	1	1	1						2	2				

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

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA212	**Title of the Course**	COMPUTER ARCHITECTURE AND MICROPROCESSOR	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To learn the concepts regarding microprocessor with 8 and16 bit. • To understand the basic idea of the internal architecture and register configuration of respective devices. • To understand the programming techniques of with the help of Assembly Language Programming. • To understand the basic concept of parallel computing and significance of pipelining and parallelism • Understanding of the various types of interconnection networks.						

Course Outcomes	
CO1	For a microprocessor system, student should be able to deal with the internal architecture of 8 bits and 16 bit microprocessor to analyze the working operation and to know the pin configuration for the respective microprocessor. A student should be good enough to deal with interrupts internally or externally.
CO2	He/she should be able to understand the basic concepts of Assembly language programming. For a particular data instruction set, student should be having a clear idea of solving machine language programs using kit. He/she shall be having an idea to tackle with counter delays and subroutines.
CO3	He/she should be able to know the concept of pipelining and parallelism in uniprocessor system for hazard detection. Understand the basic concept of Parallel computing.
CO4	A student should have a basic idea of job levels that are governed by an organization on priority basis. He/she should know the Pipeline scheduling theory
CO5	For good networking, a student should be able to draw SIMD interconnections and FFT or a butterfly method system for collision prevention and vector dispatching. He/she should be able to make Cube Interconnection Network, Shuffle-Exchange and Omega Network.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	8-bit Microprocessor	Introduction, Pin diagram and internal architecture of 8085 Microprocessor, Registers sets. 16-bit Microprocessor: Introduction, Pin diagram and internal architecture of 8086 microprocessor, Registers sets. Interrupts: Hardware and Software Interrupts.	8	CO1
2	Assembly Language Programming and Instructions	Data transfer, Arithmetic operations, Logical operations, Branch operations, Looping counting, Indexing, Programming techniques, Counters and time delays. Parallel computing: Introduction, Parallelism in Uniprocessor Systems, Parallel computer structures, Architectural classification schemes, Parallel processing applications.	8	CO2
3	Pipelining Processing and overlapped parallelism	Principle of Linear Pipelining, Classification of Pipelined Processor, General Pipelined and reservation tables, Interleaved memory organizations, Arithmetic pipelines. Principles of designing pipelined processors: Pipeline instruction execution, Pre-fetch buffer, Internal forwarding and Register tagging, Hazard detection and resolution.	8	CO3
4	Pipeline scheduling theory	Scheduling problem, Collision vector, State diagram, Pipeline scheduling optimization, Multiple vector task dispatching, Masking and Data routing. Program partitioning and scheduling: Grain size and Latency, Grain packing and scheduling, Static multiprocessor scheduling. Program flow mechanism: Control flow vs. Data flow, Demand-driven mechanism, Comparison of flow mechanism.	8	CO4
5	SIMD Interconnection network	Static, Dynamic networks, Mesh connected Illiac network, Cube interconnection network, Shuffle-exchange and Omega network. Parallel Algorithms for Array Processors: SIMD Matrix multiplication, SIMD Fast Fourier transforms.	8	CO5

Reference Books:

1. Gaonkar, Ramesh S, "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publishing.
2. Ray A K, Bhurchandi K M , "Advanced Microprocessors and Peripherals", TMH.
3. Hall D V, Microprocessor Interfacing', TMH.
4. Liu and Gibson G A, " Microcomputer System: The 8086/8088 family" ,PHI.

e-Learning Source:

1. https://nptel.ac.in/courses/106102062
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	2	1		2	1	1							2	1				
CO2	3	2	1		1		1						3	1				
CO3	2	1		1	1	1							2	1				

CO 4	2	1	2			2	1						3	1				
CO 5		2	3	1	1	1	2						2	1				

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

Effective from Session: 2016-2017							
Course Code	CA213	**Title of the Course**	OPERATING SYSTEM	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To understand various operating system types, Architecture design of OS and their services. • To study process management concepts and various scheduling algorithm. • To understand process synchronization concepts and dead lock handling mechanism. • To learn various memory management schemes. • To study file management and Disk management techniques.						

Course Outcomes	
CO1	Know different OS types and basic component of OS Architecture.
CO2	Analyze issues in process management and evaluations of various scheduling algorithms.
CO3	Understand process synchronization problem and provide solution for critical section problem and deadlock management.
CO4	Analyze and implement various memory management techniques.
CO5	Identify the use of storage management techniques and solve various disk scheduling problems.

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.	8	CO1
2	Process Management	Process Concept, Process Scheduling, Cooperating Processes, Threads, Interprocess Communication, CPU Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling and Algorithm evaluation.	8	CO2
3	Process Synchronization And Deadlocks	The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors, Deadlocks-System Model, Characterization, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock, Combined approach to Deadlock Handling.	8	CO3
4	Memory Management	Logical and Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation with Paging, Virtual Memory, Demand Paging and its performance, Page Replacement Algorithms, Allocation of Frames, Thrashing, Page Size and other considerations, Demand Segmentation.	8	CO4
5	File Management	File Systems, Secondary Storage Structure, File concept, Access methods, Directory implementation, Efficiency and performance, Recovery. Disk Management: Disk Structure, Disk scheduling, Disk management, Recovery, Swap-Space Management, Disk Reliability. Windows NT-Design Principles, System Components, Environmental subsystems, File system, Networking and Program interface. Introduction to Android Operating System.	8	CO5

Reference Books:

1. Abraham Siberschatz and Peter Galvin "Operating System Concepts", Wiley.
2. Milan Milankovic, "Operating Systems, Concept and Design", McGraw Hill.
3. Harvey M Deital, "Operating System", Addison Wesley.
4. Tannenbaum, "Operating System", TMH.

e-Learning Source:

1. https://nptel.ac.in/courses/106106144
2. https://nptel.ac.in/courses/106105214

	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	1							3	1				
CO2	1	3	1	2	1								2	3				
CO3	2	3		2	1	1		1					3	1				
CO4	1	2	2	1		2	1						2	3				
CO5		3	1	2	1	2		1					2	2				

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

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA214	**Title of the Course**	JAVA PROGRAMMING	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To learn the various features of Java and comparing with C++. • To learn the Java environment for writing programs and Java program structure. • To learn the various Objects oriented features with Java. • To learn the Array, String, Exception Handling concepts • To learn the concepts of Thread, Package, Applet and implementing them in creating a web page.						

Course Outcomes	
CO1	Able to understand the features of Java Programming Language with Syntax and structure of Java Programs and how to use various operators in Java.
CO2	Able to understand that how to implement the Object oriented features by writing Java programs.
CO3	Ability to define Arrays, Strings, Vectors, Packages etc. in Java and implementing the Exception handling Mechanism in Java.
CO4	Ability to understand the different concepts to create and use Threads and Packages in Java.
CO5	Ability to understand the different concepts of applets and adding them to a HTML File.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Java Basic	Comparison of C++ and JAVA, JAVA and Internet, JAVA support systems, JAVA environment, JAVA program structure, Tokens, Statements, JVM, Constant and Variables, Data Types, Declaration of variables, Scope of variables, Symbolic constants, Type Casting. Operators: Arithmetic, Relational, Logical assignments, Increment and Decrement, Conditional, Bitwise, Special, Expressions and its evaluation.	8	CO1
2	Inheritance	Defining a Class, Adding variables and Methods to classes, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods. Extending a Class, Overriding Methods, Final Variables and Methods, Final Classes, Finalize Methods, Abstract Methods and Classes, Visibility Control.	8	CO2
3	Arrays	One Dimensional and Two Dimensional, Strings, Vectors, Wrapper Classes. Interface: Defining Interface, Extending Interface, Implementing Interface, Accessing Interface Variable. Exception Handling: Concepts of Exceptions, Types of Exception, Try and Catch keyword, Nested Try and Catch.	8	CO3
4	Threads	Creating Threads, Extending Threads Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization. Package: System Packages, Using System Package, Adding a Class to a Package, Hiding Classes	8	CO4
5	Applets	Local and Remote Applets, Writing Applets, Applets life cycle, Creating an executable Applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet, Passing parameters to Applets, Aligning the display, HTML Tags and Applets, Getting input from the user.	8	CO5

Reference Books:

1. E. Balagurusamy, “Programming in Java”, TMH Publications.
2. Peter Norton, “Peter Norton Guide to Java Programming”, Techmedia Publications.
3. Naughton, Schildt, “The Complete Reference JAVA 2”, TMH.
4. Dustin R. Callway, “Inside Servlets”, Addison Wesley.

e-Learning Source:

1. https://nptel.ac.in/courses/106105191
2. https://onlinecourses.nptel.ac.in/noc22_cs47

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	1								3	1				
CO2	2		1		1	2		2					3	1				
CO3	2	1	3	1		1	2	1					2	2				
CO4	1	1	2	1		3	1	2					3	1				
CO5	1	1	2	1		2	1						2	1				

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

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA215	**Title of the Course**	MICROPROCESSOR LAB	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**0**	**0**	**3**	**3**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To impart basic understanding of the internal organization of 8086 Microprocessor • To understand the addressing mode of 8086 Microprocessor • To understand the instruction sets 8086 microprocessor and their utilization • To introduce the concepts of interfacing microprocessors with external devices • To develop Assembly language programming skills.						

Course Outcomes	
CO1	Build a program on a microprocessor using instruction set of 8086.
CO2	Understand different addressing modes and instructions of 8086, design and develop assembly language programs using software interrupt subroutines and macros
CO3	Use the knowledge of the 8086 instruction set and utilize it in programming
CO4	Describe the internal architecture and different modes of operations of a typical microcontroller
CO5	Implement programming module of Stepper motor, Seven Segment Display to work with 8086 processor

Experiment No.	**Title of the Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Processors	Study of 8085 and 8086.	2	CO1
2	Assembly Language	Assembly Language programs for 8086	2	CO1
3	Data Transfers	Address and Data Transfer.	2	CO2
4	Arithmetic	Addition, Subtraction.	2	CO2
5	Data Transfer	Block transfer	2	CO3
6	Greatest numbers	Find greatest numbers.	2	CO4
7	Complements	Find r's and (r-l)'s complements of signed and unsigned number.	2	CO4
8	Multiplication	Multiplication of two hexadecimal/octal numbers. Division of two hexadecimal/octalnumbers	2	CO5

Reference Books:

1. Gaonkar, Ramesh S, “Microprocessor Architecture, Programming and Applications with 8085”, Penram International Publishing.
2. Ray A K, Bhurchandi K M , “Advanced Microprocessors and Peripherals”, TMH.

e-Learning Source:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/exp8/simulation.php
2. https://nptel.ac.in/courses/108103157

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	1	3	1	1		1						2	2				
CO2	2		3	1	1		1						3	1				
CO3	3	1	2	1		1							2	1				
CO4	3	1	1	1		1	1						3	1				
CO5	1	1	3	1	1		1						2	2				

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

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA216	**Title of the Course**	JAVA PROGRAMMING LAB	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**0**	**0**	**3**	**3**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• To learn the object oriented concepts and apply them in solving problems in java. • To learn the concepts of Inheritance and Polymorphism. • To learn the concepts of Packages and Interfaces in Java. • To learn the concepts of Exception handling and Multithreading. • To learn the concepts of Graphical User Interface using Applets and AWT Controls.						

Course Outcomes	
CO1	Able to implement classes, objects, members of a class and relationships among them needed for a specific problem.
CO2	Able to implement programs using concepts of Inheritance and Polymorphism.
CO3	Able to implement the concepts of Packages and Interfaces in Java.
CO4	Able to develop Java Programs using the concepts of Exception Handling and Multithreading.
CO5	Able to develop the GUI based web applications using Applets and various AWT controls.

Experiment No.	**Title of the Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Classes and Objects	Program illustrating Classes and Objects.	2	CO1
2	Overloading	Program illustrating Method Overloading and Method Overriding.	2	CO1
3	Interface	Program illustrating concept of Interface.	2	CO2
4	Inheritance	Program illustrating use of Final and Super keyword	2	CO2
5	Packages	Program that illustrates the following a) Creation of simple package. b) Accessing a package.	2	CO3
6	Threads	Program for creating multiple threads a) Using Thread class. b) Using RunnableInterface.	2	CO4
7	Exceptions	Program that illustrates the following a) Handling predefined exceptions. b) Handling user defined exceptions.	2	CO4
8	Applets	Program to illustrate the concept of Applets.	2	CO5

Reference Books:

1. E. Balagurusamy, “Programming in Java”, TMH Publications.
2. Peter Norton, “Peter Norton Guide to Java Programming”, Techmedia Publications.

e-Learning Source:

1. https://onlinecourses.nptel.ac.in/noc22_cs47

	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		1						1	2				
CO2	2	1	3		1	1							1	2				
CO3	1	1	2	1		2	2						2	1				
CO4	1	1	3	1		1	1						2	1				
CO5	2	1	3	1		2	1						2	1				

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

Integral University, Lucknow

Effective from Session: 2016-2017							
Course Code	CA217	**Title of the Course**	SEMINAR	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**0**	**0**	**6**	**3**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• Awareness of how to use values in improving your own professionalism • Learning about personal and communication styles • Learning presentation styles • Increase knowledge of recent technologies • Learning management of values						

Course Outcomes	
CO1	Identify recent technical topics from interested domains.
CO2	Describing the future aspects of technology and problem addressed in the research
CO3	Analyze the applicability of modern software tools and technology.
CO4	Develop presentation and Communication skills.
CO5	Develop technical report preparation skills.

Experiment	**Title of the Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Phase1	The presentation should provide sufficient background of the current technology and research.	8	CO1
2	Phase2	Future aspects of technology and problem addressed in the research	8	CO2
3	Phase3	Plan on approximately a 20 minute presentation with about 10 minutes for questions	8	CO3
4	Phase4	The title should be relevant to the domain of computer science	8	CO4
5	Phase5	Future directions of the presented topic should be discussed	8	CO5
e-Learning Source:				
1. https://www.topicsforseminar.com/2020/09/seminar-topics-for-youth.html?m=1#gsc.tab=0				
2. https://www.kirkeberg.com/seminarobjectives.html				

	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	3	2	2	1		1						2	2				
CO2	2	1	3	1		2	1						3	1				
CO3	3	1	1	2	1	1							1	3				
CO4	2	1	2	1		1	1						2	1				
CO5	3	1		1	1		2						2	1				

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