



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS231	Title of the Course	Computer Architecture and Organization	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To provide elementary and application-based knowledge of different components that can be used to design an efficient architecture of the system.						

Course Outcomes	
CO1	Define registers, bus as well as memory and its hierarchy and input/output devices.
CO2	Explain division-based algorithms for different representation of data and discuss I/O interfaces, ports and Data Transfer modes
CO3	Apply register and stack organization and construct different control units.
CO4	Classify types of memory and memory mapping of one type with other
CO5	Explain Various data transfer schemes

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Register Transfer and Micro-operation	Register Transfer Language, Register Transfer, Bus and Memory Transfer: Three state bus buffers, Memory Transfer. Arithmetic Micro-operations: Binary Adder, Binary Adder-Subtrator, Binary Incrementor, Logic Micro-operations: List of Logic micro operations, Shift Micro-operations (excluding H/W implementation), Arithmetic Logic Shift Unit.	8	1
2	Basic Computer Organization	Instruction Codes, Computer Registers: Common bus system, Computer Instructions: Instruction formats, Instruction Cycle: Fetch and Decode, Flowchart for Instruction cycle, Register reference instructions.	8	2
3	Micro Programmed Control Unit	Control Memory, Address Sequencing, Conditional branching, Mapping of instruction, Subroutines, Design of Control Unit, Central Processing Unit: Introduction, General Register Organization, Stack Organization: Register stack, Memory stack; Instruction Formats, Addressing Modes.	8	3
4	Computer Arithmetic	Introduction, Addition and Subtraction, Multiplication Algorithms (Booth algorithm), Division Algorithms, Input-Output Organization: Peripheral devices, Input – Output interface, Introduction of Multiprocessors: Characteristics of multi-processors.	8	4
5	Modes of Data Transfer and Memory Organization	Modes of Data Transfer: Priority Interrupt, Direct Memory Access, Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.	8	5

Reference Books:	
1.	Computer System Architecture by Morris Mano, PHI
2.	Computer Organization and Architecture by William Stallings, PHI
3.	Digital Computer Electronics: An Introduction to Microcomputers by Malvino, TMH
4.	PC Hardware in a Nutshell by Barbara Fritchman Thompson, Robert Bruce Thompson, O'Reilly, 2nd Edition , 2010
5.	Fundamentals of Computer Organization and Architecture by Mostafa AB-EL-BARR and Hesham EL-REWNI, John Wiley and Sons
6.	Fundamental Of computer Organization by Albert Zomaya, 2010
e-Learning Source:	
https://nptel.ac.in/courses/106105163	

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS232	Title of the Course	Data Structures & Algorithms	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To introduce the fundamental concepts of data structures and to emphasize the importance of data structures in development and implementation of efficient algorithms.						

Course Outcomes	
CO1	Students would be able to Define facts, terms and basic concepts of various data structures like Array, List, Stack, Queue, Tree and Graph using C as the programming language with static or dynamic implementations.
CO2	Students would be able to Demonstrate the basic understanding using programming techniques for illustrating solution of problems.
CO3	Students would be able to Perform different operations on data structures by applying knowledge and facts gained.
CO4	Student would be able to Analyze and test appropriate data structures and algorithms to solve problems and also to draw conclusions regarding the best data structure for the problem.
CO5	Students would be able to Define tree, graph and its applications

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Data structures	Definition, Classification of data structures: primitive and non-primitive, Elementary data organization, Time and space complexity of an algorithm (Examples), String processing. Dynamic memory allocation and pointers: Definition of dynamic memory allocation, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer, Meaning of static and dynamic memory allocation, Memory allocation functions: Malloc(), Calloc(), free() and realloc(). Recursion: Definition, Recursion in C (advantages), Writing Recursive programs – Binomial coefficient, Fibonacci, GCD.	8	1
2	Searching and Sorting	Basic Search Techniques: Sequential search: Iterative and Recursive methods, Binary search: Iterative and Recursive methods, Comparison between sequential and binary search. Sort: General background and definition, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort.	8	2
3	Stack and Queue	Stack – Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks. Queue: Definition, Array representation of queue, Types of queue: Simple queue, Circular queue, Double ended queue (deque), Priority queue, Operations on all types of Queues.	7	3
4	Linked List	Definition, Components of linked list, Representation of linked list, Advantages and Disadvantages of linked list. Types of linked list: Singly linked list, doubly linked list, Circular linked list, Operations on singly linked list: creation, insertion, deletion, search and display.	9	4
5	Tree Graphs and their Applications	Definition : Tree, Binary tree, Complete binary tree, Binary search tree, Heap Tree terminology: Root, Node, Degree of a node and tree, Terminal nodes, Non-terminal nodes, Siblings, Level, Edge, Path, depth, Parent node, ancestors of a node. Binary tree: Array representation of tree, Creation of binary tree. Traversal of Binary Tree: Preorder, Inorder and postorder. Graphs, Application of Graphs, Depth First search, Breadth First search.	8	5

Reference Books:
1. Weiss, Data Structures and Algorithm Analysis in C, II Edition, Pearson Education, 2001
2. Lipschutz: Schaum’s outline series Data structures Tata McGraw-Hill
3. Robert Kruse Data Structures and program designing using ‘C’
4. Trembley and Sorenson Data Structures
5. E. Balaguruswamy Programming in ANSI C
6. Bandyopadhyay, Data Structures Using C Pearson Education, 1999
7. Tenenbaum, Data Structures Using C. Pearson Education, 200
8. Kamthane: Introduction to Data Structures in C. Pearson Education 2005.
9. Hanumanthappa M., Practical approach to Data Structures, Laxmi Publications, Fire Wall media 2006
10. Langsam, Ausenstein Maoshe & M. Tanenbaum Aaron Data Structures using C and C++ Pearson Education
e-Learning Source:
https://nptel.ac.in/courses/106102064

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	BM-226	Title of the Course	Human Values & Professional Ethics	L	T	P	C
Year	II	Semester	III	3	0	0	0
Pre-Requisite	None	Co-requisite	None				
Course Objectives	<p>To understand the moral values that ought to guide the Management profession, Resolve the moral issues in the profession,</p> <ul style="list-style-type: none"> ➤ To justify the moral judgment concerning the profession. ➤ To create an awareness on Management Ethics and Human Values. ➤ To inspire Moral and Social Values and Loyalty. ➤ Intended to develop a set of beliefs, attitudes, and habits that engineers should display concerning morality. 						

Course Outcomes	
CO1	Define the human values and related terms.
CO2	Explain the difference between the moral, social and human values and others
CO3	Build become a moral human being from inside.
CO4	Analyze the right or wrong before proceeding to a task.
CO5	Create awareness about management ethics and human values.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Human Value Education	Understanding the need, basic guidelines, content and process for Value Education, SelfExploration - Its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for selfexploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly.	6	1
2	Introduction to Ethical Concept	Definition of industrial ethics and values, Ethical rules of industrial worker. Values and Value Judgments. Moral Rights and Moral rules, Moral character and responsibilities. Privacy, Confidentiality, Intellectual Property and the Law. Ethics as Law.	6	2
3	Professional Responsibility	The basis and scope of Professional Responsibility, Professions and Norms of Professional Conduct, Ethical Standards versus Profession, Culpable mistakes, the Autonomy of professions and codes of ethics. Employee status and Professionalism. Central Professional Responsibilities of Engineers: The emerging consensus on the Responsibility for safety among engineers, hazards and risks.	6	3
4	Engineers Ethics	Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles theories about right action - Self-interest - customs and religion - uses of ethical theories. Valuing Time - Cooperation - Commitment.	6	4
5	Global Issues: A Glimpse of Life Stories	Life story of Prophet Mohammad, Mahatma Gandhi, Swami Vivekanand, Marie Curie and Steve Jobs. Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers consulting engineers-engineers as expert witnesses and advisors - moral leadership.	6	5

Reference Books:															
1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.															
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.															
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.															
e-Learning Source:															
https://nptel.ac.in/courses/109104068															

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS230	Title of the Course	Introduction to Communication Skills	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To state the principles of Communication Classify the different models of communication Explain how to plan a presentation Compose business letters and reports						

Course Outcomes	
CO1	State the principles of communication
CO2	Classify the different models of communication
CO3	Explain how to plan a presentation
CO4	Compose business letters and reports
CO5	Explain different types of business letters

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Oral Communication	Principles of nonverbal communication - through clothes and body language, Types of managerial speeches – speech of introduction, speech of thanks, occasional speech, theme speech, Mastering the art of giving interviews in selection or placement interviews, discipline interviews, appraisal interviews, exit interviews, Building Persuasion & Negotiation abilities.	8	1
2	Communication in Business	Role of Communication in Business - Main forms of Communication in Business - Communication process – Coding and decoding - Roots of misunderstanding - Inferential model - Original message and reconstructed message Symbols mismatch implications -Non-verbal symbols - Verbal symbols - Seven communication roadblocks Communicating across cultures.	8	2
3	Better Public Speaking & Presentation Introduction:	Definition; Speaking to Audience; Preparing a Presentation; Achieving Clarity and Impact; Using Visuals; Arranging the room; Presentation Planning Checklist; Presentation Delivery, appearance, Visual Aids; Understanding Presentations Aspects; Making Technical Talk interesting, Preparation, Research, Organizing Materials; Delivering presentation.	8	3
4	Written Communication	7cs of written communication, Business letters - Stationery - Format and layout -E-mail - Managing the mailbox Presenting mail – Common sense and etiquette. Report Writing - Parts of a report - Qualities of a good report improving writing skills, internal communication through memos, minutes, notices & reports.	8	4
5	Sample Business Letters	Types of Business letters - routine letters, bad news and persuading letters, sales letters, Inquiries, Circulars, Quotations, Orders, Acknowledgments, Executions, Complaints, Claims & Adjustments, collection letters, job application letters, Curriculum Vitae / Resume - Invitation to interview - Offer of employment - Letter of acceptance Letter of resignation - Recommendation letter, Logical Traps.	8	5

Reference Books:

1. Matthukutty M Monippally, Business Communication Strategies, Tata McGraw-Hill.
2. Chaturvedi P.D. et al, Business Communication; Concepts, Cases, & Applications, Pearson Education.
3. Shirley Taylor, Communication for Business, Pearson Education.
4. Lesiicar and Flatley, Basic Business Communication, Tata McGraw-Hill.
5. Courtan L. Bovees et al., Business Communication Today, Pearson Education.

e-Learning Source: <https://nptel.ac.in/courses/109104031>

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS254	Title of the Course	Introduction to Information Security & Cryptography	L	T	P	C
Year	II	Semester	III	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	The course is designed to provide Basic knowledge of information security and cryptography. Students will be able to learn various algorithm used in securing information.						

Course Outcomes	
CO1	Describes Information System and classify various threats to Information System.
CO2	Illustrate various types of cyber-attacks and demonstrate various security techniques.
CO3	Apply different ways for developing secure Information System.
CO4	Define various encryption & decryption algorithms, Message authentication codes and Digital Signature and ability to relate Modular arithmetic Approaches and Network Security Approaches with Data Security.
CO5	Explain Key Management & Distribution Technique, Electronic mail security and ability to Discuss IP Security and System security to compute keys for encryption and decryption

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Information Security	Overview of Information security, Threats, Type of Vulnerabilities and Risk, Business Requirements, Information Security Definitions – Security Policies – Tier 1 (origination Level), Tier 2 (Functional Level), Tier 3 (Application or Device Level), Procedures, Standards, Guidance. Role of Governance in Information Security, Develop a Risk Management Program, Risk Management Process, Best Practices for IT Governance.	8	1
2	Information Asset Classification	Classification of Information, Information Assets – Owner, Custodian, User, Information Classification in terms of Secret, Confidential, Private and Public, Declassification. Retention and Disposal of Information Assets. Provide Authorization for Access – Owner, Custodian and User.	8	2
3	Logical Access Control	User Identity and Access Management- Account Authorization, Access and Privilege Management, System and Network Access Control. Operating Systems Access Controls, Monitoring Systems Access Controls, Intrusion Detection System, Event logging, Cryptography. Physical Security: Identify Assets to be Protected, Perimeter Security, Firewalls, Prevention and Detection Systems, Safe Disposal of Physical Assets. Email Security: PGP, MIME, IP Security: IP security overview.	8	3
4	Introduction to Cryptography	Introduction to Advanced Cryptography and Cryptanalysis, Classical Encryption Techniques – Substitution Techniques, Transposition Techniques, Permutation Method. Advanced Encryption Techniques and Security Issues – RC4, One-time Pad, RSA, DES, Triple DES, AES and Diffie Hellman.	8	4
5	Conventional Encryption	Confidentiality using conventional encryption – Placement of Encryption, Traffic Confidentiality, Key Distribution and Random Number Generation. Key management – Generating Keys, Nonlinear Keyspaces, Transferring Keys, Verifying Keys, Using Keys, Updating Keys, Storing keys, Backup keys, Compromised Keys, Lifetime of Keys, Destroying Keys and Public-Key Management	8	5

Reference Books:

1. Mark Stamp's Information Security: Principles and Practice (WIND) Paperback – 2009 by Deven N. Shah, Wiley (2009)
2. Information Security Risk Analysis - Thomas R. Peltier, Third Edition, Pub: Auerbach, 2012
3. Cryptography and Network Security Principles and Practices, by William Stallings, Pearson Education; Seventh edition (30 June 2017)
4. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole, Wiley, 1st ed; 2008
5. Information Security: The Complete Reference by Mark Rhodes-Ousley, McGraw Hill Education; Second edition (1 May 2013)
6. Principles of Information Security by Michael E. Whitman, Cengage Learning India Private Limited; 5 edition (2015)
7. Cryptography and Information Security by V. K. Pachghare, Prentice-Hall of India Pvt.Ltd; 2nd Revised edition edition (30 March 2015)

e-Learning Source:
<https://nptel.ac.in/courses/106106129>

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS234	Title of the Course	Object Oriented Programming Using Java	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	None	Co-requisite	None				
Course Objectives	Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc. Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc. and exception handling mechanisms. Understand the principles of inheritance, packages and interfaces.						

Course Outcomes	
CO1	Identify classes, objects, members of a class and relationships among them needed for a specific problem.
CO2	Explain Java application programs using OOP principles and proper program structuring.
CO3	Demonstrate the concepts of polymorphism and inheritance.
CO4	Write Java programs to <i>Analyze</i> error handling techniques using exception handling
CO5	Explain and demonstrate database connectivity.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	History and Overview of Java, Object Oriented Programming, Control statements- if and for loop. Using Blocks of codes, Lexical issues - White space, identifiers, Literals, comments, separators, Java Key words, Data types - Integers, Floating point, characters, Boolean, A closer look at Literals, Variables, Type conversion and casting. Automatic type promotion in Expressions Arrays. Operators - Arithmetic operators, Bit wise operators, Relational Operators, Boolean Logical operators, Assignment Operator, Operator Precedence. Control Statements – Selection Statements - if, Switch, Iteration Statements - While, Do-while, for Nested loops, Jump statements.	8	1
2	Classes	Class Fundamentals, Declaring objects, Assigning object reference variables. Methods - constructors, “this” keyword, finalize () method A stack class, Over loading methods. Using objects as parameters, Argument passing, Returning objects. Recursion, Access control, Introducing final, understanding static. Introducing Nested and Inner classes. Using command line arguments. Inheritance – Basics, Using super, method overriding, and Dynamic method Dispatch, Using abstract classes and final with Inheritance.	8	2
3	Packages	Definition. Access protection importing packages. Interfaces: Definition and implementation. Exception Handling – Fundamentals, types, Using try and catch and Multiple catch clauses, Nested try Statements, throw, throws, finally. Java’s built-in exception, using Exceptions.	8	3
4	Multithreaded Programming	Java thread model – main thread, creating single and multiple thread. Is alive () and join (). Thread – Priorities, Synchronization, Inter thread communication, suspending, resuming and stopping threads, using multi-threading. I / O basics – Reading control input, writing control output, Reading and Writing files. Applet Fundamentals – AWT package, AWT Event handling concepts, the transient and volatile modifiers. Using instance of using assert.	8	4
5	Database Connectivity (JDBC)	Database connectivity – JDBC architecture and Drivers. JDBC API - loading a driver, connecting to a database, creating and executing JDBC statements, handling SQL exceptions. Accessing result sets: types and methods. An example - JDBC application to query a database.	8	5

Reference Books:	
1.	The complete reference Java – 2: V Edition by Herbert Schildt Pub. TMH.
2.	SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education.
e-Learning Source:	
https://onlinecourses.nptel.ac.in/noc22_cs47/preview	

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS239	Title of the Course	Operating Systems Building Blocks	L	T	P	C
Year	II	Semester	III	2	1	0	3
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To study and apply concepts relating to operating systems, such as concurrency and control of asynchronous processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization.						

Course Outcomes	
CO1	Analyze the structure of OS and basic architectural components involved in OS design.
CO2	Analyze and design the applications to run in parallel either using process or thread models of different OS
CO3	Analyze the various device and resource management techniques for timesharing and distributed systems
CO4	Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Operating System	Introduction, Objectives and Functions of OS, Evolution of OS, OS Structures, OS Components, OS Services, Systemcalls, System programs, Virtual Machines.	6	1
2	Process Management	Processes: Process concept, Process scheduling, Co-operating processes, Operations on processes, Inter processcommunication, Communication in client-server systems. Threads: Introduction to Threads, Single and Multi-threaded processes and its benefits, User and Kernel threads, Multithreading models, threading issues.CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling, Realtime Scheduling, Algorithm Evaluation, Process Scheduling Models.Process Synchronization: Mutual Exclusion, Critical – section problem, Synchronization hardware, Semaphores,Classic problems of synchronization, Critical Regions, Monitors, OS Synchronization, Atomic TransactionsDeadlocks: System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention,Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	14	2
3	Storage Management	Memory Management: Logical and physical Address Space, Swapping, Contiguous Memory Allocation, Paging,Segmentation with Paging.Virtual Management: Demand paging, Process creation, Page Replacement Algorithms, Allocation of Frames,Thrashing, Operating System Examples, Page size and other considerations, Demand segmentationFile-System Interface: File concept, Access Methods, Directory structure, File- system Mounting, File sharing,Protection and consistency semanticsFile-System Implementation: File-System structure, File-System Implementations, Directory Implementation,Allocation Methods, Free-space Management, Efficiency and Performance, RecoveryDisk Management: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Attachment, stable-storage Implementation.	10	3
4	Protection and Security	Protection: Goals of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Revocationof Access Rights, Capability- Based Systems, Language – Based ProtectionSecurity: Security Problem, User Authentication, One – Time Password, Program Threats, System Threats,Cryptography, Computer – Security Classifications.	5	4

Reference Books:	
1.	Milan Milonkovic, Operating System Concepts and design, II Edition, McGraw Hill 1992.
2.	Tanenbaum, Operation System Concepts, 2nd Edition, Pearson Education.
3.	William Stallings, Operating System, 4th Edition, Pearson Education.
4.	H.M.Deitel, Operating systems, 2nd Edition ,Pearson Education
5.	Abraham Silberschatz and peter Baer Galvin, Operating System Concepts, 8th Edition, Pearson Education 1989 (Chapter 1,3,1,3,2,3,3,3,4,3,6,4,5,6 (Except 6.8,6.9), 7, 8,9,10,11,13, (Except 13.6) 19 (Except19.6),20(Except 20.8, 20.9), 22,23)
6.	Nutt: Operating Systems, 3/e Pearson Education 2004
e-Learning Source:	
https://nptel.ac.in/courses/106105214	

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS252	Title of the Course	Python Programming	L	T	P	C
Year	II	Semester	III	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	<p>The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.</p> <p>Major Course learning objectives</p> <ol style="list-style-type: none"> 1. To acquire programming skills in core Python. 2. To acquire Object Oriented Skills in Python 3. To develop the skill of designing Graphical user Interfaces in Python 4. To develop the ability to write database applications in Python 						

Course Outcomes	
CO1	Define Object Oriented Programming paradigm and its use in web programming
CO2	Explain basic principles of Python programming language and its integration with database
CO3	Apply python programming techniques to accessing Data in Structured Flat- File Form and sending Data in Unstructured File Form.
CO4	Analyze problem solving and programming capability of python programming
CO5	Design and Develop an application using python for Multithreading

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Python Environment	History and development of Python, Why Python? Grasping Python's core philosophy, discovering present and future development goals, working at the command line or in the IDE, Installing Anaconda on Windows, Linux and MAC, variables, data types. Output statements.	9	1
2	Expressions and Control Statements	Working with Numbers and Logic, Performing variable assignments, Doing arithmetic, Comparing data using Boolean expressions, Creating and Using Strings, Interacting with Dates, Creating and Using Functions, Calling functions in a variety of ways, Using Conditional and Loop Statements, Making decisions using the if statement, Choosing between multiple options using nested decisions, Performing repetitive tasks using for, Using the while statement.	9	2
3	Data Structures	Storing Data Using Sets, Lists, and Tuples: Performing operations on sets, working with lists, Creating and using Tuples, Defining Useful Iterators, indexing Data Using Dictionaries.	8	3
4	Data Management	Introduction to RDMS, Working with Real Data, Uploading small amounts of data into memory, Streaming large amounts of data into memory, Sampling data, Accessing Data in Structured Flat-File Form, Sending Data in Unstructured File Form, Managing Data from Relational Databases.	8	4
5	CGI and GUI Programming in Python	Classes and Objects, Regular Expressions, CGI Programming, Networking, Sending Email, Multithreading, XML Processing, GUI Programming, Extending and Embedding Python	8	5

Reference Books:	
1.	Python: Essential Reference, by David M. Beazley
2.	Core Python Programming, by Wesley J. Chun, Prentice Hall
3.	Python Programming: An Introduction to Computer Science, by John M. Zelle, Franklin – Beedle and Associates
4.	Professional Ruby on Rails by Noel Rappin, Wiley India Pvt Ltd
5.	Learn Ruby on Rails: Book one, by Daniel Kehoe
e-Learning Source:	
https://onlinecourses.swayam2.ac.in/cec22_cs20/preview	

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

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



Integral University, Lucknow

Effective from Session: 2018							
Course Code	CS233	Title of the Course	Data Structures & Algorithms Labs	L	T	P	C
Year	II	Semester	III	0	0	2	1
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To introduce the fundamental concepts of data structures and to emphasize the importance of data structures in development and implementation of efficient algorithms.						

Course Outcomes	
CO1	Students would be able to Define facts, terms and basic concepts of various data structures like Array, List, Stack, Queue, Tree and Graph using C as the programming language with static or dynamic implementations.
CO2	Students would be able to Demonstrate the basic understanding using programming techniques for illustrating solution of problems.
CO3	Students would be able to Perform different operations on data structures by applying knowledge and facts gained.
CO4	Student would be able to Analyze and test appropriate data structures and algorithms to solve problems and also to draw conclusions regarding the best data structure for the problem.
CO5	Students would be able to Define tree, graph and its applications

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Part A		
2	1. Use a recursive function to find GCD of two numbers.	2	1
3	2. Use a recursive function to find the Fibonacci series.	2	1
4	3. Use pointers to find the length of a string and to concatenate two strings.	2	1
5	4. Use pointers to copy a string and to extract a substring from a given a string.	2	1
6	5. Use a recursive function for the towers of Hanoi with three discs.	2	1
7	6. Insert an integer into a given position in an array.	2	2
8	7. Deleting an integer from an array.	2	3
9	8. Write a program to create a linked list and to display it.	2	4
10	9. Write a program to sort N numbers using insertion sort.	2	2
11	10. Write a program to sort N numbers using selection sort.	2	2
12	Part B		
13	1. Inserting a node into a singly linked list.	2	4
14	2. Deleting a node from a singly linked list.	2	4
15	3. Pointer implementation of stacks.	2	3
16	4. Pointer implementation of queues.	2	3
17	5. Creating a binary search tree and traversing it using in order, preorder and post order.	2	5
18	6. Sort N numbers using merge sort	2	2

Reference Books:	
1. Weiss, Data Structures and Algorithm Analysis in C, II Edition, Pearson Education, 2001	
2. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill	
3. Robert Kruse Data Structures and program designing using 'C'	
4. Trembley and Sorenson Data Structures	
e-Learning Source:	
https://nptel.ac.in/courses/106102064	

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

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



Integral University, Lucknow

Effective from Session: 2018							
Course Code	CS-237	Title of the Course	Information Security Fundamentals Lab	L	T	P	C
Year	II	Semester	III	3	0	0	0
Pre-Requisite	None	Co-requisite	None				
Course Objectives	The course is designed to provide Basic knowledge of information security and cryptography. Students will be able to learn various algorithm used in securing information.						

Course Outcomes	
CO1	Describes Information System and classify various threats to Information System.
CO2	Illustrate various types of cyber-attacks and demonstrate various security techniques.
CO3	Apply different ways for developing secure Information System.
CO4	Define various encryption & decryption algorithms, Message authentication codes and Digital Signature and ability to relate Modular arithmetic Approaches and Network Security Approaches with Data Security.
CO5	Explain Key Management & Distribution Technique, Electronic mail security and ability to Discuss IP Security and System security to compute keys for encryption and decryption

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	System Security Configuration and Security Policy Management in Windows 10	2	
2	Studying and configuring Windows and Linux based password authentication and user privilege management processes	2	
3	Hashes and message digests calculation using has calculators	2	
4	Generate Hash File and testing Kerberos Authentication	2	
5	HMAC Construction using a "Dummy" Hash Function	2	
6	Setting up simulator for SHA-1	2	
7	Implement following Substitution & Transposition techniques a. Caesar cipher b. Play fair cipher c. Hill cipher d. Vigenere cipher e. Rail fence – row & Column Transformation	2	
8	Implement following algorithms a. DES b. RSA c. MD5 d. SHA-1	2	
9	Diffie – Hellman	2	

Reference Books:	
8.	Mark Stamp's Information Security: Principles and Practice (WIND) Paperback – 2009 by Deven N. Shah, Wiley (2009)
9.	Information Security Risk Analysis - Thomas R. Peltier, Third Edition, Pub: Auerbach, 2012
10.	Cryptography and Network Security Principles and Practices, by William Stallings, Pearson Education; Seventh edition (30 June 2017)
11.	Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole, Wiley, 1st ed; 2008
e-Learning Source:	

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

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



Integral University, Lucknow

Effective from Session: 2018							
Course Code	CS-235	Title of the Course	Object Oriented Programming Using Java Lab	L	T	P	C
Year	II	Semester	III	0	0	2	1
Pre-Requisite	None	Co-requisite	None				
Course Objectives	Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc. Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc. and exception handling mechanisms. Understand the principles of inheritance, packages and interfaces.						

Course Outcomes	
CO1	Identify classes, objects, members of a class and relationships among them needed for a specific problem.
CO2	Explain Java application programs using OOP principles and proper program structuring.
CO3	Demonstrate the concepts of polymorphism and inheritance.
CO4	Write Java programs to <i>Analyze</i> error handling techniques using exception handling
CO5	Explain and demonstrate database connectivity.

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Part A		
2	1. Write a program to check whether two strings are equal or not.	2	1
3	2. Write a program to display reverse string.	2	1
4	3. Write a program to find the sum of digits of a given number.	2	1
5	4. Write a program to display a multiplication table.	2	2
6	5. Write a program to display all prime numbers between 1 to 1000.	2	1
7	6. Write a program to insert element in existing array.	2	1
8	7. Write a program to sort existing array.	2	1
9	8. Write a program to create object for Tree Set and Stack and use all methods.	2	2
10	9. Write a program to check all math class functions.	2	2
11	10. Write a program to execute any Windows 95 application (Like notepad, calculator etc.)	2	2
12	11. Write a program to find out total memory, free memory and free memory after executing garbage Collector (gc).	2	2
13	Part B		
14	12. Write a program to copy a file to another file using Java to package classes. Get the file names at run time and if the target file is existed then ask confirmation to overwrite and take necessary actions.	2	3
15	13. Write a program to get file name at runtime and display number of lines and words in that file.	2	4
16	14. Write a program to list files in the current working directory depending upon a given pattern.	2	4
17	15. Create a text field that allows only numeric value and in specified length.	2	4
18	16. Create a Frame with 2 labels, at runtime display x and y command-ordinate of mouse pointer in the labels.	2	5

Reference Books:
3. The complete reference Java –2: V Edition by Herbert Schildt Pub. TMH.
4. SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education.
e-Learning Source:
https://onlinecourses.nptel.ac.in/noc22_cs47/preview

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS240	Title of the Course	Desktop Operating System	L	T	P	C
Year	II	Semester	IV	2	1	0	3
Pre-Requisite	None	Co-requisite	None				
Course Objectives	Student will be able to understand the basic components of a computer operating system, and the interactions among the various components. The course will cover an introduction on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.						

Course Outcomes	
CO1	Describe and explain the fundamental components of a windows operating system
CO2	Learn to do file processing, process management, storage backup, account management etc.
CO3	Demonstrate the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems
CO4	Analyze the application of windows administrative features available to make system secure and easy to use.
CO5	Explain mobile computing and demonstrate remote access in windows.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Operating System	Introduction to Operating System, Evolution of operating system, Structure of Operating, OS Operations OS Organizations, Distributed Systems, Open source Operating systems, Process Management, Memory Management, Storage Management, Computing Environment.	8	1
2	Installing, upgrading and managing Windows	Gathering hardware devices, preparing to install windows, upgrading and migrating, Clean and Image based installation, Configuring Application Compatibility, administrating windows features, Disk management, and installing and configuring device drivers.	8	2
3	File Access, Printers and Network connectivity with Windows	Introduction to Authentication and Authorization, Managing file access , Shared Folders, File compression, file archiving, managing printers, connecting windows client with server, configuring ipv4 & ipv6 connectivity, Implementing APIPA, Introduction to Name resolution, troubleshooting network issues, Overview of wireless network, configuring wireless network.	8	3
4	Securing, Optimizing and maintaining windows Client	Overview of local security management, local security policy settings, EFS and Bitlocker, Application restrictions, UAC, Windows Firewall, Administrating IE8, Windows Defender.	8	4
5	Configuring Mobile Computing and Remote Access in windows	Configure Mobile computer and device settings, Remote desktop, remote assistance, direct access, branch cache	8	5

Reference Books:	
1.	Milan Milenkovic - Operating Systems – TATA McGraw hILL, 2009.
2.	Operating Systems Fundamentals D. Irtegov, 2005 Python: Essential Reference, by David M. Beazley
3.	A Short Introduction to Operating Systems (M. Burgess), 2010
4.	Operating Systems: Design and Implementation (Second Edition), Andrew S. Tanenbaum, 2010
e-Learning Source:	
https://archive.nptel.ac.in/courses/106/105/106105214/	

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS246	Title of the Course	Enterprise Network Engineering	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To provide an in-depth view of the advanced technologies used in enterprise-wide computer networks, provide the theoretical foundation and practical skills of advanced computer networks for many other relevant topics, such as distributed computing.						

Course Outcomes	
CO1	Analyze state-of-the-art real-world enterprise-wide networks.
CO2	Design build, and implement advanced enterprise-wide computer networks;
CO3	Manage configure, troubleshoot, and maintain typical enterprise-wide computer networks
CO4	Introduce both theoretical, practical, and technical issues in enterprise-wide computer networks
CO5	Introduction device security and network address translation

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Networking Fundamentals	The TCP/IP and OSI Networking Models, Fundamentals of Ethernet LANs, fundamentals of WANs, Fundamentals of IPv4 Addressing and Routing, Fundamentals of TCP/IP Transport and Applications.	7	1
2	Ethernet LANs and Switches	Building Ethernet LANs with Switches, Cisco LAN Switches, Configuring Ethernet Switching.	6	2
3	IP Version 4 Addressing and Subnetting	Perspectives on IPv4 Subnetting, Analyzing Classful IPv4 Networks, Analysing Subnet Masks, Analysing Existing Subnets, Implementing IP Version 4: Operating Cisco Routers, Configuring IPv4 Addresses and Routes, Implementing Ethernet Virtual LANs, Troubleshooting Ethernet LANs, Spanning Tree Protocol Concepts, Troubleshooting LAN Switching.	9	3
4	LAN Routing	Configure IPv4 Routing, Configure and Verify Host Connectivity, Advanced IPv4 Addressing Concepts, Describe the boot process of Cisco IOS routers; Operation status of a serial interface; Manage Cisco IOS files; Routing and Routing Protocols; OSPF (multi-area); EIGRP (single AS); Passive Interface.	9	4
5	IPv4 Services and IP Version 6	Basic IPv4 Access Control Lists, Advanced IPv4 ACLs and Device Security, Network Address Translation, Recognize high availability (FHRP); Describe SNMP v2 and v3, IPV6 addressing.	9	5

Reference Books:															
1. CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011															
2. CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback), Pearson, 2013															
3. Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008															
4. CCNA Exploration Course Booklet : Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010															
e-Learning Source:															

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS248	Title of the Course	Introduction To Linux	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	<p>The course is designed to provide Basic knowledge of linux operating systems. Major Course learning objectives are</p> <ol style="list-style-type: none"> 1. Teach Basics of Linux Operating System 2. Teach ownership and permissions of the files and directories. 3. Explain why these issues exist. 4. How to set permissions files/directories 5. How to manipulate files/directories 						

Course Outcomes	
CO1	Students will be able to understand the basics of the UNIX and Linux Operating Systems
CO2	Students will have the Illustrate about the UNIX and Linux file system and comprehend the system calls
CO3	Students will be able to understand the UNIX process management
CO4	Student will be able to discuss the use and the functionality of the VI editor
CO5	Student will be able to discuss karnel, installing rpm command

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Linux Introduction	Introduction to Multi user System, History of UNIX, Features & Benefits, Versions of UNIX, Features of UNIX FileSystem,, Commonly Used Commands like who, pwd, cd, mkdir, rm, rmdir, ls, mv, ln, chmod, cp, grep, sed, awk ,tr,yacc etc. getting Started (Login/Logout) . Creating and viewing files using cat, file comparisons, View files, diskrelated commands, checking disk free spaces. Exploring Linux Flavours: Introduction to various Linux flavours. Debian and rpm packages, Vendors providing DEBIAN & RPM distribution & Features. Ubuntu. History, Versions,Installation, Features, Ubuntu one. Fedora: History, Versions, Installation, Features.	9	1
2	The UNIX File System	I nodes - Structure of a regular file – Directories - Conversion of a path name to an I node Super block – Inode assignment to a new file - Allocation of disk blocks. System calls for the file System: Open –Read - Write - Lseek – Close - File creation - Creation of special files - Changing directory and root - changing ownerand mode – stat and fstat - pipes - Dup - Mounting and Un mounting file systems - Link and Un link.	8	2
3	UNIX Process Management	The Structure of Processes: Process States and Transitions - Layout of system memory - Context of a process. ProcessControl: Process Creation – Signals – Process Termination – Invoking other programs – PID & PPID – Shell on aShell.	7	3
4	VI editor	Vi Editor: Introduction to Text Processing, Command & edit Mode, Invoking vi, deleting & inserting Line, Deleting& Replacing Character, Searching for Strings, Yanking, Running Shell Command Macros, Set Window, Set AutoIndent, Set No. Communicating with Other Users: who, mail, wall, send, msg, ftp.	7	4
5	System Administration	Common administrative tasks, identifying administrative files configuration and log files, Role of systemadministrator, Managing user accounts-adding & deleting users, changing permissions and ownerships, Creating andmanaging groups, modifying group attributes, Temporary disabling of user’s accounts, creating and mounting filesystem, checking and monitoring system performance - file security & Permissions, becoming super user using su.Getting system information with uname, host name, disk partitions & sizes, users, kernel, installing and removingpackages with rpm command.	9	5

Reference Books:															
1. The Design of Unix Operating System, Maurice J. Bach, Pearson Education, 2010															
2. Advance UNIX, a Programmer’s Guide, S. Prata, BPB Publications, and New Delhi, 2011															
3. Unix Concepts and Applications, Sumitabh Das, 2010															
4. The UNIX Programming Environment, B.W. Kernighan & R. Pike, Prentice Hall of India. 2009															
5. Guide to UNIX Using LINUX, Jack Dent Tony Gaddis, Vikas/ Thomson Pub. House Pvt. Ltd. 2010															
e-Learning Source:															
https://nptel.ac.in/courses/117106113															

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	MT206	Title of the Course	Mathematical Analysis	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To understand the concepts of algebraic and transcendental equations Gain basic of numerical integration and solution of ordinary differential equation Understanding the concepts of binomial distribution, poisson distribution and normal distribution.						

Course Outcomes	
CO1	Define normalization and state its consequences.
CO2	Explain various methods of numerical analysis
CO3	Demonstrate integral transformation of an equation using Fourier transformation.
CO4	Analyze correlation and regression of a coefficient.
CO5	Compare Euler's Method and Modified Euler's Method

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Errors	Error and their analysis, Computer Arithmetic, Floating-Point Number Operation, Normalization & their consequences. Statistics: Correlation and Regression analysis, Binomial Distribution, Poisson Distribution, Normal Distribution.	8	1
2	Algebraic & Transcendental Equations	Bisection Method, Iteration Method, False Position Method, Secant method, Newton-Raphson Method, LinBairstow's Method. Rate of Convergence of Methods. Solution of system of linear equations by LU decomposition method and Gauss Seidel Method.	8	2
3	Interpolation	Finite differences, Newton's forward & backward Formula, Gauss, Stirling and Bessel's Formula for Equal Interval. Lagrange's Formula and Newton's Divided Difference Formula for Unequal Interval, Numerical Differentiation.	8	3
4	Numerical Integration & Solution of Ordinary Differential Equations	Numerical Integration by Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Boole's & Weddle's Rule, Euler-Maclaurin's Formula. Taylor's Series Method, Euler's Method, Modified Euler's Method, Runge-Kutta Method.	8	4
5	Integral Transform & Complex Analysis	Introduction to Fourier Transform, Sine and Cosine transforms, Z-transform. Analytic functions, C-R equations and harmonic functions, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Conformal mapping and bilinear transformations..	8	5

Reference Books:															
1. Sastry, Introductory method of Numerical Analysis, PHI															
2. Balaguruswamy, Numerical method, TMH															
3. Jain, Iyengar, Jain, Numerical Methods for Scientific & Engineering Computations, New Age International															
4. P. Kandasamy, Numerical methods, S. Chand & Company															
5. H.K. Dass, Advanced Engineering Mathematics, S. Chand & Company															
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Pub.															
e-Learning Source:															

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS244	Title of the Course	Network Security Basics	L	T	P	C
Year	II	Semester	IV	3	1	0	4
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications and Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.						

Course Outcomes	
CO1	Analyze your exposure to security threats
CO2	Protect your organization's systems and data
CO3	Deploy firewalls and data encryption to minimize threats
CO4	Assess alternative user and host authentication mechanisms
CO5	Manage risks originating from inside the organization and the internet

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Network Security	Perimeter Security - Overview of Network Security, Access Control, Device Security, Security features on Switches, Firewall, Types of firewall, Attack vector and Mitigation techniques; Access Management - Securing Management Access, Multifactor Authentication, Layer 2 Access Control, Wireless LAN (WLAN) Security and Network Admission Control (NAC).	9	1
2	Threats, Vulnerabilities and Attacks	Threat; Vulnerabilities – vulnerability assessment and vulnerability scanning; Attacks – Application Attack, Network Attack and Mitigating & Deterring Attacks; Network Security – Security through network devices, Security through Network Technologies and Security through Network Design Elements; Administering a Secure Network – Network Administrative Principles and Securing Network Application.	8	2
3	Network Security Management	Secure Socket Layer (SSL) – Introduction to SSL, Open SSL basics, Problems with SSL, Cryptography, Message Digits Algorithms, Digital Signature and Public Key Infrastructure (PKI); Data Privacy – IPsec VPN, Dynamic Multipoint VPN (DMVPN), Group Encrypted Transport VPN (GET VPN), Secure Sockets Layer VPN (SSL VPN) and Multiprotocol Label Switching VPN (MPLS VPN).	9	3
4	Network Security Controls	Network Intrusion Prevention – Overview of Intrusion Prevention System (IPS), Intrusion Detection System (IDS), Deploying IPS and IPS High Availability; Host Intrusion Prevention; Anomaly Detection and Mitigation.	8	4
5	Network Management	Security Monitoring and correlation; Security Management - Security and Policy Management and Security Framework and Regulatory Compliance; Best Practices Framework, Case Studies.	6	5

Reference Books:	
1.	Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole
2.	Network Security Bible by Eric Cole
e-Learning Source:	
https://archive.nptel.ac.in/courses/106/105/106105162/	

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

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



Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS242	Title of the Course	Relational Database Management Systems	L	T	P	C
Year	II	Semester	IV	2	1	0	3
Pre-Requisite	None	Co-requisite	None				
Course Objectives	The objective of this course is to expose the students to the fundamentals & basic concepts in relational Data Base Management Systems. This course discusses architecture of Database Systems with concept of relational model & ER model. This course explains techniques for database design, Normalization and database recovery and protection.						

Course Outcomes	
CO1	Define the conceptual frameworks and definitions of specific terms that are integral to the Relational Database Management Systems
CO2	Demonstrate an understanding of the elementary & advanced features of DBMS & RDBMS
CO3	Evaluate options to make informed decisions that meet data storage, processing, and retrieval needs
CO4	Analyze normalized database that meets business requirements using industry standards and best practices

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Purpose of Database System -- Views of data – Data Models – Database Languages – Database System Architecture– Database users and Administrator – Entity– Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases.	5	1
2	Relational Model	The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations- SQL fundamentals Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables. Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data from Tables in SQL, Manipulation Data in SQL. Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause, Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating and managing User Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL- Missing Information–Views – Introduction to Distributed Databases and Client/Server Databases.	13	2
3	Database Design	Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce Codd Normal Form-Multi-valued Dependencies and Fourth Normal Form –Join Dependencies and Fifth Normal Form.	7	3
4	Transactions	Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery – Concurrency – Need for Concurrency – Locking Protocols –Two Phase Locking – Intent Locking – Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.	11	4

Reference Books:	
1.	Milan Milenkovic - Operating Systems – TATA McGraw hILL, 2009.
2.	Operating Systems Fundamentals D. Irtegov, 2005Python: Essential Reference, by David M. Beazley
3.	A Short Introduction to Operating Systems (M. Burgess), 2010
4.	Operating Systems: Design and Implementation (Second Edition), Andrew S. Tanenbaum, 2010
e-Learning Source:	
https://archive.nptel.ac.in/courses/106/105/106105175/	

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

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



Integral University, Lucknow

Effective from Session: 2018							
Course Code	CS-241	Title of the Course	Desktop Operating System Lab	L	T	P	C
Year	II	Semester	IV	0	0	2	1
Pre-Requisite	None	Co-requisite	None				
Course Objectives	Student will be able to understand the basic components of a computer operating system, and the interactions among the various components. The course will cover an introduction on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.						

Course Outcomes	
CO1	Describe and explain the fundamental components of a windows operating system
CO2	Learn to do file processing, process management, storage backup, account management etc.
CO3	Demonstrate the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems
CO4	Analyze the application of windows administrative features available to make system secure and easy to use.
CO5	Explain mobile computing and demonstrate remote access in windows.

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Installing Windows 10 <ul style="list-style-type: none"> Upgrading Windows 7 to Windows 10 Migrating User Settings 	2	1
2	Configuring Windows 10 <ul style="list-style-type: none"> Using the Settings App Using Control Panel Using Windows PowerShell Using GPOs 	2	1
3	Configuring Network Connectivity <ul style="list-style-type: none"> Verifying and Testing IPv4 Settings Configuring Automatic IPv4 Settings Configuring and Testing Name Resolution 	2	2
4	Managing Storage <ul style="list-style-type: none"> Adding a Disk Creating a Simple Volume Compressing a Folder Enabling Disk Quotas Creating a Storage Space 	2	2
5	Configuring and Managing Permissions and Shares <ul style="list-style-type: none"> Creating, Managing, and Sharing a Folder Using Conditions to Control Access and Effective Permissions 	2	3
6	Installing and managing a printer <ul style="list-style-type: none"> Managing and using a printer 	2	3
7	Managing Data Security <ul style="list-style-type: none"> Using EFS Using BitLocker 	2	4
8	Managing Device Security <ul style="list-style-type: none"> Creating Security Policies Testing Security Policies Configuring UAC Prompts Configuring and Testing AppLocker 	2	4

Reference Books:
5. Milan Milenkovic - Operating Systems – TATA McGraw hILL, 2009.
6. Operating Systems Fundamentals D. Irtegov, 2005 Python: Essential Reference, by David M. Beazley

7. AShort Introduction to Operating Systems (M. Burgess), 2010

8. Operating Systems: Design and Implementation (Second Edition)., Andrew S. Tanenbaum, 2010

e-Learning Source:

<https://archive.nptel.ac.in/courses/106/105/106105214/>

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

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



Integral University, Lucknow

Effective from Session: 2018							
Course Code	CS247	Title of the Course	Enterprise Network Engineering Lab	L	T	P	C
Year	II	Semester	IV	0	0	2	1
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To provide an in-depth view of the advanced technologies used in enterprise-wide computer networks, provide the theoretical foundation and practical skills of advanced computer networks for many other relevant topics, such as distributed computing.						

Course Outcomes	
CO1	Analyze state-of-the-art real-world enterprise-wide networks.
CO2	Design build, and implement advanced enterprise-wide computer networks;
CO3	Manage configure, troubleshoot, and maintain typical enterprise-wide computer networks
CO4	Introduce both theoretical, practical, and technical issues in enterprise-wide computer networks
CO5	Introduction device security and network address translation

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Executing of Switch Configuration - Basic Commands	2	1
2	Recognize Switch Configuration - Switch Port Security	2	1
3	Schematize Router - Configuration	2	2
4	Demonstrate Configuration of IP Address for a Router	2	3
5	Classify Setting up of Passwords	2	3
6	Compare PPP Encapsulation, PPP PAP Authentication, PPP CHAP Authentication	2	2
7	Differentiate Configuration of Static and Dynamic Routing	2	2
8	Analyse Configuration of Default Route	2	4
9	Execute Implementation of EIGRP	2	4
10	Execute Implementation of OSPF	2	4
11	Interpret VLAN Configuration	2	4
12	Show Switch Troubleshooting	2	5
13	Justify Configuration of Access-lists - Standard & Extended ACLs	2	5
14	Analyse Cisco Discovery Protocol	2	4
15	Illustrate DHCP, DHCP Relay & DHCP Exclusions	2	4
16	Demonstrate Configuring Logging to a Remote Syslog Server	2	5

Reference Books:	
5.	CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011
6.	CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback), Pearson, 2013
7.	Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008
8.	CCNA Exploration Course Booklet : Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010
e-Learning Source:	

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

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

CO1	3	3	2									3	3	3	
CO2	3	3	2	1	2							3	3	3	
CO3	3	3	2	2	2							3	3	2	2
CO4	3	2	3	2	2							2	3		1
CO5	3	3	1	3	1								3	2	1

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



Integral University, Lucknow

Effective from Session: 2018							
Course Code	CS-245	Title of the Course	Network Security Basics Lab	L	T	P	C
Year	II	Semester	IV	0	0	2	1
Pre-Requisite	None	Co-requisite	None				
Course Objectives	To Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications and Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.						

Course Outcomes	
CO1	Analyze your exposure to security threats
CO2	Protect your organization's systems and data
CO3	Deploy firewalls and data encryption to minimize threats
CO4	Assess alternative user and host authentication mechanisms
CO5	Manage risks originating from inside the organization and the internet

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Firewall Configuration - I	2	1
2	Firewall Configuration - II	2	1
3	VPN Configuration - I	2	3
4	VPN Configuration - II	2	3
5	IDS Configuration - I	2	4
6	IDS Configuration - II	2	4
7	IDS Configuration - III	2	4
8	Router Security - I	2	4
9	Router Security - II	2	4
10	Router Security - III	2	4
11	Traffic Monitoring using WireShark - I	2	5
12	Traffic Monitoring using WireShark – II	2	5

Reference Books:
3. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole
4. Network Security Bible by Eric Cole
e-Learning Source:

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

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



Integral University, Lucknow

Effective from Session: 2018							
Course Code	CS-243	Title of the Course	Relational Database Management Systems Lab	L	T	P	C
Year	II	Semester	IV	0	0	2	1
Pre-Requisite	None	Co-requisite	None				
Course Objectives	The objective of this course is to expose the students to the fundamentals & basic concepts in relational Data Base Management Systems. This course discusses architecture of Database Systems with concept of relational model & ER model. This course explains techniques for database design, Normalization and database recovery and protection.						

Course Outcomes	
CO1	Define the conceptual frameworks and definitions of specific terms that are integral to the Relational Database Management Systems
CO2	Demonstrate an understanding of the elementary & advanced features of DBMS & RDBMS
CO3	Evaluate options to make informed decisions that meet data storage, processing, and retrieval needs
CO4	Analyze normalized database that meets business requirements using industry standards and best practices
CO5	Design and documents data structures incorporating integrity constraints to satisfy business rules by applying the relational model

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Create User in Oracle Database and grant and revoke the privileges and use of commitsavepointrollback command.	2	1
2	Create the following: <ul style="list-style-type: none"> • Synonym sequences and Index • Create alter and update views. 	2	1
3	Create PL/SQL program using cursors, control structure, exception handling	2	2
4	Create following: <ul style="list-style-type: none"> • Simple Triggers • Package using procedures and functions. 	2	2
5	Create the table for <ul style="list-style-type: none"> • COMPANY database • STUDENT database and insert five records for each attribute. 	2	2
6	Illustrate the use of SELECT statement	2	2
7	Conditional retrieval - WHERE clause	2	3
8	Query sorted - ORDER BY clause	2	3
9	Perform following: <ul style="list-style-type: none"> • UNION, INTERSECTION and MINUS operations on tables. • UPDATE, ALTER, DELETE, DROP operations on tables 	2	3
10	Query multiple tables using JOIN operation.	2	3
11	Grouping the result of query - GROUP BY clause and HAVING clause	2	3
12	Query multiple tables using NATURAL and OUTER JOIN operation.	2	3

Reference Books:	
5.	Milan Milenkovic - Operating Systems – TATA McGraw hILL, 2009.
6.	Operating Systems Fundamentals D. Irtegov, 2005Python: Essential Reference, by David M. Beazley
7.	A Short Introduction to Operating Systems (M. Burgess), 2010
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CO2	3	3	2	1								3	3	1	
CO3	3	3	2	2	2							3	2	2	2
CO4	3	2	3	2	2							2	3		2
CO5	3	2	3									2	2		

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