

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)



Second Year B. Tech. Computer Engineering
2021 Pattern

Curriculum

(Second Year B. Tech. Sem-III & IV with effect from Academic Year
2022-2023)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist.
Ahmednagar, Maharashtra State, India PIN 423603

Sanjivani College of Engineering, Kopergaon

(An Autonomous Institute affiliated to SPPU, Pune)

D E C L A R A T I O N

We, the Board of Studies (Computer Engineering), hereby declare that, we have designed the Curriculum of Second Year Computer Engineering Program Curriculum Structure and Syllabus for semester III & IV of Pattern 2021 w.e.f. from A.Y 2022-23 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

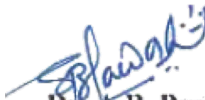
Submitted by



(Dr. D. B. Kshirsagar)

BoS Chairman

Approved by



Dr. A.B. Pawar
Dean Academics



Director
Sanjivani College of Engineering,
Kopergaon
Director

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute)

Department of Computer Engineering

COURSE STRUCTURE- 2021 PATTERN

SECOND YEAR B. TECH: COMPUTER ENGINEERING (A.Y.2022-23)

LIST OF ABBREVIATIONS			
Abbreviation	Full Form	Abbreviation	Full Form
ESC	Engineering Science courses	HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core courses	CA	Continuous Assessment
PEC	Professional Elective courses	OR	End Semester Oral Examination
OEC	Open Elective courses	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PROJ	Project	MLC	Mandatory Learning Course
LC	Laboratory course	L	Lecture
T	Tutorial	P	Practical
Cat	Category	NC	Non-Credit

SEMESTER-III

Cat.	Code	Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks					
			L (hrs)	T (hrs)	P (hrs)		Theory		Practical			Grand Total
							CIA	ESE	TW	OR	PR	
PCC	CO201	Discrete Mathematics	3	1	-	4	40	60	-	-	-	100
PCC	CO202	Object Oriented Programming	4	-	-	4	40	60	-	-	-	100
PCC	CO203	Digital Electronics and Data Communication	4	-	-	4	40	60	-	-	-	100
PCC	CO204	Computer Organization and Architecture	3	-	-	3	40	60	-	-	-	100
HSMC	HS205	Universal Human Values and Ethics	3	-	-	3	40	60	-	-	-	100
LC	CO206	Object Oriented Programming Language Laboratory	-	-	4	2	-	-	50	-	50	100
LC	CO207	Digital Electronics Laboratory	-	-	2	1	-	-	-	-	50	50
LC	CO208	Choice Based Course	-	-	2	1	-	-	-	50	-	50
MLC	MC209	Mandatory Learning Course – III	1	-	-	NC	-	-	-	-	-	Pass/Fail
		Total	18	1	8	22	300	200	50	50	100	700

Choice Based Course: 1. Web Development Using HTML & Java Script 2. Core Java 3. Application Development using Python

MC209	Mandatory Course - III	Constitution of India – Basic features and fundamental principles
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Sanjivani College of Engineering, Kopargaon

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Department of Computer Engineering

COURSE STRUCTURE- 2021 PATTERN

SECOND YEAR B. TECH: COMPUTER ENGINEERING (A.Y.2022-23)

SEMESTER-IV

Cat.	Code	Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks					
			L (hrs)	T (hrs)	P (hrs)		Theory		Practical			Grand Total
							CIA	ESE	TW	OR	PR	
BSC	BS202	Engineering Mathematics-III	3	1	-	4	40	60	-	-	-	100
PCC	CO210	Database Management System	3	-	-	3	40	60	-	-	-	100
PCC	CO211	Operating System and Administration	3	-	-	3	40	60	-	-	-	100
PCC	CO212	Advanced Data Structures	4	-	-	4	40	60	-	-	-	100
PCC	CO213	Software Engineering	3			3	40	60				100
LC	CO214	Advanced Data Structures Laboratory	-	-	2	1	-	-	-	-	50	50
LC	CO215	Operating System and Administration Laboratory	-	-	2	1	-	-	25	-	-	25
LC	CO216	Database Management System Laboratory	-	-	2	1	-	-	-	-	50	50
HSMC	HS216	Corporate Readiness-I	1	-		1	-	-	50	-	-	50
PROJ	CO217	Mini Project	-	-	2	1	-	-	25	-	-	25
MLC	MC218	Mandatory Learning Course – IV	1	-	-	NC		-	-	-	-	Pass/Fail
Total			18	1	8	22	300	200	100	-	100	700

MC218	Mandatory Learning Course - IV	Innovation - Project based – Sci., Tech, Social, Design & Innovation
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SEMESTER III

CO201: Discrete Mathematics		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	Continuous Internal Assessment:	40 Marks
Tutorial: 1 Hrs./ Week	End-Sem Exam:	60 Marks
Credits: 4	Total	100 Marks

Prerequisite: Basic Mathematics

Course Objectives:

1. To understand the set theory & propositional logic.
2. To know about relation and function.
3. To study how to model the problem using graph theory.
4. To study the concept of trees & algorithms for the construction of the tree.
5. To study how to apply the algebraic systems in coding theory.
6. To learn & understand the significance of number theory.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
1. Design and analyze real world engineering problems by applying the set theory, propositional logic and to construct proof using mathematical induction.	4	Analyze
2. Specify, manipulate and apply relations, construct and use the funtions and apply these concepts to solve the mapping problems.	3	Apply
3. Model and solve the computing problems using graph theory by applying appropriate algorithm.	3	Apply
4. Analyze the problems in computer science and represent them in hierarchical structure namely trees to find the solution by applying appropriate algorithms.	4	Analyze
5. Analyze the properties of the binary operations and apply the algebra in coding theory and evaluate the algebraic structures.	4	Analyze
6. Understand the significance of number theory and associate it with cryptography.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	2	2	2	2	2
CO2	3	3	2	2	-	-	-	-	-	-	2	2	2	2	-
CO3	3	3	3	3	2	-	-	-	-	-	2	2	2	2	2
CO4	3	3	3	3	2	-	-	-	-	-	2	2	2	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	2	2	2	-
CO6	3	2	2	2	-	-	-	-	-	-	-	2	2	2	-

COURSE CONTENTS

Unit I	SET THEORY AND LOGIC	No. of Hours	COs
	Significance of Discrete Mathematics in Computer Engineering, Sets– Need of Sets, Representation of Sets, Set Operations, Venn diagram, cardinality of set, principle of inclusion and exclusion, Types of Sets –Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets. Introduction to bounded and unbounded sets and multiset, power set, Subset, Universal Set, Empty Set, Power Set. Propositional Logic-logic, Propositional Equivalences, Application of Propositional logic-translating English Sentences, Proof by Mathematical Induction.	8	1
Unit II	RELATION AND FUNCTIONS	No. of Hours	COs
	Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings, partitions, Hasse Diagram, Lattices, Chains and Anti-Chains, Transitive Closure and Warshall's Algorithm, n-Ary Relations and their Applications. Functions- Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Functions, The Pigeonhole Principle.	8	2

Unit III	GRAPH THEORY	No. of Hours	COs
	Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Single source shortest path- Dijkstra's Algorithm, Planar Graphs, Regular graph, Bipartite graph, Euler's graph Graph Colouring. Case Study- Web Graph, Google map	6	3
Unit IV	TREES	No. of Hours	COs
	Introduction, properties of trees, Binary search tree, decision tree, prefix codes and Huffman coding, cut sets, Spanning Trees and Minimum Spanning Tree, Kruskal's and Prim's algorithms, The Max flow- Min Cut Theorem (Transport network). Case Study- Game Tree, Mini-Max Tree.	6	4
Unit V	ALGEBRAIC STRUCTURES AND CODING THEORY	No. of Hours	COs
	The structure of algebra, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups, and congruence relations, Rings, Integral Domains and Fields, coding theory, Polynomial Rings and polynomial Codes, error correction & detection code. Case Study- Brief introduction to Galois Theory –Field Theory and Group Theory.	6	5
Unit VI	NUMBER THEORY	No. of Hours	COs
	Introduction, Basic Properties of Integers, Division Greatest common divisor, Euclidean Algorithm, Least common Multiple, Congruence Relation, Properties of congruence relation, Congruence Arithmetics, Residue or Congruence classes, Properties of Residue Classes, Arithmetic of Residue Classes, Congruence Equation, Linear Congruence Equation, Simultaneous linear Congruence, Application of Congruence: Hash function, cryptography.	6	6
Books:			
Text Books(T):			
T1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, ISBN978-0-07-288008-3, 7 th Edition.			
T2. C. L. Liu, "Elements of Discrete Mathematics," TMH, ISBN 10:0-07-066913-9.			
Reference Books(R):			
R1. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures", Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.			
R2. N. Biggs, "Discrete Mathematics", 3rd Edition, Oxford University Press, ISBN 0 –19850717			

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R3. Dr. K. D. Joshi, “Foundations of Discrete Mathematics”, New Age International Limited, Publishers, January 1996, ISBN: 8122408265, 9788122408263.

R4. Seymour Lipschutz and Marc Lars Lipson “Discrete Mathematics”, 3rd Special, Indian Edition, ISBN-13: 978-0-07-060174-1

R5. DeoNarsingh, “Graph theory with applications to Engineering & Computer Science”, Prentice Hall of India Pvt. Ltd., 2000

E-Resources(E):

https://onlinecourses.nptel.ac.in/noc23_cs22/preview

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CO202: Object Oriented Programming

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs. / Week	Continuous Internal Assessment:	40 Marks
Credits: 4	End-Sem Exam:	60 Marks
	Total:	100 Marks

Prerequisite Course: Fundamental concept of C Language

Course Objectives:

1. To explore the basic principles of Object Oriented Programming.
2. To study the concepts of operator overloading and Inheritance.
3. To learn the concept of polymorphism and virtual function.
4. To understand the concept of Template and Exception Handling.
5. To learn the concept of file handling.
6. To learn and understand the concepts of Standard Template Library.

Course Outcomes (COs): On completion of the course, students will be able to-

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
1. Describe the basics of object oriented programming	2	Understand
2. Understand the concept of Operator overloading and inheritance	2	Understand
3. Demonstrate the use of Polymorphism and virtual function	3	Apply
4. Use the concept of Template and Exception Handling in program development	3	Apply
5. Examine the OOP system using File handling in C++	4	Analyse
6. Implement programming application using Standard Template Library	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	3	2	2	-	-	-	-	-	3	-	2	-	3
CO 2	2	2	3	2	2	-	-	-	-	-	3	-	2	-	3
CO 3	2	2	3	2	2	-	-	-	-	-	3	-	2	-	3
CO 4	2	2	3	2	2	-	-	-	-	-	3	-	3	-	3
CO 5	2	2	3	2	2	-	-	-	-	-	3	-	2	-	3
CO 6	2	2	3	2	2	-	-	-	-	-	3	-	2	-	3

COURSE CONTENTS

Unit I	FUNDAMENTALS OF OOP	No. of Hours	COs
	<p>Introduction to procedural, modular, object-oriented and generic programming techniques, Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, C++ as object oriented programming language.</p> <p>C++ Programming- C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, class scope and accessing class members, controlling access to members.</p> <p>Functions- Function, function prototype, accessing function and utility function, Constructors and destructors, Objects and Memory requirements, Static Class members, data abstraction and information hiding, inline function.</p>	8	1
Unit II	OVERLOADING AND INHERITANCE	No. of Hours	COs
	Operator Overloading- Concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit	8	2

	and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and mutable. Function overloading Inheritance- Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Class Hierarchies, Inheritance, Public and Private Inheritance, Types of Inheritance, Ambiguity in Multiple Inheritance, Virtual Base Class, Classes Within Classes.		
Unit III	POLYMORPHISM AND VIRTUAL FUNCTION	No. of Hours	COs
	Polymorphism- Concept, abstract classes, polymorphism. , Overriding Member Functions Virtual Function-Pointers- indirection Operators, Memory Management: new and delete, Pointers to Objects, accessing Arrays using pointers, Function pointers, Pointers to Pointers, Smart pointers, Shared pointers. This Pointer, Virtual function, Rules of Virtual functions, dynamic binding, pure virtual function, Virtual destructor. Overloading and Overriding concept.	7	3
Unit IV	TEMPLATES AND EXCEPTION HANDLING	No. of Hours	COs
	Templates- function templates, Overloading Function templates, class templates, class template and Nontype parameters, template and inheritance, Applying Generic Function, Generic Classes, The type name and export keywords, The Power of Templates. Exception Handling- Fundamentals, other error handling techniques, simple exception handling- Divide by Zero, throwing an exception, exception specifications, processing unexpected exceptions, constructor, destructor and exception handling,	7	4
Unit V	FILES AND STREAMS	No. of Hours	COs
	Data hierarchy, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments.	7	5

Unit VI	STANDARD TEMPLATE LIBRARY (STL)	No. of Hours	COs
	Introduction to STL, Containers, algorithms and iterators, Containers- Sequence container and associative containers, container adapters, Algorithms- basic searching and sorting algorithms, min-max algorithm, set operations, heap sort, Iterators- input, output, forward, bidirectional and random access.	7	6
Books:			
Text Books(T):			
T1. Bjarne Stroustrup, “The C++ Programming language”, Third edition, Pearson Education. ISBN 9780201889543. T2. Deitel, “C++ How to Program”, 4th Edition, Pearson Education, ISBN:81-297-0276-2 T3. E Balgurusamy, “Object Oriented Programming with C++”, 4 th Edition, Tata McGraw-Hill, ISBN-13:978-0-07-066907-9			
Reference Books(R):			
R1. Robert Lafore, —Object-Oriented Programming in C++I, fourth edition, Sams Publishing, ISBN:0672323087 (ISBN 13: 9780672323089) R2. Herbert Schildt, —C++ The complete referenceII, Eighth Edition, McGraw Hill Professional, 2011, ISBN:978-00-72226805 R3. Cox Brad, Andrew J. Novobilski, —Object –Oriented Programming: An Evolutionary ApproachII, Second Edition, Addison–Wesley, ISBN:13:978-020-1548341			
E-Resources(E):			
https://onlinecourses.nptel.ac.in/noc23_cs50/preview https://onlinecourses.nptel.ac.in/noc23_cs46/preview			

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CO203: Digital Electronics and Data Communication		
Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs. / Week	Continuous Internal Assessment:	40 Marks
Credits: 4	End-Sem Exam:	60 Marks
	Total:	100 Marks

Prerequisite Course: Basics of Electronic Engineering

Course Objectives:

1. To understand procedure of Logic Minimization.
2. To study combinational circuits.
3. To study sequential circuit.
4. To learn different signal modulation techniques.
5. To understand basics of data communication.

Course Outcomes (COs): On completion of the course, students will be able to-

Course Outcomes	Blooms Taxonomy	
	Level	Descriptor
1. Apply acquired knowledge to Logic Minimization Problem.	3	Apply
2. Develop circuit diagram for given specification of Combinational circuits.	3	Apply
3. Develop circuit diagram for given specification of Sequential circuits.	3	Apply
4. Compare types of signals (Analog and Digital) and Illustrate different types of signal modulation techniques.	2	Understand
5. Explain basics of data communication and Compare various transmission medium.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

COURSE CONTENTS

Unit I	LOGIC MINIMIZATION	No. of Hours	COs
	<p>Logic gates: NOT , AND , OR , NAND , NOR, EX-OR, EX-NOR</p> <p>Boolean Function Representation: Sum of Product (SOP) and Product of Sum (POS) form of Boolean expression, Standard SOP and POS form.</p> <p>Minimization Technique: K-map representation of Logical function, Simplification of Logical function using K-map. Minimization of SOP forms using K- Map, Minimization of POS forms using K-Map, Don't Care Condition, and Implementation of circuits using Universal gates.</p> <p>Codes: Binary code, BCD code, Excess-3 code, Gray code, Alphanumeric code, Error Detecting and Correcting code</p>	8	1
Unit II	COMBINATIONAL LOGIC DESIGN	No. of Hours	COs
	<p>Introduction, Adder: Half and Full Adder, Subtractor: Half subtractor, Full Subtractor, Parallel Adder, Look ahead carry adder, BCD Adder, 4-bit Subtractor, Code Converters.</p> <p>Multiplexer: Design examples using Multiplexer IC 74151, Multiplexer Tree.</p> <p>Demultiplexer: Design examples using Demultiplexer, Demultiplexer Tree.</p> <p>Comparator: One and Two bit Comparator, IC 7485.</p> <p>Encoder, Priority Encoder, Decoder, Case Study (Any one): IC 74181 (ALU), BCD to 7-Segment display controller, Calender Subsystem</p>	9	1, 2

Unit III	SEQUENTIAL CIRCUIT DESIGN-1	No. of Hours	COs
	Flip Flop: 1 bit memory cell, clocked S-R FF, J-K FF, race around condition, M/S J-K FF, D and T FF, Excitation table, flip-flop conversion. Counter: Asynchronous and Synchronous Counters, Design of Asynchronous counter, Modulus Asynchronous Counters, IC 7490, Design of Synchronous Counter, Modulus Synchronous Counter, Case Study: Security Monitoring System	9	3
Unit IV	SEQUENTIAL CIRCUIT DESIGN-2	No. of Hours	COs
	Shift Register: Shift Registers: SISO, SIPO, PIPO, PISO, Bidirectional Shift Register, Universal Shift Register, Ring and twisted ring/Johnson Counter. Moore / Mealy Machine: Representation techniques, state diagrams, state tables, state reduction, state assignment, Implementation using flip-flops. Design of Sequence Generator and Detector.	9	3
Unit V	SIGNALS	No. of Hours	COs
	Signals, Classification of signals, Digital transmission- Analog to digital conversion(ADC)-PCM, Delta modulation, Digital to Digital conversion-line coding, Block Coding, Scrambling, Analog to Analog Conversion-AM, FM, PM	8	4
Unit VI	DATA COMMUNICATION	No. of Hours	COs
	Introduction to Data Communication, Baseband, Broadband, Carrier Communication, Baud rate, Bit rate, SNR, Channel Bandwidth. Transmission Media: Guided media- Twisted pair, Coaxial, Fiber Optic Cable Unguided Media-Electromagnetic Spectrum FHSS, DSS	8	5
Books:			
Text Books(T):			
T1. Jain R.P., "Modern Digital Electronics", 4 th ed. Tata McGraw-Hill Education, ISBN-13: 978-0-07-066911-6. T2. Forouzan B. A., "Data Communications and Networking", 5 th ed. Mc Graw Hill, ISBN 13-978-0-07-063414-5.			

Reference Books(R):
R1.Tocci R.J., Widmer N.S., Moss G.L., “Digital systems: principles and applications”, 8 th ed. Prentice Hall,ISBN-978-0-13-700510-9
R2. Leach D.P., Malvino A.P., Saha G., “Digital Principles and Applications”, 8 th ed. Tata McGraw-Hill. ISBN 978-0-07-060175-8.
R3.J. Crowe, Barrie Hayes-Gill, “Introduction to Digital Electronics”, Butterworth-Heinemann, 1998, 978-0-34-064570-3
R4.Wayne Tomasi, “Introduction to Data communication and Networking”, 8th ed. Pearson Education. ISBN 9788131709306
E-Resources(E):
https://onlinecourses.nptel.ac.in/noc23_ee50/preview
https://onlinecourses.nptel.ac.in/noc23_ee73/preview

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CO204: Computer Organization and Architecture		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	Continuous Internal Assessment:	40 Marks
Credits: 3	End-Sem Exam:	60 Marks
	Total:	100 Marks

Prerequisite Course: Digital Electronics, Computer Fundamentals and Programming.

Course Objectives:

1. To understand the basic structure and operation of a digital computer.
2. To learn implementation of fixed-point operations and representation of floating-point numbers.
3. To understand processor organization and pipeline architecture.
4. To learn the hierarchical memory system including cache memories and virtual memory.
5. To study RISC architecture.
6. To study CISC architecture and superscalar architecture.

Course Outcomes (COs): On completion of the course, students will be able to-

Course Outcome(s)	Bloom's Taxonomy	
	Level	Descriptor
1. Illustrate the basic structure of the computer system.	2	Understand
2. Apply / Identify arithmetic algorithms for solving ALU operations.	3	Apply
3. Illustrate processor organization and pipeline architecture.	2	Understand
4. Classify memory architecture and apply mapping techniques for cache memory.	3	Apply
5. Explain RISC architecture.	2	Understand
6. Explain and Compare CISC with RISC architecture and describe superscalar architecture.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	3	1	-
CO3	1	-	1	-	-	-	-	-	-	-	-	-	1	1	-
CO4	1	-	1	-	-	-	-	-	-	-	-	-	1	1	-
CO5	1	-	1	-	-	-	-	-	-	-	-	-	1	2	-
CO6	1	-	1	-	-	-	-	-	-	-	-	-	1	2	-

COURSE CONTENTS

Unit I	INTRODUCTION	No. of Hours	COs
	Overview of Computer Architecture & Organization Basic organization of Computer. A top-level view of Computer function and interconnection: Computer Components, Computer Function, Interconnection structure, Von Neumann model, Harvard Architecture.	6	1
Unit II	ARITHMETIC OPERATIONS	No. of Hours	COs
	Data Representation and Arithmetic Algorithms: Integer Data computation- Addition, Subtraction, Multiplication: unsigned multiplication, Booth's algorithm, Division of integers: Restoring and Non-restoring algorithm Floating point representation: IEEE 754 floating point number representation.	7	2
Unit III	PROCESSOR ORGANIZATION	No. of Hours	COs
	Processor Organization, Register Organization, Case Study- Microprocessor 8086, Instruction formats, addressing modes, instruction cycle, Performance measures: CPI, speed up, efficiency, throughput Instruction Pipelining- Pipelining strategy, pipeline performance, Data dependencies, data hazards, branch hazards,	7	3

Unit IV	MEMORY ORGANIZATION	No. of Hours	COs
	Classifications of primary and secondary memories. Characteristics of memory, Memory hierarchy: cost and performance measurement. Virtual Memory: Concept, Segmentation and Paging, Address translation mechanism. Cache Memory: Cache memory Concepts, Locality of reference, design problems based on mapping techniques, Cache Coherency, Write Policies. Introduction to Associative memory and SCM (Storage Class Memory)	7	4
Unit V	RISC PROCESSOR ARCHITECTURE	No. of Hours	COs
	Characteristics of RICS Processor, The Use of Large Register File, Compiler - Based Register Optimization, RISC Pipelining, Case Study: ARM Processor	7	5
Unit VI	CISC PROCESSOR ARCHITECTURE	No. of Hours	COs
	Why CISC, Characteristics of CISC processor, RISC architecture vs CISC architecture, Superscalar Architecture, Features of Superscalar Architecture, Case study: Pentium Processor	7	6
Books:			
Text Books(T):			
T1. W. Stallings, "Computer Organization and Architecture: Designing for performance", 10th Edition, Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4. T2. Zaky S, Hamacher, "Computer Organization", 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5			
Reference Books(R):			
R1. John P Hays, "Computer Architecture and Organization", 3rd Edition, McGraw-Hill Publication, 1998, ISBN:978-1-25-902856-4. R2. A. Tanenbaum, "Structured Computer Organization", 4th Edition, Prentice Hall of India, 1991 ISBN: 81 – 203 – 1553 – 7. R3. Steve Furber, "ARM System On Chip architecture", 2 nd Edition, Pearson, ISBN-10: 8131708403. R4. Patterson and Hennessy, "Computer Organization and Design", 4 th Edition, Morgan Kaufmann Publishers, ISBN 978-0-12-374750-1. R5. C. William Gear, "Computer Organization And Programming: With An Emphasis", 4 th Edition, McGraw-Hill Publication, ISBN-13: 978-0070230491.			
E-Resources(E):			
https://onlinecourses.nptel.ac.in/noc23_cs07/preview			

HS205: Universal Human Values and Professional Ethics		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	Continuous Internal Assessment:	40 Marks
Credits: 3	End-Sem Exam:	60 Marks
	Total:	100 Marks

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Prerequisite Course:

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Course Objectives:

1. To help the students appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity.
2. To elaborate on 'Self exploration' as the process for Value Education
3. To facilitate the understanding of harmony at various levels starting from self and going towards family and society.
4. To elaborate on the salient aspects of harmony in nature and the entire existence
5. To explain how the Right understanding forms the basis of Universal human values and definitiveness of Ethical human conduct.
6. To provide the vision for a holistic way of living and facilitate transition from chaotic life to an orderly life.

Course Outcomes (COs):

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

Course Outcomes	Blooms Taxonomy	
	Level	Descriptor
1. Recognize the concept of self-exploration as the process of value education.	1	Remember
2. Interpret the human being as the coexistence of Self and Body.	2	Understand
3. Explain relationship between oneSelf and the other Self as the essential part of relationship and harmony in the family	2	Understand
4. Explain the goal of human beings living in the society, the system required to achieve the human goal and the scope of this system.	2	Understand
5. Interpret the interconnectedness, harmony and mutual fulfilment inherent in the nature and the entire existence	2	Understand
6. Draw ethical conclusions in the light of Right understanding facilitating the development of holistic technologies, production systems and management models	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HS 205.1	-	-	-	-	-	2	-	3	2	1	-	3
HS 205.2	-	-	-	-	-	2	-	3	2	1	-	3
HS 205.3	-	-	-	-	-	3	2	3	3	1	-	3
HS 205.4	-	-	-	-	-	3	2	3	3	1	-	3
HS 205.5	-	-	-	-	-	3	2	3	3	1	-	3
HS 205.6	-	-	-	-	-	3	2	3	3	1	-	3

COURSE CONTENTS

UNIT-I	INTRODUCTION TO VALUE EDUCATION	No. of Hours	COs
	Value education and Skill education; Priority of values over skills; Implications of Value education; Self-exploration as the process for Value education; Basic human aspirations and their fulfillment; Understanding Happiness and Prosperity-Their continuity and programme for fulfilment	06	HS 205.1
UNIT-II	HARMONY IN THE HUMAN BEING	No. of Hours	COs
	Understanding Human being as the coexistence of self and the body; Discrimination between the needs of the self and the body; The body as an instrument; Harmony in the self; Harmony of the self with the body	06	HS 205.2
UNIT-III	HARMONY IN THE FAMILY	No. of Hours	Cos
	Family as the basic unit of human interaction; Understanding relationship; Feelings in relationship; Right feeling; Role of physical facility in fulfilment of relationship; Response and reaction in behaviour; Understanding Justice	06	HS 205.3
UNIT-IV	HARMONY IN THE SOCIETY	No. of Hours	Cos
	Understanding Human Goal; Human Order; Dimensions of Human Order; Professions in a human society; World Family Order; Harmony from Family Order to World Family Order	06	HS 205.4
UNIT-V	HARMONY IN THE NATURE AND EXISTENCE	No. of Hours	COs

	Nature as a collection of units; Classification of units into four orders; Interconnectedness and mutual fulfillment among the four orders; Significance of Education – Sanskar for human order; Existence as units in space; Understanding submergence; Material and consciousness units; Expression of coexistence at different levels; Role of human being in existence	06	HS 205.5
UNIT-VI	RIGHT UNDERSTANDING IN LIFE AND PROFESSION	No. of Hours	COs
	Universal Human Values and Ethical Human Conduct; Professional Ethics in the light of right understanding; Holistic development towards Universal Human Order; Vision for Holistic technologies, Production systems and Management models; Journey towards Universal Human Order	06	HS 205.6
Text Books:			
R. R. Gaur, R. Sangal, G. P. Bagaria, “A Foundation Course in Human Values and Professional Ethics”, Excel Books Pvt. Ltd.			
M. Govindrajan, S. Natarajan, V. S. Senthil Kumar, “Engineering Ethics (including Human Values)”, Eastern Economy Edition, Prentice Hall of India, 2001			
Reference Books:			
1. B. P. Banerjee, “Foundations of Ethics and Management”, Excel Books Pvt. Ltd. 2. P. L. Dhar, R. R. Gaur, “Science and Humanism”, Commonwealth Publishers 3. M. K. Gandhi, “The Story of my Experiments with Truth”, Discovery Publisher			
E-Resources(E):			
http://uhv.org.in/			

Guidelines for Continuous Assessment:

1. Three class tests based on Units I&II, Units III &IV and Units V and VI respectively.
2. One Group activity on entire course.

Considering the specific nature of this course, the methodology is explorational and thus universally adaptable. In order to connect the content of this course with practice, minimum 1 group activity should be conducted with active involvement of the students. 50% of the continuous assessment should be strictly based on the participation of the students in these activities

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CO206: Object Oriented Programming Language Laboratory

Teaching Scheme	Examination Scheme
Lectures: 4 Hrs. / Week	Term Work: 50 Marks
Credits: 2	Practical Exam: 50 Marks
	Total: 100 Marks

Prerequisite Course: Fundamental concept of C Language

Course Objectives:

1. To study basic object oriented programming concept.
2. To learn the operator overloading, Inheritance, virtual function.
3. To understand the exception handling concept.
4. To learn and understand file handling operation.
5. To study STL programming.
6. To get familiar with JAVA basic concept.

Course Outcome (s): On completion of the course, students will be able to-

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
1. Demonstrate the basic object oriented programming concept	3	Apply
2. Apply the concept of operator overloading, Inheritance, virtual function.	3	Apply
3. Illustrate the concept exception handling.	4	Analyse
4. Implement the various file operations.	3	Apply
5. Design the small application using OOP	3	Apply
6. Understand the basic concept of JAVA programming.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	-	2	2	-	-	-	-	-	-	2	-	3	-	2
CO2	3	-	2	2	-	-	-	-	-	-	2	-	3	-	2
CO3	3	-	2	2	-	-	-	-	-	-	2	-	2	-	2
CO4	3	-	2	2	-	-	-	-	-	-	2	-	3	-	2
CO5	3	-	2	3	-	-	-	-	2	-	3	-	3	-	2
CO6	3	-	2	3	-	-	-	-	2	-	3	-	3	-	2

Operating System Recommended: 64-bit Open source Linux or its derivative

Programming tools recommended: - Open Source C++ Programming tool like G++/GCC and jdk 1.8 or above.

Set of suggested assignment list is provided in 4 groups- A, B, C, D. Instructor is suggested to design assignments list by selecting/designing at least 10 suitable Assignments.

4 Assignments from group A, 3 Assignments from group B, 2 from group C, Group D compulsory.

Suggested list of Assignments

Group-A

1. Write a Program to Implement a Class STUDENT having Following Members:

Data members & Member functions, Accept Name of the student, marks of the student to Compute Total, Average to Display the Data.

2. Create a class named weather report that holds a daily weather report with data member's day_of_month, hightemp, lowtemp, amount_rain and amount_snow. The constructor initializes the fields with default values: 99 for day_of_month, 999 for hightemp, -999 for low emp and 0 for amount_rain and amount_snow. Include a function that prompts the user and sets values for each field so that you can override the default values. Write a C++ program that creates a monthly report.

a) Menu driven program with options to Enter data and Display report

b) Report Format

Day	Amt_Rain	Amt_Snow	High_Temp	Low_Temp
Avg				

3. A book shop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book, the sales person inputs the title and author and the system searches the list and displays whether it is available or not. If it is not, an appropriate message is displayed. If it is, then the system displays the book details and requests for the number of copies required. If the requested copies book details and requests for the number of copies required. If the requested copies are available, the total cost of the requested copies is displayed; otherwise the message “Required copies not in stock” is displayed.

Design a system using a class called books with suitable member functions and Constructors. Use new operator in constructors to allocate memory space required. Implement C++ program for the system.

4. Design a C++ Class ‘Complex ‘ with data members for real and imaginary part. Provide default and parameterized constructors. Write a program to perform arithmetic operations of two complex numbers using operator overloading (using either member functions or friend functions).

5. Implement C++ program to implement a base class consisting of the data members such as name of the student, roll number and subject. The derived class consists of the data members subject code ,internal assessment and university examination marks. The program should have the facilities. i) Build a master table ii) List a table iii) Insert a new entry iv) Delete old entry v) Edit an entry vi) Search for a record. Use virtual functions.

Group -B

6. Develop an object oriented program in C++ to create a database of the personnel information system containing the following information: Name, Date of Birth, Blood group, Height, Weight, Insurance Policy number, Contact address, telephone number, driving licence no. etc Construct the database with suitable member functions for initializing and destroying the data viz constructor, default constructor, copy constructor, destructor, static member functions , friend class, this pointer, inline code and dynamic memory allocation operators-new and delete.

7. Create a C++ class named Television that has data members to hold the model number and the screen size in inches, and the price. Member functions include overloaded insertion and extraction operators. If more than four digits are entered for the model, if the screen size is smaller than 12 or greater than 70 inches, or if the price is negative or over \$5000 then throw an integer. Write a main() function that instantiates a television object, allows user to enter data and displays the data members .If an exception is caught, replace all the data member values with zero values.

8. Write a function template selection Sort. Write a program that inputs, sorts and outputs an integer array and a float array.

9. Write a menu driven program that will create a data file containing the list of telephone numbers in the

following form

John 23456

Ahmed 9876

.....

.....

Use a class object to store each set of data, access the file created and implement the following tasks I. Determine the telephone number of specified person II. Determine the name if telephone number is known III. Update the telephone number, whenever there is a change

10. Write C++ program using STL to add binary numbers (assume one bit as one number); use STL stack

Group C

11. Develop the application using the basic concepts of java programming.

12. Develop the application using the various types of inheritance and polymorphism in java programming.

13. Write a JAVA program to calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions

14. Write a JAVA program to check whether input number is Armstrong number or not. An Armstrong number is an integer with three digits such that the sum of the cubes of its digits is equal to the number itself.

15. To accept from user the number of Fibonacci numbers to be generated and print the Fibonacci series using JAVA programming language.

Group D

16. To Develop a Mini project using OOP/JAVA concept.

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CO207: Digital Electronics Laboratory

Teaching Scheme	Examination Scheme	
Practical : 2 Hrs. / Week	Term Work:	--
Credits: 1	Practical Exam:	50 Marks
	Total:	50 Marks

Course Objectives:

1. To understand the representation of basic gates using universal gates.
2. To understand design and implementation steps of Combinational circuits.
3. To study Flip-flop conversion logic.
4. To understand the use of flip flops in sequential circuits.
5. To understand design and implementation steps of Sequential circuits.
6. To study transmission media used in data communication.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Blooms Taxonomy	
	Level	Descriptor
1. Apply acquired knowledge to represent any Boolean function using Universal gate.	3	Apply
2. Develop combinational circuit for a given problem statement.	3	Apply
3. Apply flip-flop conversion logic to convert given flip-flop to desired flip-flop.	3	Apply
4. Develop sequential circuit for a given problem statement.	3	Apply
5. Compare transmission media used in Data Communication	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Suggested List of Assignments

Group A (Any 4)

1. Realize Basic gates (AND,OR,NOT) From Universal Gates(NAND & NOR)
2. Design and implement Full Adder and Full Subtractor using Logic gates
3. Design and implement Code Gary to Binary , BCD to Excess-3 code converter
4. Design and implement Boolean functions using Multiplexer IC 74151
5. Design and implement 1 bit and 2-bit Comparator.
6. Design and Implement Parity generator and Checker.
7. A Jet Aircraft employ a system for monitoring rpm, pressure, temperature values of engine using sensors that operate as follows:

RPM sensor output = 0 only when speed < 4800 rpm

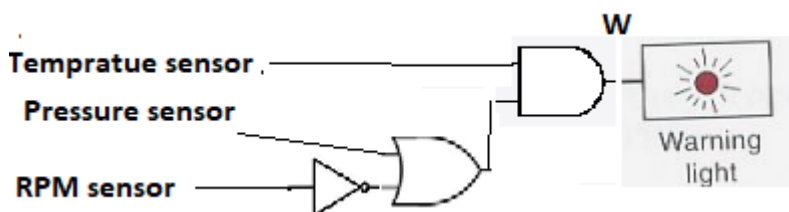
P sensor output = 0 only when pressure < 220 psi

T sensor output = 0 only when temperature < 200°F

Figure shows logic circuit that controls cockpit warning light for certain engine condition. Assume that high output W activate the warning light.

(a) Determine what engine conditions will give a warning to the pilot.

(b) Implement the circuit using NAND gate.



8. A manufacturing plant needs to have a horn sound to signal quitting time. The horn should be activated when either of the following condition is met.

- a. Its after 5 o'clock and all machines are shut down.
- b. Its Friday, the production run for day is complete and all machine are shut down.

Design logic circuit that will control the horn.

9. Design multiplier circuit that takes two bit binary number x_1x_0 and y_1y_0 as a input and produces binary output $z_3z_2z_1z_0$ that is equal to arithmetic product of the input numbers.

10. Four large tanks at chemical plant contain different liquids being heated. Liquid level sensors are used to detect whenever level in tank A or tank B rises above predetermined level. Temperature sensors in tank C and tank D detect when temperature in either of these tanks drops prescribed temperature limit. Assume that liquid level sensor outputs A and B are low when level is satisfactory and HIGH when level is too high. Also temperature sensor output C and D are low when temperature is satisfactory and HIGH when temperature is too low. Design logic circuit that will detect whenever level in tank A or tank B is too high at the same time that the temperature in either tank C or tank D is too low.

Group B (Any 4)

- 11. Realization of Flip-Flop Conversion
- 12. Design and implement Asynchronous counter using suitable Flip flops
- 13. Design and implement Synchronous counter using suitable Flip flops
- 14. Design and implement Modulus asynchronous counter using IC 7490
- 15. Design and Implement Sequence Generator using suitable Flip flops

Group C (Mandatory)

- 16. Study various Transmission media of Data communication.

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CO208: Choice Based Course	
Teaching Scheme	Examination Scheme
Lectures: 2 Hrs. / Week	Oral Exam: 50 Marks
Credits: 1	Total: 50 Marks

Prerequisite: Basics of Programming

Students need to select any one of the following training buckets, learn the course, perform list of assignments, develop mini-project in a group of 3-4 students and at the end need to submit project report as per the guidelines given in course syllabus:

Bucket 1: Web Development Using HTML & Java Script

Bucket 2: Core Java Programming

Bucket 3: Application Development Using Python

Guidelines for Assessment:

Continuous assessment of laboratory work is done based on overall performance in lab assignments and mini-project. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage.

Term Work will be based on assignments carried out by a student and mini-project demonstration and related skills learned.

General Guidelines for Mini-Project:

1. The mini project should be undertaken preferably by a group of 3-4 students who will jointly work together and implement the project.
2. Topic should be based on the technology that students have studied in choice based subject.
3. It is appreciated if the mini-project is based on real world problems and day to day life.
3. Use of open source software is to be appreciated.
4. The group has to select the project topic with the approval of the guide and submit the name of the project with synopsis of the proposed work.
5. At the end of the semester each group need to submit a report of minimum 15 pages.

The formats for synopsis and report are as given below:

Synopsis

Group Id:

Student Name: 1.

2.

3.

Title:

Abstract:

Objectives:

Technology Used:

Outcomes:

Report

Group Id:

Student Name: 1.

2.

3.

Title:

Abstract:

Introduction:

Objectives:

Technology Used:

System Design:

Implementation Details:

Results:

Outcomes:

Conclusion:

References:

Bucket-1

Web Development Using HTML & Java Script

Course Objectives:

- 1.To Learn Client Side Scripting Using HTML
- 2.To Learn CSS to decorate the HTML Page
- 3.To Validate and add Dynamic essence to HTML pages using JS
- 4.To learn JQuery and Bootstrap framework to develop static websites

Course Outcomes (COs): On completion of the course, students will be able to-

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
1. Explore Client side technologies using HTML	2	Understand
2. Apply CSS for designing attractive web pages	3	Apply
3. Apply the concept of JS for validating HTML forms	3	Apply
4. Apply the JQuery and Bootstrap framework Concepts to develop static websites	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

COURSE CONTENTS

Unit I	FUNDAMENTALS OF HTML	No. of Hours	COs
	HTML,HTTP, Server side Scripting, Client side scripting, Session, Cookies, What Is SVN, Usage Of SVN Introduction to WWW and HTML: HTML/HTML5 Tags, Creating a Webpage Document,XHTML,CSS, Essentials HTML Tags, Linking Pages Together, Adding Images, Creating Lists and Tables, Testing and Validation	4	1,4
Unit II	CSS BASICS	No. of Hours	COs
	CSS Basics: Separation of Content and Style, How CSS Works, Selectors and Properties, Text, Margins, Borders and Backgrounds,CSS Selectors and Layout, More Powerful CSS Selectors HTML DIV and SPAN Tags: Understanding the Box Model, Creating Layout in CSS More Advanced Topics: Creating a CSS Rollover Navigation, Adding Interactivity, Getting onto the Web, Resources for Continuing On Laying out a site with CSS AJAX: Working of Ajax, Processing Steps, Coding Ajax script.	5	2,4
Unit III	JAVASCRIPT BASICS WITH CODING STANDARDS	No. of Hours	COs
	JS How To, JS Where To,JS Statements, JS Comments, JS Variables, JS Operators, JS Comparisons, JS If...Else, JS Switch, JS Popup Boxes, JS Functions, JS For Loop, JS While ,Loop, JS Break Loops, JS For...In, JS Events, JS Try...Catch, JS Throw, JS Special Text, JS Guidelines	4	3,4
Unit IV	JAVASCRIPT ADVANCE	No. of Hours	COs
	JS Objects, JS Objects Intro, JS String, JS Date, JS Array, JS Boolean, JS Math, JS RegExp, JS Browser, JS Cookies, JS Validation, JS Timing, JS Create Object, JS Summary, JQuery Introduction, Bootstrap	5	3,4
List of Assignments 1.Design a simple static web page using Text tags 2.Extend the Assignment 1 by applying the concept of Frames, Img, href 3.Improve the Assignment 2 by applying Table concept 4.Add the simple registration form to Assignment 4 5.Apply the Javascript and Validate the registration form designed in Assignment 4			

6. Make the web page attractive Using the concept CSS
7. Design the static website using JQuery and Bootstrap

Mini Project

Design and Develop a static website for any organization/company/institute using all possible HTML tags, validate the registration form using Javascript and apply the CSS

Books:

Text Books(T):

T1. HTML & CSS: The Complete Reference, Fifth Edition by Thomas Powell ISBN 9780201889543.

T2. JavaScript from Beginner to Professional: Learn JavaScript quickly by building fun, interactive, and dynamic web apps, games, and pages, ISBN: 1800562527

Reference Books(R):

R1. HTML Black Book, by Steven Holzner, Publisher : Dreamtech Press (3 July 2000), ISBN-10 : 8177220861 ISBN-13 : 978-8177220865

R2. Developing Web Applications, Ralph Moseley, John Wiley & Sons, 2007, ISBN 8126512881, 978812651288

R3. Mastering HTML, CSS & Javascript Web Publishing, by Laura Lemay, Rafe Colburn, Jennifer Kyrnin, Publisher : BPB Publications, ISBN-10 : 8183335152, ISBN-13 : 978-8183335157

E-Resources(E):

<https://in.coursera.org/learn/html-css-javascript-for-web-developers>

<https://in.coursera.org/specializations/web-design>

Bucket-2 Core Java Programming

Course Objectives:

1. To learn the fundamental concept of Java Programming.
2. To learn and understand the concept of Inheritance and Package.
3. To learn and understand the concept of Exception Handling and Multithreading.
4. To understand the concepts of Applet and JDBC.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Blooms Taxonomy	
	Level	Descriptor
1. Apply Java Programming concepts for application development.	3	Apply
2. Apply the re-usability concept in development of application.	3	Apply
3. Design and Analyze the Multi-threaded application.	4	Analyze
4. Apply JDBC concept for database application development.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	-	3	-	2	-	-	-	2	2	2	2	-	2	3
CO 2	2	-	3	-	2	-	-	-	2	2	2	2	-	2	3
CO 3	2	-	3	-	2	-	-	-	2	2	2	2	-	2	3
CO 4	2	-	3	-	2	-	-	-	2	2	2	2	-	2	3

COURSE CONTENTS			
I	FUNDAMENTALS OF JAVA PROGRAMMING	No. of Hours	Cos
	Review of Object oriented concepts, History of Java, JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes, Using Java API Document.	5	1
II	INHERITANCE AND POLYMORPHISM	No. of Hours	COs
	Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword. Packages And Interfaces: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces.	5	2
III	EXCEPTION HANDLING & MULTITHREADED PROGRAMMING	No. of Hours	Cos
	The Idea behind Exception, Exceptions & Errors, Types of Exception, Checked and Un-Checked Exceptions ,Control Flow in Exceptions, Use of try and catch block, Multiple catch block, Nested try, finally block, throw keyword, Exception Propagation, throws keyword, Exception Handling with Method Overriding, In-built and User Defined Exceptions. Multi-threaded programming Introduction, Creating Threads, Extending Thread Class, Stopping and Blocking the threads, Life	4	3

	Cycle of Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the Runnable interface.		
IV	APPLET PROGRAMMING & JDBC	No. of Hours	COs
	<p>Introduction, Local and Remote Applet, How applet Differ from Applications, Preparing to write Applets, Building Applet code, Applet life Cycle, Creating Executable Applet, Designing web page, Applet tag, Adding applet HTML file, Passing parameter to applets, Getting input from user.</p> <p>JDBC</p> <p>The design of JDBC, Basic JDBC program Concept, Drivers, Architecture of JDBC, Making the Connection, Statement, ResultSet, Prepared Statement, Collable Statement, Executing SQL commands, Executing queries</p>	4	4

Suggested List of Laboratory Assignments on Core Java Programming

Develop the application using the basic concepts of java programming.

Develop the application using the various types of inheritance and polymorphism in java programming.

Develop the application in java programming using the concept of interface.

Implement the program in java to demonstrate create and of use of package concept in java.

Develop the application to demonstrate the exception handling mechanism in java programming.

Develop the Multithreaded application in java programming using extending Thread class.

Develop the Multithreaded application in java programming using implementing the runnable interface.

Develop the GUI application using the concept of applet in java programming.

Develop the application using concept of JDBC to perform the various operations with database like mysql.

Suggested Mini Project on Core Java Programming

Students should work in a group of 2 to 4 for each project. They should come up with project topic in the area of systems or business applications. They are free to choose any project title for implementation of project. The group should work on following phases of software development lifecycle. 1)Requirement Analysis 2)System Design 3)Coding 4)Testing

A mini project should consist of 15-20 pages report and softcopy of project.

Books:

Reference Books (R):

- R1. Java: The Complete Reference Hebert Schildt, 8th Edition, Mc Graw Hill
- R2. Programming with Java A Primer, E. Balaguruswamy Tata McGraw Hill Companies.
- R3. J D B C: Java Database Connectivity Haecke, B. V. IDG Books India Ltd
- R4. Java 2 Programming Shah, Keyur TMH
- R5. Java 2 Programming Bible Walsh, A/ Couch J/ Steinberg, D. IDG Books India Ltd

R6. Java 2 Programming: Black Book Holzner, Steven 5th edition Dreamtech

E-Resources(E):

https://onlinecourses.nptel.ac.in/noc23_cs49/preview

Bucket-3
Application Development Using Python

Course Objectives:

1. To learn fundamental concepts of Python programming language
2. To understand how to write and define functions and modules.
3. To understand the concept of how to read and write data from and to files in Python.
4. To understand the fundamentals of Object-Oriented Programming in Python.
5. To learn Python GUI Programming + Tkinter to make Graphical User Interfaces applications.
6. To learn advanced concepts of Python like Turtle programming, Flask Framework etc for designing Graphical based applications.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Blooms Taxonomy	
	Level	Descriptor
1. Define basic principles of Python programming language	1	Remember
2. Discuss how to write and define functions in Python.	2	Understand
3. Implement the concepts of reading/ writing data from and to files in Python programming.	3	Apply
4. Examine fundamentals of Object-Oriented Programming in Python.	4	Analyze
5. Create a GUI Based application using Tkinter in Python Programming.	6	Create
6. Design a GUI Based application using Turtle programming and other advanced Python concepts and frameworks.	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	-	2	2	-	2	-	-	-	1	-	2	1	-	-	--
CO 2	-	2	2	-	2	-	-	-	1	-	2	1	-	-	--
CO 3	-	2	3	-	2	-	-	-	2	-	2	1	-	-	---
CO 4	-	2	3	-	2	-	-	-	2	-	2	1	-	-	--
CO 5	-	2	3	-	3	-	-	-	2	-	2	1	-	-	--
CO 6	-	2	3	-	3	-	-	-	2	-	2	1	-	-	--

COURSE CONTENTS			
I	DATA TYPES IN PYTHON	No. of Hours	COs
	Mutable data types, Immutable Data Types and their manipulations.	2	1
II	FUNCTIONS AND MODULES	No. of Hours	COs
	Built in functions, User defined functions, recursive functions, Built in Modules.	4	2
III	OPERATIONS ON FILES	No. of Hours	COs
	Text files, Ms Excel files, Opening, reading, writing , appending files	2	3
IV	OOPS IN PYTHON	No. of Hours	COs
	Classes and objects,Data Abstraction,Data Hiding, Encapsulation, Modularity, Inheritance, Polymorphism, Exception handling	5	4
V	GUI PROGRAMMING	No. of Hours	COs
	Tkinter programming, Tkinter Widgets, GUI Designing	3	5

VI	DESIGNING THE APPLICATIONS USING PYTHON	No. of Hours	COs
	Turtle Programming in Python, Flask framework, Django framework, Using Google Colab. Networking in Python	4	6

Suggested List of Laboratory Assignments on Python Programming

1. Write a Python program to get a list, sorted in increasing order by the last element in each tuple from a given list of non-empty tuples.

Sample List : [(2, 5), (1, 2), (4, 4), (2, 3), (2, 1)]

Expected Result : [(2, 1), (1, 2), (2, 3), (4, 4), (2, 5)]

2. Python Program for factorial of a number using function with and without recursion.

3. Write a Python program to compute the sum of all the elements of each tuple stored inside a list of tuples.

Original list of tuples:

[(1, 2), (2, 3), (3, 4)]

Sum of all the elements of each tuple stored inside the said list of tuples:

[3, 5, 7]

4. Design a calculator using Tkinter.

5. Write an assignment that opens a file, writes into it, appends data into it, reads the file. Include exception handling in the same assignment.

6. Design the following design using loops in python.

```

      *
    *  *
  *    *    *
*      *      *      *
```

7. Write a function, **area_difference**, that takes two Rectangle instances as parameters and returns the signed difference in area between them. "signed difference" means that rather than always returning a positive number, the sign of the return value should be negative if the first rectangle is smaller. Test your code with:

```
r1 = create_rectangle(10, 20, 10, 10)
```

```
r2 = create_rectangle(20, 50, 15, 20)
```

```
print area_difference(r1, r2)
```

(Use OOPs Concept)

8. Write an `__add__` method for the rectangle class that returns the **sum** of two rectangles as a new rectangle which is the smallest rectangle that encloses the two input rectangles. Test your code with:

```
r1 = Rectangle(10, 20, 10, 10)
r2 = Rectangle(20, 50, 15, 20)
print(r1 + r2)
```

The answer should be `(10, 20, 25, 50)`.

9. Design the following design using loops in python.(T)

*

*

*

10. Get current date, time using date object in python. Calculate one age using current date and birth date.

11. Design a simple network using Python.

Suggested Mini Project on Python Programming

It is expected to develop a mini project based on concepts learnt in the course. The mini project should demonstrate the concepts and critical thinking of students. However, the scope of project is not restricted up to syllabus. Preferably project should address the real life problem.

Ex. Build a mobile application using Python.

Books:

Reference Books (R):

R1. Mark Lutz, Programming Python, O'Reilly, 4th Edition, 2010

R2.Allen B Downey, "Think PYTHON", O'Rielly, ISBN: 13:978-93-5023-863-9, 4th Indian Reprint 2015

Text Books(T):

T1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016.

T2.Learn Python the Hard Way, Zed A. Shaw (3rd Edition)

T3.Kenneth A Lambert and B L Juneja, "Fundamentals of PYTHON", CENGAGE Learning, ISBN:978-81-315-2903-4

E-Resources(E):

https://onlinecourses.nptel.ac.in/noc23_cs20/preview

MLC 209 : Constitution of India (Mandatory Course – III)

Teaching Scheme	Examination Scheme
Lectures: 1Hrs./Week	Term Work: NA
Credits: Non Credit	Practical: NA
	Total: NA

Course Objectives

1. To study the historical background, salient features, preamble and union territories of Indian constitution
2. To study the provision of fundamental right in the Indian constitution.
3. To study the directive principle of state policy and fundamental duties.
4. To study the system of government through parliamentary and federal system,
5. To understand the formation, structure and legislative framework of central government.
6. To understand the formation, structure and legislative framework of state government.

Course Outcomes (COs):

After successful completion of the course, student will be able to

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	The student will get acquainted with the historical background, salient features, preamble and union territories of Indian constitution	2	Understand
CO2	The student will get aware about the fundamental rights.	2	Understand
CO3	The student will get aware about directive principle of state policy and fundamental duties.	2	Understand
CO4	The student will understand the system of government through parliamentary and federal system,	2	Understand
CO5	The student will understand structure, formation and legislative framework of central government.	2	Understand
CO6	The student will understand structure, formation and legislative framework of state government.	2	Understand

Course Contents			
Unit-I	INTRODUCTION TO CONSTITUTION OF INDIA	No. of Hours	COs
	Historical background, Salient features, Preamble of constitution, Union and its territory	1	1
Unit-II	FUNDAMENTAL RIGHTS	No. of Hours	COs
	Features of fundamental rights, Basic rights: 1. Right to equality; 2. Right to freedom; 3. Right against exploitation; 4. Right to freedom of religion; 5. Cultural and educational rights; 6. Right to property; 7. Right to constitutional remedies	1	2
Unit-III	DIRECTIVE PRINCIPLE OF STATE POLICY AND FUNDAMENTAL DUTIES	No. of Hours	COs
	Directive principle of state policy: Features of directive principle, Classification of directive principle, Criticism of directive principle, Utility of directive principle, Conflict between Fundamental rights and directive principle Fundamental duties: List of fundamental duties, Features of fundamental duties, Criticism of fundamental duties, Significance of fundamental duties, Swaran Singh Committee Recommendations	1	3
Unit-IV	SYSTEM OF GOVERNMENT	No. of Hours	COs
	Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system Federal system: Federal features of constitution, unitary features of constitution Centre and state relation: Legislative relation, administrative relations and financial relation. Emergency provision: National emergency, Financial emergency and criticism of emergency provision	1	4
Unit-V	CENTRAL GOVERNMENT	No. of Hours	COs
	President: Election of president, powers and functions of president, and Veto power of president Vice-president: Election of vice-president, powers and functions of vice-president Prime minister: Appointment of PM, powers and functions of PM, relationship with president Central council of ministers: Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees Parliament: Organization of parliament, composition of the two houses, duration two houses, membership of parliament, session of parliament, joint sitting of two houses, budget in parliament. Supreme court (SC): Organization of supreme court, independence of supreme court, jurisdiction and powers of supreme court	1	5

Unit-VI	STATE GOVERNMENT	No.of Hours	COs
	<p>Governor: Appointment of governor, powers and functions of governor, constitutional position Chief minister: Appointment of CM, powers and functions of CM, relationship with governor</p> <p>State council of ministers: Appointment of ministers, responsibility of ministers, cabinet. High court (HC): Organization of HC, independence of HC, jurisdiction and powers of HC Sub-ordinate court: Structure and jurisdiction, Lok Adalats, Family court, Gram Nyayalayas</p>	1	6
Text Books:			
<p>1. M Laxmikanth, Indian Polity for Civil Service Examination, Mc GrawHill Education, 5th Edition.</p> <p>2. Durga Das Basu, LexisNexis, Introduction to the Constitution of India, 22nd Edition</p>			

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SEMESTER IV

BS202: Engineering Mathematics-III

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs. / Week	Continuous Assessment: 40 Marks
Tutorial: 1 Hrs./Week	End-Sem Exam: 60 Marks
Credits: 4	Total: 100 Marks

Prerequisite Course:

Course Objectives

- 1 To make students familiarize with concepts and techniques of vector calculus, probability and differential calculus.
- 2 The intent is to furnish them with the techniques to understand engineering mathematics and its applications that would develop logical thinking power, useful in their disciplines.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Describe and recall the basics of vector algebra, apply it to calculate directional derivative, divergence and curl of vector function.	3	Apply
2. Understand the concept vector integration, analyze and apply it to solve engineering problems using Green's theorem, Stoke's theorem, and Gauss's Divergence theorem.	3	Apply
3. Analyze data, Find mean, correlation, regression and Test hypothesis with suitable method.	3	Apply
4. Characterize probability model and function of discrete random variables based on one and two random variables.	3	Apply
5. Characterize probability model and function of continuous random variables based on one and two random variables.	3	Apply
6. Apply integral transform technique to solve equations involved in engineering applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	1	1	1	-	-	-	-	-
CO2	3	2	-	-	-	-	-	1	1	1	-	-	-	-	-
CO3	2	3	-	-	1	-	-	1	1	1	-	-	-	-	-
CO4	3	2	-	-	-	-	-	1	1	1	-	-	-	-	-
CO5	2	2	-	-	-	-	-	1	1	1	-	-	-	-	-
CO6	3	3	-	-	-	-	-	1	1	1	-	-	-	-	-

COURSE CONTENTS

Unit-I	VECTOR DIFFERENTIATION	No. of Hours	COs
	Scalar and vector point function, Derivative of a vector point function, Gradient of scalar function ϕ , Directional derivative, Divergence and Curl of vector point function, Solenoidal and irrotational vector field and scalar potential, vector identities.	6	1
Unit-II	VECTOR INTEGRATION	No. of Hours	COs
	Line integral, Green's theorem, Work done, Conservative field, surface integral, Stokes theorem, volume integral, Gauss Divergence theorem.	6	2
Unit-III	BASIC STATISTICS	No. of Hours	COs
	Measures of Central tendency, Moments, Skewness and Kurtosis, Correlation and regression	6	3
Unit-IV	DISCRETE RANDOM VARIABLES	No. of Hours	COs
	Probability mass function and Distribution function, Mathematical Expectation, Variance & Standard Deviation, Binomial distribution, Poisson distribution, Joint distributions, Independent Random variables.	6	4

Unit-V	CONTINUOUS RANDOM VARIABLES	No. of Hours	COs
	Cumulative probability function and Distribution function, Mathematical Expectation, Variance & Standard Deviation, Normal distribution, Covariance and Correlation, Joint distributions, Independent Random variables.	6	5
Unit-VI	FOURIER TRANSFORM	No. of Hours	COs
	Definition of Fourier transform, Properties of Fourier transform, Fourier Cosine transform, Fourier sine transform, Inverse Fourier transform	6	6
Books:			
Text Books(T):			
T1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012, ISBN-13: 978-8174091154.			
T2. Scott Miller, Donald Childers, Probability and Random Processes, 2 Ed, Elsevier, 2012.			
T3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 2014. ISBN-13: 978-1842653418.			
References			
R1. K.A. Stroud & D. S. Booth, Advanced Engineering Mathematics, Industrial Press, 5/e, 2011, ISBN-9780831134495			
R2. P. C. Matthews, Vector Calculus, Springer, 2/e, 2012, ISBN-9783540761808			
R3. T. Veerarajan, Probability Statistics and random processes, Tata McGraw Hill, 3/e, 2008. ISBN 13: 9780070669253.			
R4. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 9/e, 2013, ISBN-13: 978-0471488859.			
E-Resources(E):			
https://onlinecourses.nptel.ac.in/noc23_ma25/preview			

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CO210: Database Management System

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs. / Week	Continuous Assessment: 40 Marks
Credits: 3	End-Sem Exam : 60 Marks
	Total: 100 Marks

Prerequisite Course: (if any) Discrete Mathematics, Data Structures

Course Objectives:

1. To understand the fundamental concepts of database management (Database design, database languages, and database-system implementation).
2. To provide a strong formal foundation in database concepts, technology and practice.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. Be familiar with the basic issues of transaction processing and concurrency control.
5. To learn and understand various Database Architectures and Applications.
6. To learn a powerful, flexible and scalable general purpose database to handle big data.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcome	Bloom's Taxonomy	
	Level	Descriptor
1. Create E-R diagram for given requirements and convert the same into database tables.	4	Analyse
2. Use database techniques such as SQL & PL/SQL.	3	Apply
3. Implement good database design using normalization.	3	Apply
4. Use transaction Management and query processing in relational database System.	3	Apply
5. Compare different database architecture and use of appropriate architecture in real time application.	4	Analyse
6. Use advanced NoSQL databases and programming concepts.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	--	2	2	2	--	--	--	--		3	2	3	2	1
CO2	2	--	2	2	2	--	--	--	--		2	2	2	2	--
CO3	1	--	2		2	--	--	--	--		2	2	2	3	--
CO4	2	--	--	2	--	--	--	--	--		2	2	1	2	--
CO5	2	--	2	2	--	--	--	--	--		2	2	2	3	--
CO6	2	--	3	2	2	--	--	--	--		2	3	2	2	1

COURSE CONTENTS

Unit I	INTRODUCTION TO DBMS	No. of Hours	COs
	Introduction to Database Management Systems, File system verses database system, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database users, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.	7	1
Unit II	SQL and PL/SQL	No. of Hours	COs
	SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored Procedures & Functions, Cursors, Triggers, Assertions, roles and privileges, Embedded SQL, Dynamic SQL.	7	2
Unit III	RELATIONAL DATABASE DESIGN	No. of Hours	COs
	Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional	8	3

	Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF		
Unit IV	DATABASE TRANSACTIONS AND QUERY PROCESSING	No. of Hours	COs
	Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints, Query Processing, Query Optimization, Performance Tuning.	8	4
Unit V	DATABASE SYSTEM ARCHITECTURES	No. of Hours	COs
	Introduction to Database Architectures: Multi-user DBMS Architectures, Case study- Oracle Architecture. Parallel Databases: Speedup and Scale up, Architectures of Parallel Databases, Distributed Databases: Architecture of Distributed Databases, Distributed Database Design, Distributed Data Storage, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database. Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	7	5
Unit VI	NoSQL DATABASE	No. of Hours	COs
	Introduction to NoSQL Database, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Distributed Database Model, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL Data Models, MongoDB- Introduction, CRUD operation, aggregation, indexing, sharding, Case Study-unstructured data from social media. Introduction to Big Data.	8	6
Books:			
Text Books:			
T1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition			
T2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4			
Reference Books:			
R1. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719			
R2. S.K.Singh, "Database Systems : Concepts, Design and Application", Pearson, Education, ISBN 978-81-317-6092-5			
R3. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN-10: 0321826620, ISBN-13: 978-0321826626.			
R4. Kristina Chodorow, Michael Dirolf, "MongoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468-9.			
E-Resources(E):			
https://in.coursera.org/learn/database-management			

CO211: Operating System and Administration

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs. / Week	Continuous Assessment: 40 Marks
Credits: 3	End-Sem Exam: 60 Marks
	Total: 100 Marks

Prerequisite:

Course Objectives:

1. To learn and understand basics of Operating Systems including Boot process.
2. To learn and understand Shells Scripts and File System.
3. To introduce to administrative features of Operating Systems
4. To learn and understand the process control and its execution.
5. To learn and understand Memory management and Network communication in Operating system
6. To learn and understand the user and its access control

Course Outcomes (COs): On completion of the course, students will be able to–

Course Outcomes	Blooms taxonomy	
	Level	Descriptor
1. Understand the basic concept of operating system and Linux administrative commands.	2	Understand
2. Write a shell and python scripts by using the concepts of scripts programming.	3	Apply
3. Understand process control, execution and scheduling.	2	Understand
4. Acquire the Knowledge of files and storage systems.	2	Understand
5. Understand memory management in Linux Operating System and socket communication.	2	Understand
6. Add and Manage the users and storage devices in Linux OS.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	1	-	-	-	-	-	-	1	1	1	1
CO2	2	2	3	1	2	-	-	-	-	-	-	1	2	3	2
CO3	1	2	2	-	1	-	-	-	-	-	-	1	1	1	-
CO4	1	1	1	-	1	-	-	-	-	-	-	1	1	1	-
CO5	1	1	2	-	2	-	-	-	-	-	-	1	1	1	1
CO6	2	2	3	2	3	-	-	-	-	-	-	2	2	2	2

COURSE CONTENTS

Unit I	INTRODUCTION TO OPERATING SYSTEM	No. of Hours	COs
	General Overview: History of Unix, System Structure User perspective, Operating system Services Assumptions about Hardware, Basic Concepts of Operating Systems, Kernel, shell and file system structure, Basic Concepts of Linux, Basic Commands of Linux, Advanced Linux Commands, Installation of Linux, Interactive Installation,	8	2
Unit II	INTRODUCTION TO THE KERNEL AND BUFFER CACHE	No. of Hours	COs
	Architecture of Unix operating system, Introduction to the system concepts, Kernel data structure, System Administration. Buffer Cache, Buffer Headers, Structure of Buffer Pool, Reading and Writing disk block. Case Study- Booting and Shut Down, Scripting and Shell , Bootstrapping, Booting PCs, GRUB, Booting with single user mode, Rebooting and Shutting down, Shell Basics, bash scripting Python Scripting, Scripting Best Practices, Working with Startup Scripts	8	2
Unit III	THE STRUCTURE OF PROCESS, PROCESS CONTROL AND PROCESS SCHEDULING	No. of Hours	COs
	Process state and transitions, Layout of the system memory, Context of the process, saving the context of the process, Manipulation the process address space, Sleep, Process creation, Signal, Process termination, Awaiting the process termination, Invoking other program, Process Scheduling Case Study - Access Control, Rootly Powers and Controlling Processes Traditional UNIX access control, Modern Access Control, Real-world Access Control, Pseudo-users other than root. Components of a process, the lifecycle of a process,	8	4

	Signals, Kill, Process states, nice and renice, ps, Dynamic monitoring with top, prstat and topas, the /proc file system, strace, truss and tusc, runaway processes..		
Unit IV	INTRODUCTION TO THE FILE SYSTEM	No. of Hours	COs
	Internal representation of the files, i-node, structure of regular files, directories, conversion of pathnames to i-node, Superblock, i-node assignments to new files, Allocation of disk blocks Pathnames, File system, Mounting and unmounting, The organization of the File Tree, File Types, File Attributes, Access Control lists. Case Study – Open Source Automation Red Hat Ansible , Introduction, Overview and setup, How Ansible works, Playbooks, Variables, Advanced execution.	8	3
Unit V	MEMORY MANAGEMENT POLICIES, I/O SUBSYSTEM AND IPC	No. of Hours	COs
	Swapping, Demand Paging, Driver interface, disk drivers, Process Tracing , Network communication, Sockets Case study –Container, Dockers Containers,	8	5
Unit VI	ADDING NEW USERS AND STORAGE	No. of Hours	COs
	The /etc/passwd file, The /etc/shadow and /etc/security/passwd files /etc/group,file, Adding users, Adding users with useradd,, Storage: Adding a hard Disk, Storage Hardware, Storage hardware InterfacesSoftware aspects of storage, Formatting, Disk PartitioningRAID, LVMLinuxFile System: The ext family, file system terminology, mkfs, fsck, file system mounting, setup for automatic.mounting, USB drivemounting, Enabling swapping Case Study –Advanced Operating System like iPhone OS (IOS), Tizen, Iris OS, Swift, Virtual OS	8	6
Books:			
Text Books(T):			
T1. Maurice J. Bach , The Design of the Unix Operating System, Pearson Education, ISBN: 81-7758-770-6			
T2. Evi Nemeth, Garth Snyder, Tren Hein, Ben Whaley, Unix and Linux system AdministrationHandbook, Fourth Edition, ISBN: 978-81-317-6177-9, 2011			
T3. <u>Abraham Silberschatz</u> , <u>Peter B.Galvin</u> , <u>Greg Gagne</u> , Operating System Concepts, 8th Edition, ISBN-13: 978-0470128725ISBN-10: 0470128720 John Willy & Sons Publications.			
Reference Books(R):			
R1. William Stallings, Operating Systems: Internals and Design Principles, PearsonPublication.			
R2. D M Dhamdhare, Operating Systems: A Concept-Based Approach,ISBN-13: 978-1259005589 ISBN-10: 1259005585,McGraw-Hill Publication-.			
R3. Charles Crowley, Operating System: Design-oriented Approach, ISBN-13: 978-0256151510 ISBN-10: 0256151512, McGraw-Hill Publication.			
E-Resources(E):			
https://in.coursera.org/specializations/codio-introduction-operating-systems			

CO212: Advanced Data Structures

Teaching Scheme	Examination Scheme
Lectures: 4 Hrs. / Week	Continuous Assessment: 40 Marks
Credits: 4	End-Sem Exam: 60 Marks
	Total: 100 Marks

Prerequisite: Fundamentals of Data Structure, Computer Fundamentals and Programming

Course Objectives:

1. To understand various types of linked lists and operations on linked list.
2. To learn and understand various operations on Trees.
3. To represent and handle data using graph data structure.
4. To learn and represent data in hash table using various hashing techniques.
5. To learn and design static and dynamic symbol table.
6. To understand various types of search trees and Heap.

Course Outcomes (COs): On completion of the course, students will be able to-

Course Outcomes	Blooms Taxonomy	
	Level	Descriptor
1. Operate on various types of linked lists	3	Apply
2. Interpret various operations on trees for a given problem statement.	2	Understand
3. Construct a solution for a given specific problem using Graph data structure.	3	Apply
4. Illustrate various hashing techniques to represent data in hash table	2	Understand
5. Understand and Design symbol tables using static and dynamic strategy	3	Apply
6. Construct different types of search trees and heaps	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	2	2	-	-	-	-	-	-	3	3	3	-
CO5	3	3	3	3	2	-	-	-	-	-	-	3	3	3	-
CO6	2	3	1	-	-	-	-	-	-	-	-	3	3	3	-

COURSE CONTENTS

Unit I	LINKED LIST	No. of Hours	COs
	Introduction, Comparison of sequential and linked organizations, Representation of Linked List, Realization of linked list using arrays, Linked list using dynamic memory management, Implementation of Linked List, Introduction to Types of linked list: Circular Linked List, Doubly Linked List and operations. Case Study on Link List	8	1
Unit II	TREE	No. of Hours	COs
	Introduction, Basic Tree Terminologies, Binary Tree, Representation of BT, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, operations on BST. Case Study – Expression Tree, Huffman Encoding.	9	2
Unit III	GRAPH	No. of Hours	COs
	Basic Concepts, Storage representation, Adjacency matrix representation of graph, adjacency list representation of graph. Tree Traversals-depth first and breadth first, Introduction to minimum spanning tree- Prim's and Kruskal Algorithm, Dijkstra's Single source shortest path. Real time case study- Data structure used in World Wide Web, Facebook, Google map.	9	3
Unit IV	HASHING	No. of Hours	COs
	Introduction to Hash Table, Concepts-hash table, hash function, bucket, collision, probe, synonym, overflow, Open hashing vs. closed hashing, perfect hash function,	8	4

	load density, full table, load factor, rehashing. Issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, Case Study- Collision resolution strategies like (Open Hashing and open addressing and chaining, extendible hashing)		
Unit V	SYMBOL TABLE	No. of Hours	COs
	Symbol Table- Representation of Symbol Tables- Static tree table and Dynamic tree table Introduction to Dynamic Programming, Weight balanced tree, Optimal Binary Search Tree (OBST), Case Study- Height Balanced Tree- AVL tree.	8	5
Unit VI	SEARCH TREES & HEAP	No. of Hours	COs
	Multiway-Search Trees: B-Tree, B+Tree, String Trees: Trie Tree. Self-adjusted Tree: Splay Tree, Red-Black Tree. Heap-Basic concepts, realization of heap and operations, Heap as a priority queue, heap sort, Binomial Heaps.	8	6
Books:			
Text Book(T):			
T1. Horowitz and Sahani, Fundamentals of Data Structures, Galgotia Publisher, T2. Sartaj Sahani, Data Structures, Algorithms and Applications in C++, 2 nd edition, Universities Press, ISBN-81-7371-522			
Reference Books(R):			
R1. A. Aho, J. Hopcroft, J. Ulman, Data Structures and Algorithms, 2 nd edition, Pearson Education, ISBN-97881-775-8826-2. R2. G A V Pai, Data Structures and Algorithms, The McGraw-Hill Companies, ISBN 9780070667266. R3. Peter Brass, Advanced Data Structures, Cambridge University Press, ISBN: 978-1-107-43982-5			
E-Resources(E):			
https://in.coursera.org/learn/advanced-data-structures https://www.coursera.org/specializations/data-structures-algorithms https://onlinecourses.nptel.ac.in/noc23_cs15/preview			

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CO213: Software Engineering		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	Continuous Assessment:	40 Marks
Credits: 3	End-Sem Exam:	60 Marks
	Total:	100 Marks

Prerequisite Course: Computer Fundamentals and Programming

Course Objectives:

1. To learn and understand the principles of Software Engineering.
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
3. To apply Design and Testing principles to S/W project development.
4. To understand project management through the life cycle of the project.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Apply software engineering principles to develop software.	2	Understand
2. Analyze software requirements and formulate design solution for a software.	4	Analyze
3. Explain concepts of project estimation, planning and scheduling.	2	Understand
4. Illustrate Design Concepts Context of Software Engineering.	2	Understand
5. Explain risk management and software configuration management.	2	Understand
6. Explain various types of software testing.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	2	2
CO2	2	1	-	-	2	-	-	-	-	-	-	1	1	2	2
CO3	2	-	-	-	1	-	-	-	1	-	1	-	1	2	2
CO4	2	-	-	-	1	-	-	-	-	-	-	1	-	2	2
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	2	2
CO6	2	-	-	-	1	-	-	-	-	-	-	1	1	2	2

COURSE CONTENTS

Unit I	SOFTWARE ENGINEERING and SOFTWARE PROCESS MODELS	No. of Hours	COs
	<p>Software Engineering Fundamentals: Introduction to software engineering, The Nature of Software, Defining Software, Software Engineering Practice.</p> <p>Software Process: A Generic Process Model, defining a Framework Activity, Identifying a Task Set, Process Patterns, Process Assessment and Improvement, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, A Final Word on Evolutionary Processes. Unified Process, Agile software development: Agile methods, plan driven and agile development.</p>	6	1
Unit II	S/W REQUIREMENTS ENGINEERING & ANALYSIS	No. of Hours	COs
	<p>Modelling: Requirements Engineering, Establishing the Groundwork, Identifying Stakeholders, Recognizing Multiple Viewpoints, working toward Collaboration, Asking the First Questions, Eliciting Requirements, Collaborative Requirements Gathering, Usage Scenarios, Elicitation Work Products, Developing Use Cases, Building the Requirements Model, Elements of the Requirements Model, Negotiating Requirements, Validating Requirements.</p>	6	2

Unit III	ESTIMATION AND SCHEDULING	No. of Hours	COs
	<p>Estimation for Software Projects: The Project Planning Process, Defining Software Scope and Checking Feasibility, Resources management, Reusable Software Resources, Environmental Resources, Software Project Estimation, Decomposition Techniques, Software Sizing, Problem-Based Estimation, LOC-Based Estimation, FP-Based Estimation, Object Point (OP)-based estimation, Process-Based Estimation, Process-Based Estimation, Estimation with Use Cases, Use-Case-Based Estimation, Reconciling Estimates, Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Mode, Preparing Requirement Traceability Matrix.</p> <p>Project Scheduling: Project Scheduling, Defining a Task for the Software Project, Scheduling.</p>	6	3
Unit IV	DESIGN ENGINEERING	No. of Hours	COs
	<p>Design Concepts: Design within the Context of Software Engineering, The Design Process, Software Quality Guidelines and Attributes, Design Concepts - Abstraction, Architecture, design Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object-Oriented Design Concept, Design Classes, The Design Model , Data Design Elements, Architectural Design Elements, Interface Design Elements, Component-Level Design Elements, Component Level Design for WebApps, Content Design at the Component Level, Functional Design at the Component Level, Deployment-Level Design Elements,</p> <p>Architectural Design: Software Architecture, What is Architecture, Why is Architecture Important, Architectural Styles, A brief Taxonomy of Architectural Styles.</p>	6	4
Unit V	RISKS AND CONFIGURATION MANAGEMENT	No. of Hours	COs
	<p>Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.</p> <p>Software Configuration Management: Software Configuration Management, The SCM Repository</p> <p>The SCM Process, Configuration Management for any suitable software system</p>	6	5
Unit VI	SOFTWARE TESTING	No. of Hours	COs
	A Strategic Approach to Software Testing, Verification and Validation, Organizing for Software Testing, Software Testing Strategy—The Big Picture, Criteria for Completion of	8	6

	Testing, Strategic Issues, Test Strategies for Conventional Software, Unit Testing, Integration Testing, Test Strategies for Object-Oriented Software, Unit Testing in the OO Context, Integration Testing in the OO Context, Test Strategies for WebApps, Validation Testing, Validation-Test Criteria, Configuration Review.		
Books:			
Text Books(T):			
T1. Roger Pressman, “Software Engineering: A Practitioner’s Approach”, McGraw Hill, ISBN 0-07-337597-7			
T2. Ian Sommerville, “Software Engineering”, Addison and Wesley, ISBN 0-13-703515-2			
Reference Books(R):			
R1. Carlo Ghezzi, “Fundamentals of Software Engineering”, Prentice Hall India, ISBN-10:0133056996			
R2. Rajib Mall, “Fundamentals of Software Engineering”, Prentice Hall India, ISBN-13: 978-8120348981			
R3. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Springer, ISBN 13: 9788173192715.			
R4. S K Chang, —Handbook of Software Engineering and Knowledge Engineering, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1			
E-Resources(E):			
https://onlinecourses.nptel.ac.in/noc23_cs38/preview			

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CO214: Advanced Data Structure Laboratory

Teaching Scheme	Examination Scheme
Practical : 2 Hrs. / Week	Term Work: -----
Credits: 1	Practical Exam: 50 Marks
	Total: 50 Marks

Course Objectives:

1. To learn representation of structured data.
2. To construct and perform various operations on Tree.
3. To represent data as per the problem statement using Graph data structure.
4. To represent, retrieve and search specific data using hash table.
5. To implement symbol tables using dynamic Programming with minimum search cost

Course Outcomes: On completion of the course, students will be able to–

Course Outcomes	Blooms taxonomy	
	Level	Descriptor
1. Represent and Implement operations on structured data.	3	Apply
2. Construct and Implement various operations on Tree data structure	3	Apply
3. Represent and Implement Solution for given problem statement using Graph.	6	Create
4. Construct hash table and implement various hash functions for retrieving and searching data.	3	Apply
5. Build symbol table with minimum search cost using Dynamic programming.	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO2	PSO 3
CO1	3	3	3	3	2	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO5	3	3	3	2	2	-	-	-	-	-	-	3	3	3	-

Instructor Guideline:

Set of suggested assignment list is provided in groups- A, B, C and D. Each student must perform at least 8 assignments as at least 2 from Group A, 2 from Group B, 3 from Group C and 1 from Group D. For each assignment program code with sample output is to be submitted as a soft copy. Handwritten write up (Title, Objectives, Problem Statement, Outcomes, Relevant Theory- Concept in brief, Algorithm, Flowchart, Test cases, Conclusion) of each assignment is to be submitted by students.

Suggested List of Assignments:

Group A (At least two)

- Write a program to perform following operations on Singly Linked List for Employee data with fields: Emp_id, Name, Designation, Mobile_No and Salary
 - Create SLL for N employees.
 - Perform insertion at front, middle and end of SLL
 - Perform deletion at front, middle and end of SLL
 - Display status of SLL and count no of employees present in SLL
- Design a circular linked list to represent polynomials with integer coefficient. Each term of the Polynomial will be represented as a node. A node will have three fields as Coefficient, Exponent and Link to another node. Construct two CLL to represent two different polynomials. Write a program to perform addition of these two polynomials.
- Write a program for storing binary number using doubly linked lists. Write functions to:
 - Compute 1s and 2s complement
 - Add two binary numbers

Group B:(At least 2)

- Construct Tree for representing Vehicles Type Hierarchy and print the nodes. Find the time and space

requirements of your method.

5. Create Binary Search Tree for given data and write function to:

a) Perform any non-recursive traversals on tree.

b) To count no of leaf nodes present in a tree.

c) To compute Height of a tree.

d) To compute Mirror image of a tree.

6. Convert given binary tree into threaded binary tree. Analyze time and space complexity of the algorithm.

7. For any given inorder expression construct an expression tree and traverse it using post order traversal (non- recursive).

8. Write a program to create a binary tree if inorder and preorder or inorder and postorder any two traversals are given.

Group C: (At least 2)

9. There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight takes to reach city B from A or the amount of fuel used for the journey. The node can be represented by airport name or name of the city. Use adjacency list representation of the graph and adjacency matrix representation of the graph. Justify the storage representation used.

10. Company wants to lease phone lines to connect its offices of distinct cities, with each other. Phone Company charges different amounts of money to connect distinct pairs of cities. Use appropriate data structures to connect all offices of a company with a minimum cost.

11. Tour operator organizes guided bus trips across the Maharashtra. Tourists may have different preferences. Tour operator offers a choice from many different routes. Every day the bus moves from starting city S to another city F as chosen by client. Find the Shortest path from source to the specified destination. Use appropriate data structure and algorithm.

12. Consider the scheduling problem where n tasks to be scheduled on single processor. Let t_1, \dots, t_n be task to execute on single processor. The tasks can be executed as per the dependency between them but one task at a time. Implement an algorithm for this problem and schedule each task as per dependency.

Group D (At least 2)

13. Write a program to create Student Information database of N students. Make use of a hash table implementation to quickly look up Student Information.

14. Implement all the functions of a word dictionary (ADT) using hashing.

Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, and Keys must be

unique Standard Operations: Insert (key, value), Find (key), Delete (key)

15. Given sequence $k = k_1 < k_2 < \dots < k_n$ of n sorted keys, with a search probability p_i for each key k_i . Build the Binary search tree that has the least search cost given the access probability for each key.

16. A Dictionary stores keywords & its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balance tree and find the complexity for finding a keyword

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CO215: Operating System and Administration Laboratory

Teaching Scheme	Examination Scheme	
Practical : 2 Hrs. / Week	Term Work:	25Marks
Credits: 1	Practical Exam:	----
	Total:	25 Marks

Course Objectives

1. To learn and understand the basic and advance Linux commands.
2. To learn and understand the Shell Scripts, Perl Scripts and Python Scripts.
3. To be able to add and delete the user and giving access rights to users in Linux platform.
4. To be able to write and execute the C/C++, Java program under Linux Platforms.
5. To be able to perform disk formatting and partitioning.
6. To be able to install Linux operating system such Ubuntu, and Fedora.

Course Outcomes (COs): On completion of the course, students will be able to–

Course Outcomes	Blooms taxonomy	
	Level	Descriptor
1. Create the program using Linux commands	6	Create
2. Understand the Shell Scripts, Perl Scripts, Python Scripts	2	Understand
3. Create a program in C/C++ /Java under Linux Platform	6	Create
4. Understand the execution of the program under Linux platform	2	Understand
5. Process control and its execution using different System Calls	4	Analyze
6. Create disk formatting and disk portioning for Linux Installation	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2	PSO3
CO1	3	2	3	2	2	-	-	-	-	-	1	2	3	3	-
CO2	3	2	3	2	2	-	-	-	-	-	1	2	3	3	-
CO3	3	2	3	2	2	-	-	-	-	-	1	2	3	3	-
CO4	3	2	3	2	2	-	-	-	-	-	1	2	3	3	-
CO5	3	2	3	2	2	-	-	-	-	-	1	2	3	3	-
CO6	3	-	3	2	2	-	-	-	-	-	1	2	3	3	-

Suggested List of Assignments**Group A (Implement any four assignments)**

1. Implementation of Create/ rename/ delete a file using Unix/Linux commands. Adding users and access rights
2. Write a function to display the list of devices connected to your system including the physical names and its instance number. Write a function using mount and unmounts command to mount device and unmount it.
3. Implement the commands for creation and deletion of directory. Write a program to change current working directory and display the node details for each file in the new directory.
4. Process related commands list the processes for the current shell, Display information about processes, Display the global priority of a process, and change the priority of a process with default arguments.
5. Use Operating system Commands to obtain the following results
 1. To print the name of operating system
 2. To print the login name
 3. To print the host name

Group B (Implement any four assignments)

6. Write a shell program to convert all lowercase letter in a file to uppercase letter.

7. Write program to find number of CPU cores and CPU Manufacturer
8. Study assignment on Installation of Linux, Interactive Installation.
9. Write a shell script that determines the period for which a specified user is working on the system.
10. Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.

Group C (Implement any four assignments)

11. Write a C/C++ script to display all logged in users
12. C/C++ Program to Parent creating the child process by use of fork.
13. Java Program to identify the available memory in the system
14. Write Java script to display all logged in users. Count the number of logged-in users. Write a program to create a foreground and background process for the selected user and display its status.
15. Python Program to add two matrices.
16. Python Program to Illustrate Different Set Operations
17. Python Program to Generate a Random Number

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CO216: Database Management System Laboratory		
Teaching Scheme	Examination Scheme	
Practical : 2 Hrs. / Week	Term Work:	----
Credits: 1	Practical Exam:	50 Marks
	Total:	50 Marks

Prerequisite Course: Database Management System

Course Objectives:

1. To develop basic, intermediate and advanced Database programming skills.
2. To develop basic Database administration skills.
3. To apply advance database programming concept for database application.
4. To provide a strong formal foundation in database concepts, technology and practice.
5. To learn a powerful, flexible and scalable general purpose database to handle big data.
6. To learn and understand various Database Architectures and Applications.

Course Outcomes (COs) :

On completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Demonstrate the ability to handle databases of varying complexities	3	Apply
2. Use advanced database Programming concepts	3	Apply
3. Implement program for database connectivity using java/PHP/Python.	3	Apply
4. Use and handle NoSQL databases like mongoDB, Cassandra.	3	Apply
5. Implement database triggers, procedures and cursor for database application	3	Apply
6. Develop mini project using concept of database as backend.	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	1	--	2	2	2	--	--	--	--	--	3	2	3	2	1
CO2	2	--	2	2	2	--	--	--	--	--	2	2	2	2	--
CO3	1	--	2	--	2	--	--	--	--	--	2	2	2	3	--
CO4	2	--	--	2	--	--	--	--	--	--	2	2	1	2	--
CO5	2	--	2	2	--	--	--	--	--	--	2	2	2	3	--
CO6	2	--	3	2	2	--	--	--	--	--	2	3	2	2	1

COURSE CONTENTS

Sr. No.	Title of Assignment
Group A- Database Programming Languages – SQL, PL/SQL	
1	Study of Open Source Relational Databases: MySQL/Oracle and Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence
2	Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator, all types of Join, Sub-Query and View.
3	<p>Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory. Write a PL/SQL block of code for the following requirements:-</p> <p>Schema:</p> <ol style="list-style-type: none"> 1. Borrower(Rollin, Name, DateofIssue, NameofBook, Status) 2. Fine(Roll_no,Date,Amt) <ul style="list-style-type: none"> ● Accept roll_no & name of book from user. ● Check the number of days (from date of issue), if days are between 15 to 30 then fine amount will be Rs 5 per day. ● If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day. ● After submitting the book, status will change from I to R. ● If condition of fine is true, then details will be stored into fine table. <p>Frame the problem statement for writing PL/SQL block inline with above statement.</p>
4	<p>Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor)</p> <p>Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped.</p>

	Frame the separate problem statement for writing PL/SQL block to implement all types of Cursors inline with above statement. The problem statement should clearly state the requirements.
5	<p>PL/SQL Stored Procedure and Stored Function.</p> <p>Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is ≤ 1500 and marks ≥ 990 then student will be placed in distinction category if marks scored are between 989 and 900 category is first class, if marks 899 and 825 category is Higher Second Class</p> <p>Write a PL/SQL block for using procedure created with above requirement.</p> <p>Stud_Marks(name, total_marks) Result(Roll, Name, Class)</p> <p>Frame the separate problem statement for writing PL/SQL Stored Procedure and function, inline with above statement. The problem statement should clearly state the requirements.</p>
6	<p>Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers). Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in Library_Audit table.</p> <p>Frame the problem statement for writing Database Triggers of all types, in-line with above statement. The problem statement should clearly state the requirements.</p>
Group B Large Scale Databases	
7	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution).
8	<p>Implement aggregation and indexing with suitable example using MongoDB.</p> <p>Use Zipcode Dataset (download from url https://media.mongodb.org/zip.json) and import in mongoDB and perform following operations</p> <ol style="list-style-type: none"> Return States with Populations above 10 Million. Return Average City Population by State Return Largest and Smallest Cities by State Return States with Population Create single field index Create a compound index
9	<p>Implement Map reduce operation with suitable example using MongoDB.</p> <p>Use Movies Dataset. Write the map and reduce methods to determine the average ratings of movies. The input consists of a series of lines, each containing a movie number, user number, rating, and a timestamp: The map should emit movie number and list of rating, and reduce should return for each movie number a list of average rating.</p>
10	Implement Your own Social media network using neo4j.
Group C Mini Project : Database Project Life Cycle	
11	Write a program to implement MongoDB database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC.
12	Implement MYSQL/Oracle database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit,) using ODBC/JDBC.
13	<p>Using the database concepts covered in Part-A & Part-B & connectivity concepts covered in Part C, students in group are expected to design and develop database application with following details:</p> <p>Requirement Gathering and Scope finalization</p>

Database Analysis and Design:

- Design Entity Relationship Model, Relational Model, Database Normalization

Implementation :

- Front End : Java/Perl/PHP/Python/Ruby/.net
- Backend : MongoDB/MYSQL/Oracle
- Database Connectivity : ODBC/JDBC

Testing : Data Validation

Group of students should submit the Project Report which will be consist of documentation related to different phases of Software Development Life Cycle: Title of the Project, Abstract, Introduction, scope, Requirements, Data Modeling features, Data Dictionary, Relational Database Design, Database Normalization, Graphical User Interface, Source Code, Testing document, Conclusion. Instructor should maintain progress report of mini project throughout the semester from project group and assign marks as a part of the term work

Reference Books

1. Ivan Bayross, BPB Publication ,“SQL, PL/SQL: The Programming Language of Oracle”
2. Kristina Chodorow, Michael Dirolf, “MongoDB: The Definitive Guide”, O’Reilly Publications
3. <http://www.tutorialspoint.com/json/> & <http://docs.mongodb.org/manual/>

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HS216: CORPORATE READINESS

Teaching Scheme	Examination Scheme
Lectures: 2Hrs. / Week	Term Work: 50 Marks
Credits: 2	Total: 50 Marks

Prerequisite : (Verbal and Non-verbal communication, Writing & Reading Skills)

Course Objectives:

1. To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.
2. To improve interpersonal and communication skills.
3. To develop reading and writing skills.
4. To demonstrate the importance of team work & leadership quality.
5. To prepare students for the various professional interviews.
6. To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs):

After successful completion of the course, student will be able to:

Course Outcome (s)	Bloom's Taxonomy	
	Level	Descriptor
1. Understanding the concepts of grammar through various topics	2	Understand
2. Understanding reading skills which can improve the phonetics	2	Understand
3. Apply the knowledge of Verbal Ability to apply it in written form	3	Apply
4. Analyse and apply the critical thinking ability as required to showcase leadership skills.	4	Analyse
5. Examining based on communication skills	4	Examine
6. Judging an ideal personality that fits Industry requirement.	5	Judge

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	--	--	--	--	--	--	--	--	--	2	--	1	--	3	--	--
CO2	--	--	--	--	--	--	--	--	--	3	--	1	--	3	--	--
CO3	--	--	--	--	--	--	--	--	--	2	--	2	--	1	--	--
CO4	--	1	--	--	--	1	--	1	3	2	--	2	1	--	--	--
CO5	--	2	--	--	--	--	--	1	2	2	--	1	--	--	--	--
CO6	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--

COURSE CONTENTS

UNIT-I	VERBAL ENGLISH	No. of Hours	CO
	Para Jumbles, Idioms and phrases, Parts of speech, Brief overview of Tense	6	CO1
UNIT-II	READING SKILLS	No. of Hours	CO
	Reading Skills-why and how, Reading Newspaper, Reading Comprehension, Passage Reading	4	CO2
UNIT-III	WRITING SKILLS	No. of Hours	CO
	Story Writing, Email Writing, Content Writing, Article and Passage Writing	4	CO3
UNIT-IV	LEADERSHIP AND TEAMING UP	No. of Hours	CO
	Team work, Good team member qualities, Leadership qualities, Team work activities	6	CO4
UNIT-V	COMMUNICATION SKILLS	No. of Hours	CO
	Spoken English, Phonetics, Accent and Intonation, Interpersonal Activities	6	CO5
UNIT-VI	BODY LANGUAGE	No. of Hours	CO
	Reveals your Inner Self and Personality, Grooming, Personal Interviews	4	CO6
Text Books:			
T1. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal. T2. Reasoning verbal and Non-Verbal by B. S. Sijwali. T3. Master the Group Discussion & Personal Interview - Complete Discussion on the topics asked by reputed B-schools & IIMs by Sheetal Desarda.			
References:			
R1. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical). R2. Analytical Reasoning by M. K. Panday. R3. Logical and analytical reasoning by K. Gupta. R4. Multi-dimensional reasoning by Mishra & Kumar Dr. Lal.			
E- Books:			
1. https://themech.in/quantitative-aptitude-and-logical-reasoning-books/ 2. https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html			
E-learning Resources/MOOCs/ NPTEL Course Links:			
1. https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/ 2. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/ 3. https://www.livecareer.com/resume/examples/web-development/e-learning-developer 4. https://novoresume.com/career-blog/how-to-write-a-resume-guide			

CO217: Mini Project

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs. / Week	Term Work:	25 Marks
Credits: 1	Total:	25 Marks

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Prerequisite: Basics of Programming

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Students need to select any one of the following training buckets, learn the course, perform list of assignments, develop mini-project in a group of 3-4 students and at the end need to submit project report as per the guidelines given in course syllabus:

Guidelines for Assessment:

Continuous assessment of laboratory work is done based on overall performance in lab assignments and mini-project. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage.

Term Work will be based on assignments carried out by a student and mini-project demonstration and related skills learned.

General Guidelines for Mini-Project:

1. The mini project should be undertaken preferably by a group of 2-3 students under the guidance of domain expert faculty who will jointly work together and implement the project.
2. Topics should be based on the technology that students have studied in choice based subjects.
3. It is appreciated if the mini-project is based on real world problems and day to day life.
3. Use of open source software is to be appreciated.
4. The group has to select the project topic with the approval of the guide and submit the name of the project with synopsis of the proposed work.
5. At the end of the semester each group need to submit a report of minimum 15 pages.

The formats for synopsis and report are as given below:

1. Title page 1
2. Certificate Page 1
3. Acknowledgement Half
4. Content (Index) 1 or one & half
5. Introduction 1 or 2
6. Problem statement and Objectives 1
7. Literature Review 5 to 10 pages depending on topic
8. Work Methodology as per nature of topic/work 10 to 20 pages
9. Summary of Results and discussion 2 to 4 pages
10. Conclusion and Future Scope 1 or half page
11. Letter of interaction with outside industry /institute/ individuals, paper details in journal or Participation certificate in conference, seminar, paper, Email correspondence, 1 to 4 pages
12. References 1 or 2 pages
13. Appendix if any 1 to 4 pages.

Procedure of Evaluation

Normally, evaluation of mini-projects is done through presentations by a group of students in front of two or more faculty and assessment of individual students is done by faculty and average of marks are worked out. Proper Assessment Rubrics will be developed and disseminated by the faculty. General procedure is given below.

1. As per departmental academic policy, mini-projects may be evaluated similar to laboratory course work. 2. The faculty Coordinator collects the soft copies of Mini-projects in the department and the grouping of the Mini-projects is done depending upon the topics of the Mini projects. Panels of 3 to 4 faculty guiding concerned Mini-projects, are formed for the evaluation
3. Mini-project Guide (internal Faculty) will evaluate project reports submitted by his group of students, in the form of soft copy in the “suggested” format and recalling the observations of performance of the students in a group, faculty will give marks out of 25.
4. As per the midterm evaluation schedule, a concerned panel of the faculty does the evaluation of the Mini-projects and average marks out of 25 are given to the students. Suggestions by the panels during the presentation works play a very important role for the motivation and guidance for further work on the Mini – projects.
5. After mid semester evaluation for 25 marks, student groups continue their work under the guidance of concerned guides. After completion of the Mini-projects by the students, the students under the guidance of concerned guides prepare a small report based on the work and the faculty guide does the evaluation for 25 marks.
6. The final presentation (Internal Evaluation) of the Mini-projects for 50 marks will be conducted as a part of external ORAL Examination.

Common Instructions for the Conduction.

1. Department has to identify skill sets requirements in consultation with Industry.
2. The mini-project will be on a particular skill set only, it is encouraged to conduct it with the involvement of Industry Expert to acquire such skill set, and internal faculty will act as a facilitator for the students.
3. Proper Assessment Rubrics will be developed, explained to the students, disseminated to the students well in advance.
4. At the end of this, students must be able to exhibit the acquired skills through its proper use in the development of selected applications

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MLC218: Innovation - Project based – Science and Technology, Social, Design & Innovation

Teaching Scheme	Examination Scheme
Practical : 1Hrs. / Week	
Credits: No Credit	

Course Objectives:

1. To develop strategic thinking to solve social problems
2. Understand the role of innovation and technical change in enterprise and national level economic performance

Course Outcomes: On completion of the course, students will be able to-

Course Outcomes	Blooms Taxonomy	
	Level	Descriptor
1. Understand the role of innovation and technical change in enterprise and national level economic performance	2	Understanding
2. Develop strategic thinking to solve social problems	3	Applying
3. Recognize opportunities for the commercialization of innovation	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

COURSE CONTENTS

Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student, which may result in development of a working system, a prototype, or a device or material, etc. They are expected to come up with novel and useful ideas on social problems. Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non-conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities may be undertaken under this

- (a) Exposure to social problems (which are amenable to technological solutions)
- (b) Design & Innovation (to address above problems)

After this student, be encouraged to undertake technology projects of social relevance

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Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopergaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)



TY B. Tech. Computer Engineering

2021 Pattern

Curriculum

(T Y B. Tech. Sem-V & VI with effect from Academic Year 2023-2024)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopergaon Dist.

Ahmednagar, Maharashtra State, India PIN 423603

Sanjivani College of Engineering, Kopergaon

(An Autonomous Institute affiliated to SPPU, Pune)

DECLARATION

We, the Board of Studies (Computer Engineering), hereby declare that, we have designed the Curriculum of Third Year Computer Engineering Program Curriculum Structure and Syllabus for semester V & VI of Pattern 2021 w.e.f. from A.Y 2023-24 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by



(Dr.D.B.Kshirsagar)

BoS Chairman

Approved by



Dean Academics



Director
Sanjivani College of Engineering,
Kopergaon

Sanjivani College of Engineering, Kopergaon

(An Autonomous Institute)

Department of Computer Engineering

COURSE STRUCTURE- 2021 PATTERN

THIRD YEAR B. TECH: COMPUTER ENGINEERING (A.Y. 2023-24)

SEMESTER V

Cat .	Code	Design and Analysis of Algorithms	Teaching Scheme				Evaluation Scheme					
			L (hrs)	T (hrs)	P (hrs)	Credits	Theory		Practical			Grand Total
							CIA	ESE	TW	OR	PR	
PCC	CO301	Design and Analysis of Algorithms	3	1	-	4	40	60	-	-	-	100
PCC	CO302	Computer Network	3	-	-	3	40	60	-	-	-	100
PCC	CO303	Web Technology	3	-	-	3	40	60	-	-	-	100
PCC	CO304	Theory of Computation	3	1	-	4	40	60	-	-	-	100
PEC	CO305	Professional Elective - I	3	-	-	3	40	60	-	-	-	100
LC	CO306	Design and Analysis of Algorithms Laboratory	-	-	2	1	-	-		50	-	50
LC	CO307	Computer Network Laboratory	-	-	2	1	-	-	25	-		25
LC	CO308	Web Technology Laboratory	-	-	2	1	-	-	-	-	50	50
PROJ	CO309	Seminar and Communication Skills		-	2	1	-		25	-	-	25
PROJ	CO310	Corporate Readiness-II			2	01			50			50
MLC	MC311	Mandatory Learning Course-V	1	-	-	NC	-	-	-	-	-	Pass/Fail
Total			16	2	10	22	200	300	100	50	50	700

Mandatory Learning Course-V: Learning an Art Form (Music: vocal or instrumental, dance, painting, clay modeling, etc.):

Code	Professional Elective-1
CO305 A	Advanced Databases
CO305 B	Software Testing and Quality Assurance
CO305 C	Cloud Computing

Sanjivani College of Engineering, Kopargaon
(An Autonomous Institute)

Department of Computer Engineering

COURSE STRUCTURE- 2021 PATTERN

THIRD YEAR B. TECH: COMPUTER ENGINEERING (A.Y. 2023-24)

SEMESTER VI

Cat .	Cod e	Course Title	Teaching Scheme				Evaluation Scheme					
			L (h rs)	T (h rs)	P (h rs)	Credi ts	Theory		Practical			Gra nd Tot al
							CIA	ESE	TW	OR	PR	
PCC	CO3 12	Internet of Things	4	-	-	4	40	60	-	-	-	100
PCC	CO3 13	System Software	4	-	-	4	40	60	-	-	-	100
PCC	CO3 14	Data Mining and Warehousing	3	1	-	4	40	60	-	-	-	100
PCC	CO3 15	Professional Elective - II	4			4	40	60				100
PROJ	PR3 16	IPR and EDP	2	-	-	2	20	30	-	-		50
LC	CO3 17	Internet of Things Laboratory	-	-	2	1	-	-	-	50	-	50
LC	CO3 18	System Software Laboratory	-	-	2	1	-	-	25	-	50	75
LC	CO3 19	Data Mining and Warehousing Laboratory	-	-	2	1			25	-	50	75
PROJ	CO3 20	Creational Activity Lab			2	1			50			50
MLC	MC3 21	Mandatory Learning Course-VI	1	-	-	N C	-	-	-	-	-	Pass/ Fail
To tal			18	1	0 8	2 2	180	270	10 0	50	10 0	700

**Mandatory Learning Course-VI: Behavioral and Interpersonal skills
(non-verbal skills / behaviors, nonaggression)**

Code	Professional Elective-II
CO315 A	Digital Forensics
CO315 B	Digital Image Processing
CO315 C	Advanced Java Programming

SEMESTER

V

CO301: Design and Analysis of Algorithms			
Teaching Scheme		Examination Scheme	
Lectures:	3Hrs. / Week	Continuous Assessment:	40 Marks
Credits:	3	End Sem:	60 Marks
		Total:	100 Marks

Prerequisite Course: Fundamentals of Data Structures Advanced Data Structures, Discrete Mathematics.

Course Objectives:

1. To study and understand problem solving & basics of algorithm.
2. To study how to solve problems using greedy strategy.
3. To study how to solve problems using dynamic programming.
4. To study how to solve problems using backtracking and branch-n-bound strategies
5. To understand computational complexity theory.
6. To study parallel algorithms.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand basics of problem solving and algorithm designing.	2	Understand
2. Solve problems using divide & conquer and greedy strategy.	3	Apply
3. Solve problems using dynamic programming strategy.	3	Apply
4. Solve problems using backtracking and branch-n-bound strategies.	3	Apply
5. Understand computational complexity theory.	2	Understand
6. Understand parallel algorithms.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO5	-	2	2	3	-	1	1	1	-	-	-	1	3		2
CO6	1	-	2	3	-	1	1	1	-	-	-	1	2	1	-

COURSE CONTENTS

Unit I	Problem Solving & Basic of Algorithm	No. of Hours	Cos
	<p>Problem Solving: Definition of Problem, Problem solving principles, Classification & Strategies to solve problems,</p> <p>Algorithm: Definition, Asymptotic Notations, Time Complexities, Best, Worst & Average Case Analysis.</p> <p>Types of algorithms: Randomized, Approximate & Exact.</p> <p>Case study: Brute Force Method.</p> <p>Application: Medical Domain Problem (MRI Scanner) and Algorithm for the MRI Scanner.</p>	6	CO1
Unit II	Divide-&-Conquer and Greedy Strategy	No. of Hours	Cos
	<p>Divide and Conquer Strategy: Principle, Control Abstraction, Time complexity Analysis, Binary search algorithm. Case study: Merge Sort.</p> <p>Application: Google's Binary Search to Identify Malware.</p> <p>Greedy Strategy: Principle, Control Abstraction, Time Complexity Analysis, Knapsack Problem,</p> <p>Case study: Scheduling Algorithms-Job Scheduling.</p> <p>Application: Finding the Shortest Path on Google Map</p>	6	CO2
Unit III	Dynamic Programming	No. of Hours	Cos
	<p>Dynamic Programming: Principle, Control Abstraction, Time Complexity Analysis, Binomial Coefficients, 0/1 Knapsack,</p> <p>Case study: Optimal Binary Search Tree (OBST)</p> <p>Application of DP: Path Finder GPS Application-Uber.</p>	6	CO3
Unit IV	Backtracking and Branch & Bound	No. of Hours	Cos
	<p>Backtracking: Principle, Control Abstraction, Time Complexity Analysis, 8-Queen Problem.</p> <p>Case Study: Sum of Subsets Problem.</p>	6	CO4

	Application of BT: Sudoku Solver App Branch-and-Bound: Principle, Control Abstraction, Time Complexity Analysis, Knapsack Problem. Case Study :- Traveling Salesperson Problem, Application: Airline Crew Scheduling problem.		
Unit V	Complexity Theory	No. of Hours	Cos
	Polynomial and Non-Polynomial Class Problems, Deterministic and Non-Deterministic Algorithms, P class problems, NP class problems. NP complete class problems- Vertex cover problem, 3-SAT problem NP-Hard Problems: Clique problem. Case Study:- Reduction problem (3SAT to Clique Problem). Application of Complexity: Visiting All the Cities in State, Country and Globe	6	CO5
Unit VI	Parallel Algorithms	No. of Hours	Cos
	Sequential and Parallel Computing, RAM & PRAM Models for Parallel Processing, Parallel Algorithm with Analysis. Optimal Parallel Algorithms. Quantum Algorithms: Grover's Algorithm for Efficient Search. Case study:- Analysis of Parallel Quick Sort. Application: Database and Data Mining for Banking Data.	6	CO6
Books:			
Text Books(T):			
T1. Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press. T2. Gills Brassard and Paul Bartly, "Fundamentals of Algorithmic", PHI, New Delhi. T3. . A.V.Aho., "The Design and Analysis of Algorithms" Pearson Education, NewDelhi. T4. K, Loudon, "Mastering Algorithms", O" Reily Media Inc			
Reference Books(R):			
R1. Fayeze Gebali, "Algorithms and Parallel Computing", Willy Publication. R2. Thomas H. Cormen and Charles R. L. Leiserson, "Introduction to Algorithm", PHI Publications. R3. M.R.Kabat, "Design and Analysis of Algorithms", PHI Learning (p) Ltd. R4. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press.			

e-Resources(E):

E1:Robert Sedgewick and Kevin Wayne, "algorithms" Princeton University.
<https://bank.engzenon.com/tmp/5e7f6ee5-d4dc-4aa8-9b0a-42d3c0feb99b/6062caf3-c600-4fc2-b413-4ab8c0feb99b/Algorithms-4th-Edition.pdf>.

E2: Jeff Erickson, "algorithms", a Creative Commons Attribution 4.0 International License
<https://jeffe.cs.illinois.edu/teaching/algorithms/book/Algorithms-JeffE.pdf>.

E3: Junhui deng, "Data structures and algorithms specialization", tsinghua University, Beijing.
<https://www.coursera.org/specializations/data-structures-algorithms-tsinghua>

E4:Prof.Madhavan, "Design and Analysis of Algorithms <https://nptel.ac.in/courses/106106131>

CO302: Computer Network

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs. / Week	Continuous Internal Assessment (CIA): 40 Marks
Credits: 3	End-Sem Exam (ESE): 60 Marks
	Total: 100 Marks

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Prerequisite Course: Computer Organization and Architecture, Digital Electronics and Data Communication

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Course Objectives:

1. To learn and understand the fundamental concepts of computer network.
2. To learn and understand different techniques for framing, error control and flow control.
3. To learn and understand different techniques for channel allocation and IEEE standards.
4. To learn and understand switching and routing techniques used in internet layer.
5. To learn and understand TCP and UDP protocols used in transport layer.
6. To learn and understand application layer protocol.

Course Outcomes (COs):

On successful completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Design and implement different computer networks using network technologies.	3	Apply
2. Design and implement different error and flow control algorithms.	2	Understand
3. Demonstrate basic concepts of channel allocation.	2	Understand
4. Demonstrate different switching and routing techniques.	2	Understand
5. Design and implement client server architecture using transport layer protocol.	3	Apply
6. Develop different network applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	2	1	1	-	1		1	1	2	1	-
CO2	1	2	2	-	-	-	-	-	-	-	-	1	2	1	-
CO3	1	1	1	1	-	-	-	-	-	-	-	1	2	-	-
CO4	1	3	1	-	1	-	-	-	-	-	-	1	3	1	-
CO5	1	2	2	1	1	-	-	-	-	-	-	1	3	1	-
CO6	2	3	3	1	2	2	-	-	2	-	1	2	3	2	1

Course Contents

Unit-I	Introduction to Computer Network	No. of Hours	COs
	Communication System: Introduction of LAN, MAN, WAN, WAN Acceleration, PAN, Ad-hoc Network. Network Architectures: Client-Server, Peer To Peer. Topologies: Star and Hierarchical, OSI Model, TCP/IP Model. Network Devices: Bridge, Switch, Router and Access Point, Smart NIC. Case Study: Switch & Access point configuration	7 Hrs.	1
Unit-II	Logical Link Control Layer	No. of Hours	COs
	Design Issues: Services to Network Layer, Framing, Error Control and Flow Control, Error Control: Parity Bits, Hamming Codes (7/8-bits) and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol.	7 Hrs.	2
Unit-III	Medium Access Control Layer	No. of Hours	COs
	Channel Allocation: Static and Dynamic. Multiple Access Protocols:	7 Hrs.	3

	<p>Pure and Slotted ALOHA, CSMA, WDMA.</p> <p>IEEE Standards and Frame Formats: IEEE 802.3, CSMA/CD, Binary Exponential Back off algorithm, Fast Ethernet, Gigabit Ethernet, IEEE 802.11a/b/g/n and IEEE 802.15 and IEEE 802.16 Standards, CSMA/CA.</p> <p>Case Study: Simulation of protocols using NS2</p>		
Unit-IV	Internet Layer	No.of Hours	COs
	<p>Switching Techniques and IP Protocol: IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP,</p> <p>Routing Protocols: Distance Vector, Link State, and Path Vector.</p> <p>Routing in Internet: RIP, OSPF, BGP, Congestion control and QoS, MPLS.</p> <p>Routing in MANET: AODV, DSR.</p> <p>Case Study: Simulation of routing protocols using NS2 and Cisco Packet Tracer</p>	7 Hrs.	4
Unit-V	Transport Layer	No.of Hours	COs
	<p>Services and Berkley Sockets: Addressing, Connection establishment, Connection release.</p> <p>Protocols: TCP and UDP, Flow control and buffering, Multiplexing, TCP Congestion Control, Quality of Service (QoS), Differentiated services.</p>	7 Hrs.	5
Unit-VI	Application Layer	No.of Hours	COs
	<p>Protocols: Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP).</p> <p>Email: SMTP, MIME, POP3, Webmail.</p> <p>Network Performance: Throughput, Latency, Packet Loss, And Retransmission.</p> <p>Case study: Software Defined Network (SDN) and 5G Network</p>	7 Hrs.	6

Books:
Textbooks:
1. Andrew S. Tenenbaum, “Computer Networks”, PHI, ISBN 81-203-2175-8. 2. Fourauzan B., "Data Communications and Networking", 5 th Edition, Tata McGraw- Hill, Publications, ISBN: 0 – 07 – 058408 – 7.
Reference Books:
1. Kurose, Ross “Computer Networking a Top Down Approach Featuring the Internet”, Pearson, ISBN-10: 0132856204. 2. Matthew S. G, “802.11 Wireless Networks”, O’Reilly publications, ISBN: 81-7656-992-5 3. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols” Prentice Hall, ISBN-10: 8131706885; ISBN-13: 978-8131706886. 4. Holger Karl and Andreas Willing, “Protocols and Architectures for Wireless Sensor Networks”, Wiley India , ISBN: 9788126533695. 5. Eldad Perahia, Robert Stacey, “Next Generation Wireless LANs”, Cambridge, ISBN-10:1107016762; ISBN-13: 978-1107016767. 6. Efraim Turban, Linda Volonino, Gregory R. Wood “Computer Networking a Top Down Approach Featuring the Internet”, 10th Edition, Wiley; ISBN13: 978-1-118-96126-1.
<u>E-Resources:</u>
1. https://nptel.ac.in/courses/106/105/106105183/
2. https://nptel.ac.in/courses/106/101/106101209/
3. https://nptel.ac.in/courses/106/105/106105080/

CO303: Web Technology			
Teaching Scheme		Examination Scheme	
Lectures:	3 Hrs. / Week	CIA:	40 Marks
Credits:	3	ESE:	60 Marks
		Total:	100 Marks

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Prerequisite Course: Basic knowledge of Programming and Computer Systems

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Course Objectives:

- 1.To learn the concepts of HTML 5 for developing client side user interface
- 2.To learn the client side technologies for web development.
3. To reduce the amount of code for building user interface applications using AngularJS.
- 4.To build single-page web applications with ReactJS.
- 5.To learn the server side technologies for web development.
- 6.To build web applications quickly with less code using Spring Boot framework.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Apply HTML 5 elements for developing client side user interface	3	Apply
2. Apply the Client side technologies for web development.	3	Apply
3. Understand architecture of AngularJS and develop single page application(SPA) using fundamentals of AngularJS	3	Apply
4. Apply the fundamentals of ReactJS to develop rich web applications.	3	Apply
5. Apply the server side technologies for developing dynamic web application	3	Apply
6. Apply Spring Boot framework to build web applications in less code	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO2	3	1	3	-	2	-	1	-	2	2	1	2	3	3	3
CO3	3	1	3	-	3	-	2	-	2	2	1	2	3	3	3
CO4	3	1	3	-	3	-	2	-	2	2	1	2	3	3	3
CO5	3	1	3	-	3	-	2	-	2	2	1	2	3	3	3
CO6	3	1	3	-	3	-	2	-	2	2	1	2	3	3	3

COURSE CONTENTS

Unit I	Introduction to Web Technologies	No. of Hours	Cos
	HTML 5: HTML5 Introduction, Structure of Web Page, Text Formatting tags, Image, tables, links, frames, forms, Semantic Elements, Form Elements, Form Attributes, Form Input Types, Media Elements, SVG, Media Elements, Canvas, Drag and Drop	6	CO1 CO2
Unit II	Client Side Technologies	No. of Hours	Cos
	CSS: Need of CSS, Types of CSS, CSS Selectors, CSS for basic HTML tags, responsive CSS framework: Bulma XML: Introduction to XML, XML key component, Transforming XML into XSLT, DTD: Schema, elements, attributes, Introduction to JSON. Java Script: JS in an HTML (Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS. Bootstrap: Introduction Bootstrap, Syntax of Bootstrap, Container and Container-fluid, Connectivity of Bootstrap in page	7	CO2 CO3 CO6
Unit III	AngularJS	No. of Hours	Cos
	Introduction, MVC Architecture, Conceptual Overview, Setting up the Environment First Application, Understanding ng attributes, Expressions and Data Binding, Working with Directives, Conditional Directives, Styles Directives, Mouse and Keyboard Events	7	CO3 CO4

	Directives, Controllers, Filters, Forms, Modules, Ajax in AngularJS, Routing, Introduction to SPA, Creating HTML Templates, Configuring Route Provider.		
Unit IV	ReactJs	No. of Hours	Cos
	<p>What is React Js, Advantages of React Js, Limitation of React Js, Installation.</p> <p>Overview of JSX, Rendering an Element into the DOM, Naming Conventions.</p> <p>Overview of Components, Props, State, Life Cycle of component and reusing of Component, Props Validation, API Calls Using WebApi.</p> <p>Overview of Flux, Flux Elements, Limitations of Flux, Advantages of Flux</p>	8	CO3 CO4
Unit V	Server side Technologies	No. of Hours	Cos
	<p>Servlet: Introduction, life cycle of servlet, servlet directory structure, servlet example, form handling, cookies and session tracking.</p> <p>JSP : life cycle, JSP tags, built in objects, Directives, File uploading and page redirecting. Database connectivity using servlet and JSP</p>	8	CO3 CO4 CO6
Unit VI	Spring boot	No. of Hours	Cos
	Introduction to spring boot, Building Spring Boot Application, Rest Annotation with In Memory Database & CRUD Operations, Rest Annotation with Relation DB, JPA Repository Concepts, Actuator Concepts, Spring Boot Custom Logging, Spring Boot Profile Components, Auto Configuration, Thymleaf Concepts, Integration with Spring Web, Spring Boot Security, Database Concepts	6	CO4 CO5
Books:			
Text Books(T):			

<p>T1. Robin Nixon,” Learning PHP, Mysql and Javascript with JQuery, CSS & HTML5”, O'REILLY</p> <p>T2. Juha Hinkula,”Full Stack Development with Spring Boot and React”,3rd Edition Paperback</p> <p>T3. Ken Williamson,”Learning AngularJS: A Guide to AngularJS Development (Greyscale Indian Edition)”,O'REILLY</p>
Reference Books(R):
<p>R1. Adam Bretz & Colin J Ihri,”Full Stack Javascript Development with MEAN”,SPD</p> <p>R2. McGraw Hill Education publications,” Developing Web Applications”.</p> <p>R3. Allan Cole,” Build Your Own Wicked Wordpress Themes”,SPD</p>
E-Resources:
<p>E1: https://www.mygreatlearning.com/full-stack-web-development/free-courses</p> <p>E2: https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javascript</p>

CO304: Theory of Computation			
Teaching Scheme		Examination Scheme	
Lectures: 3 Hrs. / Week		Continuous Internal Assessment:	40 Marks
Tutorial : 1 Hr / Week		End-Sem Exam:	60 Marks
Credits: 4		Total:	100 Marks

Prerequisite Course: Discrete Mathematics, Data Structures

Course Objectives:

1. To study Finite State Machine, Finite Automata and its language
2. To learn Regular Expressions and Regular Languages
3. To understand Context Free Grammars and Context Free Languages
4. To study Pushdown Automata and its language
5. To learn and understand Turing Machine and its language
6. To be familiar with the theory of computability and complexity

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Construct Finite Automata and its variants for regular languages.	3	Apply
2. Build regular expressions for a regular language and to prove theorems and properties of regular languages	3	Apply
3. Write context free grammar for context free languages and to prove properties of CFL	3	Apply
4. Construct Pushdown Automata for context free language	3	Apply
5. Construct Turing Machines for unrestricted kind of languages	3	Apply
6. Understand the key terms, such as computability, decidability, and complexity through problem solving.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO3	2	2	2	1	-	-	-	-	2	1	-	1	2	-	-
CO4	3	2	2	2	-	-	-	-	2	1	-	1	3	1	-
CO5	3	2	2	2	-	-	-	-	2	1	-	1	3	1	-
CO6	2	1	-	1	-	-	-	-	2	1	-	2	2	1	-

COURSE CONTENTS

Unit I	FORMAL LANGUAGE THEORY AND FINITE AUTOMATA	No. of Hours	COs
	<p>Introduction to Formal language, Alphabets, Strings and languages, Finite representation of language,</p> <p>Finite Automata (FA): An Informal Picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language, Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA, Minimization of DFA's</p> <p>FA with output: Moore and Mealy machines -Definition, models, inter-conversion.</p> <p>Case Study: FSM for Traffic Signal Controller, Vending Machine</p>	6	1
Unit II	REGULAR EXPRESSIONS	No. of Hours	COs
	<p>Operators of RE, Building RE, Precedence of operators, Algebraic laws for RE, Equivalence of two RE's</p> <p>Conversions: RE to NFA, NFA to DFA, DFA to RE using Arden's theorem.</p> <p>Pumping Lemma for Regular languages, Closure and Decision properties.</p> <p>Case Study : RE in Text Search and Replace, Lexical analysis</p>	6	2
Unit III	CONTEXT FREE GRAMMAR	No. of Hours	COs
	<p>Context Free Grammar- Definition, sentential forms, Derivations, Parse trees, Context Free Language. Ambiguous Grammar, writing a grammar for language.</p> <p>Simplification of CFG, Eliminating ϵ-productions, unit</p>	6	3

	<p>productions, useless production, useless symbols</p> <p>Normal Forms- Chomsky normal form, Greibach normal form, Closure properties of CFL, Decision properties of CFL's, Chomsky Hierarchy</p> <p>Case Study: CFG for Parenthesis Match, Palindrome Strings, Parsers</p>		
Unit IV	PUSHDOWN AUTOMATA & LINEAR BOUNDED AUTOMATA	No. of Hours	COs
	<p>Formal Definition of the PDA, Equivalence of Acceptance by Final State & Empty stack, Non-Deterministic PDA, PDA and Context Free Language, Equivalence of PDA's and CFG's, Definition of Linear Bounded Automata- LBA and Context Sensitive Language.</p> <p>Case Study: Use of PDA in Top-Down and Bottom-up Parser Design</p>	6	4
Unit V	TURING MACHINES	No. of Hours	COs
	<p>Turing Machine Model, Formal Definition of TM, Instantaneous description for TM, Transition diagrams for TM, The Language of Turing Machine, Design of TM, Description of TM, Programming techniques for TM's, Extensions to the basic TM, Universal TM's, Halting Problem of TM,</p>	6	5
Unit VI	UNDECIDABILITY & INTRACTABLE PROBLEMS	No. of Hours	COs
	<p>Decidable Problems and Un-decidable Problems, Church-Turing Thesis, an un-decidable problem that is RE, Post's Correspondence Problem, The Classes P and NP, An NP-Complete Problem, A Restricted Satisfiability Problem, The Problem of Independent Sets, The Node-Cover Problem</p>	6	6
Books:			
Text Books(T):			
<p>T1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory Languages and Computation", Addison-Wesley, ISBN 0-201-44124-1.</p>			

T2. John Martin, “Introduction to Languages of The Theory of Computation”, 2nd Edition, Mc Graw Hill Education, ISBN-13: 978-1-25-900558-9, ISBN-10: 1-25-900558-5

Reference Books(R):

R1.H.L. Lewis, Christos H. Papadimitriou, “Elements of the Theory of Computation”, Prentice Hall, ISBN-10: 0132624788; ISBN-13: 978-0132624787

R2.Sanjeev Arora and Boaz Barak, “Computational Complexity: A Modern Approach”, Cambridge University Press, ISBN:0521424267 97805214242643.

R3.Daniel Cohen, “Introduction to Computer Theory”, Wiley & Sons, ISBN 97881265133454.

R4.J. Carroll & D Long, “Theory of Finite Automata”, Prentice Hall, ISBN 0-13-913708-45

R5.Kavi Mahesh, “Theory of Computation: A Problem-Solving Approach”, Wiley India, ISBN10 81265331106

R6.Michael Sipser, “Introduction to the Theory of Computation”, Cengage Learning, ISBN-13: 97811331878137

R7.Vivek Kulkarni, “Theory of Computation”, Oxford University Press, ISBN 0-19-808458

E-Books :

1. <https://cglab.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf>
2. https://www.u-cursos.cl/ingenieria/2010/2/CC3102/1/material_docente/bajar?id=322214
3. https://e.famnit.upr.si/pluginfile.php/636821/mod_page/content/8/Automata.pdf
4. http://staff.ustc.edu.cn/~huangwc/book/Sipser_Introduction.to.the.Theory.of.Computation.3E.pdf

MOOCs Courses Links:

1. <https://nptel.ac.in/courses/106/104/106104148/>
2. <https://nptel.ac.in/courses/106/104/106104028/>

CO305A: Advanced Databases		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	CIA:	40 Marks
Credits: 3	End-Sem Exam :	60 Marks
	Total:	100 Marks

Prerequisite Course: (if any) Database Management System Concepts

Course Objectives:

1. To understand the types of digital data and big data.
2. To understand the Hadoop architecture.
3. To use map reduce Programming model for NoSQL Data.
4. To learn and use CQL on Column oriented data.
5. To learn and use the Redis Query Language on Key-Value Pair Data.
6. To learn and use the Neo4j Concepts on Graph Data.

Course Outcomes (COs): On completion of the course, student will be able to—

Course Outcome	Bloom's Taxonomy	
	Level	Descriptor
CO1: Understand the Types of Digital Data and Characteristics of Big Data	2	Understand
CO2: Understand the Hadoop Architecture	2	Understand
CO3: Apply the Mapreduce Programming model for NoSQL Data	3	Apply
CO4: Apply the CQL on Column Oriented Data	3	Apply
CO5: Apply the Redis Query Language on Key-Value Pair Data	3	Apply
CO6: Apply the Neo4j Concepts on Graph Data	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	--	2	2	2	--	--	--	--		3	2	3	2	1
CO2	2	--	2	2	2	--	--	--	--		2	2	2	2	--

CO3	1	--	2		2	--	--	--	--		2	2	2	3	--
CO4	2	--	--	2	--	--	--	--	--		2	2	1	2	--
CO5	2	--	2	2	--	--	--	--	--		2	2	2	3	--
CO6	2	--	3	2	2	--	--	--	--		2	3	2	2	1

COURSE CONTENTS

Unit I	Types of Digital Data	No. of Hours	COs
	Classification of Digital Data. Introduction to Big Data: Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Big Data Analytics: Where do we Begin?, What is Big Data Analytics?, What Big Data Analytics isn't?, Classification of Analytics, Terminologies Used in Big Data Environments.	7	1
Unit II	Hadoop	No. of Hours	COs
	Hadoop Overview, why not RDBMS?, RDBMS versus Hadoop, HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator).	7	2
Unit III	MAPREDUCE	No. of Hours	COs
	MAPREDUCE Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. Word Count example using MAPREDUCE	7	3
Unit IV	Cassandra	No. of Hours	COs
	Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD, Collections, Using a Counter, Time to Live, Alter Commands, Import and Export.	7	4
Unit V	Redis	No. of Hours	COs
	Compared to Other Databases and Software ,Features ,Why Redis, Strings, Lists, Sets, Hashes , Sorted sets , Strings Publish/Subscribe , Transactions , Expiring Keys, Elastic search.	7	5
Unit VI	GraphDB	No. of Hours	COs

	What is GraphDB, GraphDB vs RDBMS, GraphDB vs NoSQL, Data Modelling, Neo4j QL, Neo4j General Clauses, Neo4j Read Clauses, Neo4j Write Clauses, Neo4j Functions.	7	6
Books:			
Text Books:			
T1: Rathinaraja Jeyaraj , Ganeshkumar Pugalandhi, Anand Paul , Big Data with Hadoop MapReduce A Classroom Approach , First Edition , Apple Academic Press, 2020			
T2: Seema Acharya, Subjashini Chellappan, Big Data and Analytics,First Editon, Wiley, 2015			
Reference Books:			
R1. S.K.Singh, “Database Systems : Concepts, Design and Application”, Pearson, Education, ISBN 978-81-317-6092-5			
R2. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley, ISBN-10: 0321826620, ISBN-13: 978-0321826626.			
E-Resources(E):			
1. https://in.coursera.org/learn/Advanceddatabase			

CO305B: Software Testing and Quality Assurance		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	Continuous Internal Assessment (CIA):	40 Marks
Credits: 3	End Sem Exam (ESE):	60 Marks
	Total:	100 Marks

Prerequisite Course: Software Engineering.

Course Objectives:

1. To study & understand fundamentals concepts of software testing.
2. To understand Black box testing with boundary value analysis.
3. To understand White box testing with its challenges.
4. To understand Testing Strategies, software quality management systems.
5. To learn Test planning and Management.
6. To learn various automated testing tools.

Course Outcomes (COs): After successful completion of the course, student will be able to:-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand fundamentals concepts of software testing.	2	Understand
2. Understand black box testing with subtypes of black box testing	2	Understand
3. Understand white box testing with subtypes of white box testing	2	Understand
4. Apply different approaches of Testing Strategies with quality Management aspects.	3	Apply
5. Apply and analyze Test planning and Management with case study.	3	Apply
6. Apply automated tools for different types of application	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes(PSOs):

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

CO6	3	3	3			3	2			2			3	
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Course Contents

Unit-I	Introduction to Software Testing	No. of hours	COs
	Need of testing, Basics of Software Testing, Testing Principles, Goals, Software Testing Life Cycle, Defects, Defect management, Verification and validation, Introduction Testing Strategies.	Hrs.6	CO1
Unit-II	Black Box Testing	No. of hours	
	Need of black box testing, Requirements Analysis, Testing Methods - Requirements based testing, Positive and negative testing, Boundary value analysis, Equivalence Partitioning class, Domain testing, Design of test cases. Case studies- ATM Machine & Internet Banking	Hrs.6	CO2
Unit-III	White Box Testing	No. of hours	
	Introduction, Need of white box testing, Testing types, Static testing by humans, Structural Testing – Control flow testing, Loop Testing, Design of test cases, Challenges in White box testing, Case studies- ATM Machine & Internet Banking	Hrs.6	CO3
Unit-IV	Testing Strategies and Quality Management	No. of hours	
	Types of Testing Strategies with Types: Unit, Integration, System, Acceptance testing, Usability testing, Regression testing, Scenario testing, Adhoc testing, Functional, Performance testing, Stress testing, Security testing, Alpha-Beta testing, Software Quality Management: Elements of SQA, SQA Tasks, Goals, and Metrics, Six Sigma for Software Engineering, ISO9000 Quality Standards. Case Study- Online shopping portal management	Hrs.6	CO4

Unit-V	Test Planning and Management	No. of hours	
	Requirement Traceability matrix, Work bench & writing test cases, Important Features of Testing Process, Test Strategy, Test Planning, Testing Process, establishing testing policy, categories of defect, Defect/ error/ mistake in software, Developing TestStrategy and Plan, Testing process. Case Study: Online Banking System	Hrs.6	CO5
Unit-VI	Automation Testing	No. of hours	
	Introduction to Agile Testing, Model based testing, Data driven automation, Manual testing versus Automated testing, Automated Testing Tools Case Studies 1.Introducing Selenium, Selenium-IDE, Selenium RC, 2.Junit or JMeter 3. Basic Mobile Testing Too: opium	Hrs.8	CO6
Books:			
Text Books:			
T1. Ron Patton,” Software Testing”, Pearson Educations, ISBN-978-0-672-32798-8. T2. M. G. Limaye,” Software Testing Principles, Techniques and Tools”, Tata McGraw Hill. ISBN-978-0070-139909 00-7013990-3 T3. A.B. Mathur, “Fundamental of software Testing”, Pearson. ISBN: 9788131794760			
Reference Books:			
R1. Srinivasan Desikan, Gopalswamy Ramesh, “Software Testing principles and Practices”, Pearson. ISBN- 97881-7758-1218 R2. Naresh Chauhan, “Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847. R3. Stephen Kan, “Metrics and Models in Software Quality Engineering”, Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086			

CO305C: Cloud Computing		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	End-Sem Exam:	60 Marks
Credits: 3	Continuous Assessment:	40 Marks
	Total:	100 Marks

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Prerequisite Course: Computer Network, Operating System and Administration

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Course Objectives:

1. To study cloud computing fundamentals.
2. To understand the virtualization environment in cloud computing.
3. To study various cloud computing platforms.
4. To study the applications that use cloud computing.
5. To study cloud security aspects.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand the different cloud computing environment.	2	Understand
2. Understand virtualization concept and its types.	2	Understand
3. Apply security to cloud applications and data.	3	Apply
4. Use appropriate data storage techniques for cloud application.	3	Apply
5. Use cloud platforms like AWS and Microsoft Azure for application development and deployment.	3	Apply
6. Understand the future of cloud computing .	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO5	1	-	-	-	-	-	3	-	-	-	-	-	-	-	1
CO6	-	2	-	-	-	-	1	-	-	2	3	-	-	3	3

COURSE CONTENTS

Unit I	INTRODUCTION	No. of Hours	COs
	<p>Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing. Introduction to Cloud Computing: Characteristics of Cloud Computing, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Model.</p> <p>Cloud Service Models: SaaS, PaaS, IaaS.</p> <p>Case Study : Cloud Computing Model of IBM.</p>	6	CO1
Unit II	VIRTUALIZATION	No. of Hours	COs
	<p>Introduction: Definition of Virtualization, Adopting Virtualization, types of virtualization, types of hypervisors, virtualization tools and mechanisms- Xen, VMware.</p> <p>Types of Virtualization: Server Virtualization, OS Virtualization, Storage Virtualization, Network Virtualization, Virtualization Architecture and Software, The Virtualization Architecture, Virtual Clustering.</p> <p>Web services: AJAX and Mashups, SOAP and REST</p> <p>Case Studies: Microsoft Hyper-V.</p>	6	CO2
Unit III	SECURITY IN CLOUD COMPUTING	No. of Hours	COs
	<p>Risks in Cloud Computing: Risk Management, Enterprise-Wide Risk Management, Types of Risks in Cloud Computing.</p> <p>Data Security in Cloud: Security Issues, Challenges, advantages,</p>	6	CO3

	<p>Disadvantages, Cloud Digital persona and Data security, Content Level Security.</p> <p>Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud, Secure Cloud Software Requirements, Secure Cloud Software Testing.</p> <p>Case Study :Cloud Security Tool: Acunetix.</p>		
Unit IV	DATA STORAGE AND CLOUD COMPUTING	No. of Hours	COs
	<p>Introduction to Enterprise Data Storage: Data Storage Management, Cloud Data Stores, Using Grids for Data Storage, Direct Attached Storage, Storage Area Network, Network Attached Storage, Data Storage Management, File System, Cloud Data Stores, Using Grids for Data Storage.</p> <p>Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing.</p> <p>Cloud Storage from LANs to WANs: Introduction, Cloud Characteristic, Distributed Data Storage, Applications Utilizing Cloud Storage.</p> <p>Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo, Cloud data stores: Datastore and SimpleDB.</p>	6	CO4
Unit V	CLOUD PLATFORMS	No. of Hours	Cos
	<p>Amazon Web Services(AWS):</p> <p>Understanding Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2), Amazon Machine Images, Pricing models, System images and software.</p> <p>Creating an account and instance on EC2, Working with Amazon Storage Systems, Amazon Simple Storage System (S3) , Amazon Elastic Block Store (EBS) ,</p> <p>Using Microsoft Cloud Services:</p>	6	CO4

	Exploring Microsoft Cloud Services, Defining the Windows Azure Platform, The software plus services approach, The Azure Platform, The Windows Azure service, Windows Azure AppFabric , Azure Content Delivery Network , SQL Azure.		
Unit VI	RECENT TRENDS OF CLOUD COMPUTING	No. of Hours	COs
	<p>Recent Trends: Mobile Cloud, Autonomic Cloud Engine, Comet Cloud, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing, IOT and Cloud Convergence: The Cloud and IoT in your Home, The IOT and cloud in your Automobile.</p> <p>Kubernetes: Introduction, Architecture, Monitoring and Management, Orchestration.</p> <p>Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.</p> <p>Case studies on DevOps: DocuSign, Forter, Gengo.</p>	6	CO6
Books:			
Text Books(T):			
<p>T1. A. Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning and Implementation", Pearson, 2014, ISBN: 9788131776513.</p> <p>T2. Gautam Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications" Cambridge University Press , ISBN 978-0-521-13735-5.</p>			
Reference Books(R):			
<p>R1. Dr. Kumar Saurabh, "Cloud Computing", Wiley Publication, ISBN10: 8126536039.</p> <p>R2. Buyya, "Mastering Cloud Computing", Tata McGraw Hill, ISBN-13: 978-1-25-902995-0.</p> <p>R3. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press.</p>			
E-Books:			
<ul style="list-style-type: none"> ● https://sjceodisha.in/wp-content/uploads/2019/09/cloud-computing-Principles-and-Paradigms.pdf. ● https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf. ● https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf. 			

- <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.500-291r2.pdf>.

NPTEL /MOOCS Courses:

- https://onlinecourses.nptel.ac.in/noc21_cs14/preview?
- https://onlinecourses.nptel.ac.in/noc21_cs15/preview?
- <https://www.digimat.in/nptel/courses/video/106105167/L01.html>.
- <https://www.digimat.in/nptel/courses/video/106105167/L03.html>

CO306: Design and Analysis of Algorithms Lab			
Teaching Scheme		Examination Scheme	
Practical:	2 Hrs. / Week	Oral:	50 Marks
Credits:	1	Total:	50 Marks

Prerequisite Course: Fundamentals of Data Structures, Advanced Data Structures, Discrete Mathematics

Course Objectives:

1. To study and implement application of divide and conquer algorithmic strategy
2. To study and implement application of greedy approach
3. To study and implement application of dynamic programming strategy
4. To study and implement application of backtracking approach
5. To identify and apply the suitable algorithmic strategy for the given problem.

Course Outcomes:

After successful completion of the course, students will able to:-

Course Outcome(s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply knowledge of divide and conquer technique to implement solution of problem statement.	3	Apply
CO2	Apply knowledge of greedy strategy implement solution of problem statement.	3	Apply
CO3	Apply the concept of dynamic programming to implement solution of problem statement.	3	Apply
CO4	Apply backtracking technique programming to implement solution of problem statement.	3	Apply
CO5	Apply the suitable algorithmic strategy to solve real world problem.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO4	2	-	1	3	-	1	1	1	-	-	-	1	3	2	2
CO5	-	2	2	3	-	1	1	1	-	-	-	1	3		2

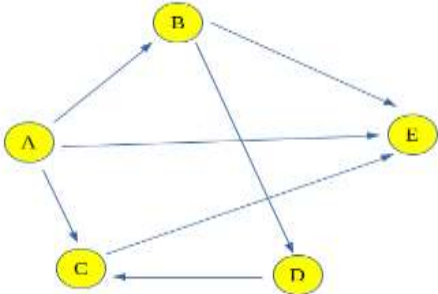
GENERAL INSTRUCTIONS:

1. Each student has to implement 5 assignment individually from set A to set E assigned by faculty members
2. Each student has to complete mini project in group of max 4 members based in CA.

LIST OF EXPERIMENTS:

	Sr. No.	Assignment	CO
A	1.	Implement a problem of number of zeroes. Statement: Given an array of 1s and 0s which has all 1s first followed by all 0s? Find the number of 0s. Count the number of zeroes in the given array. Input: arr[] = {1, 1, 1, 1, 0, 0} Output: 2 Input: arr[] = {1, 0, 0, 0, 0} Output: 4	CO1
	2.	Implement a problem of move all zeroes to end of array. Statement: Given an array of random numbers, Push all the zero's of a given array to the end of the array. For example, if the given arrays is {1, 9, 8, 4, 0, 0, 2, 7, 0, 6, 0}, it should be changed to {1, 9, 8, 4, 2, 7, 6, 0, 0, 0, 0}. The order of all other elements should be same. Input : arr[] = {1, 2, 0, 4, 3, 0, 5, 0}; Output : arr[] = {1, 2, 4, 3, 5, 0, 0, 0};	CO1
	3.	Implement a problem of smallest number with at least n trailing zeroes in factorial. Statement: Given a number n. The task is to find the smallest number whose factorial contains at least n trailing zeroes. Input : n = 1 Output : 5 Input : n = 6 Output : 25	CO1
B	1.	Implement a problem of activity selection problem with K persons. Statement: Given two arrays S[] and E[] of size N denoting starting and closing time of the shops and an integer value K denoting the number of people, the task is to find out the maximum number of shops they can visit in total if they visit each shop optimally based on the following conditions: <ul style="list-style-type: none"> • A shop can be visited by only one person • A person cannot visit another shop if its timing collide with it Input: S[] = {1, 8, 3, 2, 6}, E[] = {5, 10, 6, 5, 9}, K = 2 Output: 4 Input: S[] = {1, 2, 3}, E[] = {3, 4, 5}, K = 2 Output: 3	CO2
	2.	Implement a problem of maximize Profit by trading stocks based on given rate per day.	CO2

		<p>Statement: Given an array arr[] of N positive integers which denotes the cost of selling and buying a stock on each of the N days. The task is to find the maximum profit that can be earned by buying a stock on or selling all previously bought stocks on a particular day.</p> <p>Input: arr[] = {2, 3, 5} Output: 5</p> <p>Input: arr[] = {8, 5, 1} Output: 0</p>	
	3.	<p>Implement a problem of minimum work to be done per day to finish given tasks within D days problem.</p> <p>Statement: Given an array task[] of size N denoting amount of work to be done for each task, the problem is to find the minimum amount of work to be done on each day so that all the tasks can be completed in at most D days. Note: On one day work can be done for only one task.</p> <p>Input: task[] = [3, 4, 7, 15], D = 10 Output: 4</p> <p>Input: task[] = [30, 20, 22, 4, 21], D = 6 Output: 22</p>	CO2
C	1.	<p>Implement Coin Change problem.</p> <p>Statement Given an integer array of coins[] of size N representing different types of currency and an integer sum, The task is to find the number of ways to make sum by using different combinations from coins[].</p> <p>Note: Assume that you have an infinite supply of each type of coin.</p> <p>Input: sum = 4, coins[] = {1,2,3}, Output: 4</p> <p>Input: sum = 10, coins[] = {2, 5, 3, 6} Output: 5</p>	CO3
	2.	<p>Implement Subset Sum Problem.</p> <p>Statement Given a set of non-negative integers and a value sum, the task is to check if there is a subset of the given set whose sum is equal to the given sum.</p> <p>Input: set[] = {3, 34, 4, 12, 5, 2}, sum = 9 Output: True</p> <p>Input: set[] = {3, 34, 4, 12, 5, 2}, sum = 30 Output: False</p>	CO3
	3.	<p>Implement Check if it is possible to transform one string to another.</p> <p>Statement Given two strings s1 and s2 (all letters in uppercase). Check if it is possible to convert s1 to s2 by performing following operations.</p> <ol style="list-style-type: none"> 1. Make some lowercase letters uppercase. 2. Delete all the lowercase letters. <p>Input: s1 = daBcd s2 = ABC Output: yes</p> <p>Input: s1 = argaju s2 = RAJ Output: yes</p>	CO3
D	1.	<p>Implement program to find all distinct subsets of a given set using Bit Masking Approach.</p> <p>Statement Given an array of integers arr[], The task is to find all its subsets. The subset cannot contain</p>	CO4

		<p>duplicate elements, so any repeated subset should be considered only once in the output.</p> <p>Input: $S = \{1, 2, 2\}$ Output: $\{\}, \{1\}, \{2\}, \{1, 2\}, \{2, 2\}, \{1, 2, 2\}$</p> <p>Input: $S = \{1, 2\}$ Output: $\{\}, \{1\}, \{2\}, \{1, 2\}$</p>	
	2.	<p>Implement program Count all possible Paths between two Vertices.</p> <p>Statement Count the total number of ways or paths that exist between two vertices in a directed graph. These paths don't contain a cycle, the simple enough reason is that a cycle contains an infinite number of paths and hence they create a problem.</p>  <p>Input: Count paths between A and E Output: Total paths between A and E are 4 Input: Count paths between A and C Output: Total paths between A and C are 2</p>	CO4
	3.	<p>Implement program to print all subsets of a given Set or Array</p> <p>Statement Given a set of positive integers, find all its subsets.</p> <p>Input: array = {1, 2, 3} Output: // this space denotes null element.</p> <pre> 1 1 2 1 2 3 1 3 2 2 3 3 </pre> <p>Input: 1 2 Output: 1 2 1 2</p>	CO4
E		Mini Project:- Implement CA assignment assigned in group as a CO301 (DAA theory subject) and store in source code in git repository.	CO5
Books:			
Text Books(T):			
T1. Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press. T2. Gills Brassard and Paul Bartly, "Fundamentals of Algorithmic", PHI, New Delhi.			
Reference Books(R):			
R1. Fayeze Gebali, "Algorithms and Parallel Computing", Willy Publication.			

R2. Thomas H. Coreman and Charles R. L. Leiserson, “Introduction to Algorithm”, PHI Publications.

e-Resources(E):

E1: Robert Sedgewick and Kevin Wayne, ”algorithms” Princeton University.
<https://bank.engzenon.com/tmp/5e7f6ee5-d4dc-4aa8-9b0a-42d3c0feb99b/6062caf3-c600-4fc2-b413-4ab8c0feb99b/Algorithms-4th-Edition.pdf>.

E2: Jeff Erickson, “algorithms”, a Creative Commons Attribution 4.0 International License
<https://jeffe.cs.illinois.edu/teaching/algorithms/book/Algorithms-JeffE.pdf>.

E3: <https://www.geeksforgeeks.org/>

E4: <https://github.com/>

E5: <https://www.codechef.com/>

CO308: Computer Network Laboratory		
Teaching Scheme	Examination Scheme	
Practical : 2 Hrs. / Week	Term Work:	25 Marks
Credits: 1	Total:	25 Marks

Prerequisite Course: Computer Organization and Architecture, Digital Electronics and Data Communication

Course Objectives:

1. To learn and understand the fundamental LAN and WAN.
2. To learn and understand the error detection and correction.
3. To learn and understand Subnetting.
4. To learn and understand Client-Server architectures and prototypes by the means of network standards and technology.
5. To learn and understand DHCP protocol.
6. To learn and understand different network simulation tools.

Course Outcomes (COs):

On successful completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Design and develop Local Area Network.	3	Apply
2. Implementation of error detection and correction techniques.	3	Apply
3. Design and implementation of subnetting.	2	Understand
4. Implementation of Client-Server program using different protocols.	3	Apply
5. Installation and configuration of DHCP client and server.	3	Apply
6. Use the different network simulation tools.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3		2	1	1		1		1	1	2	2	1
CO2	1	1	3		1								2	2	
CO3	1	2	1		1								3	1	
CO4	2	2	2		1							1	3	1	
CO5	1	1	1	1	1							1	2	1	1
CO6	1	2	3	1	3	1						2	2	1	2

List of Assignments (Any 9 Assignments should be performed)

Sr.No.	Title of Assignment
1	Part A: Setup a wired LAN using Switch. It includes preparation of cable, testing of cable using LAN tester, configure machines using IP addresses, testing using PING utility. Part B: Extend the same Assignment for Wireless using Access Point.
2	Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes using C/C++.
3	Write a program to demonstrate subnetting and find the subnet masks using C/C++/Java.
4	Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window protocol using C/C++/Java.
5	Write a program using TCP socket for wired network for following using Java/Python: a. Say Hello to Each other b. File Transfer c. Calculator (Arithmetic)
6	Write a program using UDP socket for wired network for following Java/Python: a. Say Hello to Each other b. File Transfer c. Calculator (Arithmetic)
7	Study of Wireshark Packet Analyzer and test with assignment 5 & 6.
8	Study of any network simulation tools - To create a network with three nodes and establish a TCP connection between node 0 and node 1 such that node 0 will send TCP packet to node 2 via node 1.
9	Use network simulator NS2 to implement: a. Analysis of CSMA and Ethernet protocols b. Network Routing: Shortest path routing, AODV.
10	Configure RIP/OSPF/BGP routing algorithms using Cisco Packet Tracer.
11	Install and configure DHCP server.

CO308: Web Technology Laboratory			
Teaching Scheme		Examination Scheme	
Practical:	2 Hrs. / Week	PR Examination	50
Credits:	1	Total	50

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Prerequisite Course: Basic knowledge of Programming and Computer Systems

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Course Objectives:

- 1.To learn the concepts of HTML 5 for developing client side user interface
- 2.To learn the client side technologies for web development.
3. To reduce the amount of code for building rich user interface applications using AngularJS.
- 4.To build single-page web applications with ReactJS.
- 5.To learn the server side technologies for web development.
- 6.To build web applications quickly with less code using Spring Boot framework.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Develop client side user interface using HTML5 elements.	2	Apply
2. Apply knowledge of the client side technologies for web development.	2	Apply
3. Understand architecture of AngularJS and to develop single page application(SPA) using fundamentals of AngularJS.	4	Apply
4. Apply the fundamentals of ReactJS to develop rich web applications.	3	Apply
5. Apply the server side technologies for developing dynamic web application	3	Apply
6. Apply Spring Boot framework to build web applications in less code	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	-	2	-	1	-	2	2	1	2	3	3	3

CO2	3	1	3	-	2	-	1	-	2	2	1	2	3	3	3
CO3	3	1	3	-	3	-	2	-	2	2	1	2	3	3	3
CO4	3	1	3	-	3	-	2	-	2	2	1	2	3	3	3
CO5	3	1	3	-	3	-	2	-	2	2	1	2	3	3	3
CO6	3	1	3	-	3	-	2	-	2	2	1	2	3	3	3

Suggested List of Assignments

[Students have to complete all the assignments towards the successful completion of Term Work, where all the implementation and design assignments are compulsory]

Group A

1. **Case study:** Before coding of the website, planning is important, students should visit different websites (Min. 5) for the different client projects and note down the evaluation results for these websites, either good website or bad website in following format:

Sr. No.	Website URL	Purpose of Website	Things liked in the website	Things disliked in the website	Overall evaluation of the website with Justification (Good/Bad)

From the evaluation, students should learn and conclude different website design issues, which should be considered while developing a website.

2. a. Installation and configuration of LAMP stack/Tomcat Server
b. Design a static Web application using **HTML 5** with all possible elements.
3. Apply **CSS and Bootstrap** on Assignment 2
4. Implement Registration and Login Authentication using Java script.
5. Try making a to-do list app using **AngularJs**.

The app should have the following features:

1. A form which allows you to add a to-do item
2. A delete button that will allow you to delete a particular todo item.

3. An edit portion which will allow you to edit a particular to-do item.
6. Implement a web page index.htm for any client website (e.g., a restaurant website project) using the following:
 - a. HTML syntax: heading tags, basic tags and attributes, frames, tables, images, lists, links for text and images, forms etc.
 - b. Use of Internal CSS, Inline CSS, External CSS and **ReactJS**.
7. Implement Database application using **JSP/Servlet**
8. Build a dynamic web application using **Spring boot** and perform basic database operations
9. **Mini Project:** Design and implement a dynamic web application for any business functionality using web development technologies that you have learnt in this course.

Books:
Text Books(T):
T1. Robin Nixon," Learning PHP, Mysql and Javascript with JQuery, CSS & HTML5", O'REILLY T2. Juha Hinkula,"Full Stack Development with Spring Boot and React", 3rd Edition Paperback T3. Ken Williamson,"Learning AngularJS: A Guide to AngularJS Development (Greyscale Indian Edition)", O'REILLY
Reference Books(R):
R1. Adam Bretz & Colin J Ihri,"Full Stack Javascript Development with MEAN", SPD R2. McGraw Hill Education publications," Developing Web Applications". R3. Allan Cole," Build Your Own Wicked Wordpress Themes", SPD
E-Resources:
E1: https://www.mygreatlearning.com/full-stack-web-development/free-courses E2: https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javascript

CO309: Seminar and Communication skills		
Teaching Scheme	Examination Scheme	
Lectures: 1 Hrs. / Week	Term Work:	25 Marks
Practical : 2 Hrs. / Week	Oral:	25 Marks
Credits: 2	Total:	50 Marks

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Prerequisite:

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Course Objectives:

1. To develop ability of thinking and motivation for seminar.
2. To expose students to new technologies, researches, products, algorithms.
3. To explore basic principles of communication.
4. To explore empathetic listening, speaking techniques.
5. To study report writing techniques.
6. To develop Seminar presentation and Technical Communication Skills.

Course Outcomes (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Get familiar with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.	2	Understand
2. Perform literature survey	3	Apply
3. Understand system and its components	2	Understand
4. Write the technical report	6	Create
5. Prepare presentation	6	Create
6. Improve communication skills	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	1	2	-	-	-	-	-	2	-	2	-	-	2
CO2	-	3	-	-	-	-	-	-	-	3	-	-	-	-	1
CO3	1	-	-	-	-	-	-	-	-	-	-	-	2	-	1
CO4	-	1	-	-	-	-	-	-	-	3	-	1	1	-	2
CO5	-	-	-	-	2	-	-	-	-	3	-	2	-	-	2
CO6	-	-	-	-	-	-	-	-	-	3	-	2	-	-	1

Guidelines:

1. Each student will select a topic in the area of Computer Engineering and Technology Preferably keeping track with recent technological trends and development beyond scope of syllabus avoiding repetition in consecutive years.
2. The topic must be selected in consultation with the institute guide.
3. Each student will make a seminar presentation using audio/visual aids for duration of 20-25 minutes and submit the seminar report.
4. Active participation at classmate seminars is essential.

Recommended Format of the Seminar Report:

- Title Page with Title of the topic, Name of the candidate with Exam Seat Number / Roll Number, Name of the Guide, Name of the Department, Institution and Year & University
- Seminar Approval Sheet/Certificate
- Abstract and Keywords
- Acknowledgements
- Table of Contents, List of Figures, List of Tables and Nomenclature
- Chapters Covering topic of discussion- Introduction with section including organization of the report, Literature Survey/Details of design/technology/Analytical and/or experimental work, if any/ ,Discussions and Conclusions, Bibliography /References

List of Assignments

1. Identify application as social problem using algorithmic methodologies.
2. To determine scope and objectives of the defined problem.
3. To perform literature review of proposed system.
4. To represent system design and architecture.
5. To study implementation details of methodology selected.
6. To perform result analysis using data tables and comparison with other methods.
7. Seminar documentation and final presentation.

Reference Books:

1. Rebecca Stott, Cordelia Bryan, Tory Young, Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series), Longman, ISBN-13:978-0582382435
2. BarunMitra, Effective Technical Communication a Guide for Scientist and Engineers, Oxford 9780195682915
3. Raman M. ,Shama, Technical Communication, Oxford,9780199457496

CO310:Corporate Readiness

Teaching Scheme	Examination Scheme
Lectures: 2 Hrs./Week	Term Work: 50 Marks
Tutorial: --- Hr/Week	In-Sem Exam: --
Class:-TY	End-Sem Exam: --
Credits: 02	Total: 50 Marks
Prerequisite Course: (Quantitative aptitude, Verbal and Non-verbal communication)	

Course Objectives:

1. To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.
2. To develop required aptitude skills.
3. To design the functional and chronological resume.
4. To demonstrate the importance of critical thinking ability and expression in group discussions
5. To prepare students for the various professional interviews.
6. To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs):

After successful completion of the course, student will be able to:

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Remember placement processes of various organizations and modern job search approach.	BTL 1	Remember
CO2	Understand Industry Specific skill set with a view to design an Ideal Resume.	BTL 2	Understand
CO3	Apply the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.	BTL 3	Apply
CO4	Analyse and apply the critical thinking ability as required during Aptitude/Technical Tests.	BTL 4	Analyse
CO5	Evaluate Technical/General Dataset to interpret insights in it.	BTL 5	Evaluate
CO6	Create an ideal personality that fits Industry requirement.	BTL 6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	--	--	--	--	--	--	--	02	00	02	01	01	--	--	--	--
CO2	--	--	--	--	--	--	--	02	03	03	03	01	--	--	--	--
CO3	--	--	--	--	--	--	--	01	03	03	02	01	--	--	--	--
CO4	01	01	--	--	--	--	--	--	--	01	01	--	--	--	--	--
CO5	01	01	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO6	--	--	--	--	--	--	--	02	03	03	02	03	--	--	--	--

Course Contents

UNIT-I	Placement Awareness	Hrs.	Cos
	Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude.	06 Hrs.	CO1
UNIT-II	Resume Writing	Hrs.	CO
	Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume.	05 Hrs.	CO2
UNIT-III	Group Discussion and Presentation skills	Hrs.	CO
	Why GDs are implemented commonly, Aspects which make up a Group Discussion, Tips on group discussion, do's and don'ts of GD and Presentation skills.	05 Hrs.	CO3
UNIT-IV	Logical Reasoning I	Hrs.	CO
	Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Data arrangements, Crypt arithmetic.	05 Hrs.	CO4
UNIT-V	Logical Reasoning II	Hrs.	CO
	Data Interpretation, Data Sufficiency	04 Hrs.	CO5
UNIT-VI	Logical Reasoning III	Hrs.	CO
	Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle.	05 Hrs.	CO6

Text Books:

- [T1]. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal.
 [T2]. Reasoning verbal and Non-Verbal by B. S. Sijwali.
 [T3]. Master the Group Discussion & Personal Interview - Complete Discussion on the topics asked by reputed B-schools & IIMs by Sheetal Desarda.

References:

- [R1]. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical).
 [R2]. Analytical Reasoning by M. K. Panday.
 [R3]. Logical and analytical reasoning by K. Gupta.
 [R4]. Multi-dimensional reasoning by Mishra & Kumar Dr. Lal.

E- Books :

- [1]. <https://themech.in/quantitative-aptitude-and-logical-reasoning-books/>
- [2]. <https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html>

E-learning Resources/MOOCs/ NPTEL Course Links:

- [1]. <https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/>
- [2]. <https://www.educationquizzes.com/11-plus/non-verbal-reasoning/>
- [3]. <https://www.livecareer.com/resume/examples/web-development/e-learning-developer>
- [4]. <https://novoresume.com/career-blog/how-to-write-a-resume-guide>

MC 311: Mandatory Course-V			
Teaching Scheme		Examination Scheme	
Theory	1 Hrs. / Week	TW	-
Credits:	No Credits	Total:	-

Important Note:

- The department has to finalize MLC from the given choices and will prepare suitable course contents at departmental level only.
- The departments are informed to finalize MLC for SEM I and SEM II immediately and will take its approval in the BoS Meeting.
- Department will keep record of its smooth conduction and activity details.

SEMESTER V

Learning an Art Form (Music: vocal or instrumental, dance, painting, clay modeling, etc.):

Cultivation of arts is an integral part of the development of human beings since the arts are what make us most human, most complete as people. They offer us the experience of wholeness because they touch us at the deepest levels of mind and personality. They come into being not when we move beyond necessity but when we move to a deeper necessity, to the deeper human need to create order, beauty and meaning out of chaos. They are the expressions of deepest human urges, imperatives and aspirations. While enriching the process of learning through enhanced perceptual and cognitive skills, learning of arts promotes self-esteem, motivation, aesthetic awareness, cultural exposure, creativity, improved emotional expression, as well as social harmony and appreciation of diversity. They promote an understanding and sharing of culture, and equip the learners with social skills that enhance the awareness and respect of others.

Each institution will offer a range of introductory courses in different art forms: music, dance, theater, painting, and other art forms. Care should be taken to give adequate representation to local and regional art forms in which our culture abounds. This will, in turn, also ensure wider community involvement/interaction with the institution.

Students will be given an option to choose a particular art form, and learn and practice it under an artist-instructor. At the end of the course, a student should be able to demonstrate basic proficiency

in that particular art form. Contact hours per week should be 3-4 hours. Towards the end of the course, the institution can organize a function/program in which all the students publicly demonstrate their skills.

SEMESTER VI

CO312: Internet of Things		
Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs. / Week	CIA	40 Marks
Credits: 4	End-Sem Exam:	60 Marks
	Total:	100 Marks

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Prerequisite Course: Computer Networking, Digital Electronics

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Course Objectives:

1. To understand fundamentals of IoT and embedded systems including essence, basic design strategy and process modeling.
2. To learn to implement secure infrastructure for IoT applications.
3. To introduce learners to a set of advanced topics in IoT and lead them to understand research in networks.
4. To develop a comprehensive approach towards building small low cost IoT applications.
5. To learn real world application scenarios of IoT along with its societal and economic impact using case studies and real time examples.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand basic fundamentals of embedded systems and IoT Networking.	2	Understand
2. Apply knowledge of IoT programming to execute basic programs on IoT boards.	3	Apply
3. Explain Communication protocols in IoT, its enabling technologies for developing systems with its emergence.	2	Understand
4. Apply knowledge of IoT to build a sensor network for real time applications.	3	Apply
5. Analyze different computing models for building networks and cloud	4	Analyze

for IoT.		
6. Demonstrate different case studies in the field of IoT.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
CO1	3	1	1	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	2	1	-	-	-	-	-	-	-	3	-	-
CO3	2	3	3	3	2	3	-	-	2	-	1	-	-	3	-
CO4	1	2	3	2	3	3	-	-	2	1	2	2	3	2	-
CO5	2	2	2	3	3	3	-	-	2	1	2	2	2	2	-
CO6	2	2	1	2	2	2	-	-	1	-	1	-	3	-	3

COURSE CONTENTS

Unit I	Introduction	No. of Hours	COs
	Embedded System, Definition, Characteristics, Modern IoT Applications, Sensors and Actuators. IoT Architecture and block diagram Networking for IoT: Connectivity Terminologies. IoT Network Configuration	6	1
Unit II	Programming for IoT	No. of Hours	COs
	Introduction to Arduino Programming: Features of Arduino, Board details, Setup and IDE. Introduction to Python programming: Python IDE, Basic programs on Raspberry Pi, Setup and Installation of OS, Pin Configuration, Implementation of IoT Applications with Raspberry Pi.	6	2
Unit III	Communication Networks and Protocols	No. of Hours	COs
	HART (Highway Addressable Remote Transducer) and Wireless HART:	6	3

	Layers in HART, HART vs ZigBee, NFC (Near Field Comm.), Bluetooth: Features, Connections, Piconet, Modes, L2CAP, RFCOMM, SDP, Z wave, ISA 100.11A: Features, Security, Usage Target Tracking		
Unit IV	Wireless Sensor Networks	No. of Hours	Cos
	WSN: Components, Applications, Challenges, Nanonetworks, Coverage, Stationary WSN, Mobile WSN, UAV network. M2M: Overview, Application, Features, Ecosystem, Platforms. Interoperability in IoT: Challenges, Importance, Modes,	6	4
Unit V	Cloud for IoT	No. of Hours	Cos
	Introduction to SDN: Overview, Architecture, attributes, challenges. SDN for IoT: Benefits, Different Approaches, SDN for Mobile Networking: ODIN, Ubi-Flow, Mobi-Flow, Data Handling and Analytics, Cloud for IoT.	6	5
Unit VI	Case Studies	No. of Hours	COs
	Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Agriculture, Healthcare, Activity Monitoring	6	6
Books:			
Text Books(T):			
T1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.			
T2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Wiley Publication, ISBN: 978-1-119-99435-0			
Reference Books(R):			
1) S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. Availability: https://www.amazon.in/Introduction-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1			

2) S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

Availability:

https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3

3) Research Papers

eResources (ER):

1) NPTEL, Introduction To Internet Of Things, Prof. Sudip Misra, IIT Kharagpur

2) NPTEL, Introduction To Industry 4.0 And Industrial Internet Of Things, Prof. Sudip Misra, IIT Kharagpur

CO313: System Software			
Teaching Scheme		Examination Scheme	
Lectures:	3Hrs. / Week	Continuous Internal Assessment:	40 Marks
Credits:	3	End-Sem Exam:	60 Marks
		Total:	100 Marks

Prerequisite Course: Computer Organization and Architecture, Operating System and Administration, Data Structures

Course Objectives:

1. To learn and understand basics of system programming and language processing
2. To learn and understand Lexical and Syntax Analysis
3. To understand the Intermediate code forms and Intermediate Code Generation for different types of statements
4. To understand various ways for optimizing the intermediate code, and generation of target code
5. To obtain knowledge of data structures and algorithms used in design of assembler and macroprocessor.
6. To learn different variants of loaders and their functions such as allocation, linking, relocation, and loading

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Explain various Components of System Software and Understand the Fundamental of Language Processing	2	Understand
2. Demonstrate the Lexical and Syntax Analyzer for certain language.	3	Apply
3. Write the intermediate code in various forms for different types of input statements	3	Apply
4. Apply different code optimization techniques to generate the optimized code	3	Apply
5. Identify suitable data structures and design two pass assembler and macro processor	3	Apply

6. Use suitable data structures and design different types of loader schemes	3	Apply
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Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	-	-	-	-	2	1	-	1	2	1	-
CO2	2	2	3	2	2	-	-	-	2	1	-	1	2	1	-
CO3	2	2	3	2	-	-	-	-	2	1	-	1	2	1	-
CO4	2	2	3	2	-	-	-	-	2	1	-	1	2	1	-
CO5	2	2	3	2	-	-	-	-	2	1	-	1	2	1	-
CO6	2	2	3	2	-	-	-	-	2	1	-	1	2	1	-

COURSE CONTENTS

Unit I	Introduction to System Software	No. of Hours	COs
	<p>Introduction: Introduction to Systems software, Goals of System Software, System Programs, Machine Structure.</p> <p>Components of System Software: Assembler, Macro processor, Compiler, Interpreter, Linker, Loader, Debugger, Operating System.</p> <p>Language Processors: Language Processing Activities, Fundamentals of Language Processing.</p>	6	CO1
Unit II	Introduction to Compiler	No. of Hours	COs
	<p>Structure of a Compiler, Compiler and Interpreter.</p> <p>Lexical Analysis: Role of the lexical analyzer, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator LEX.</p> <p>Syntax Analysis: Role of Parser, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Parser Generators YACC.</p> <p>Case Study : LEX and YACC specification and features.</p>	6	CO2
Unit III	Intermediate Code Generation	No. of Hours	COs
	Syntax-Directed Definitions, Evaluation Orders for SDD's, Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of	6	CO3

	Expressions, Control Flow, Switch-Statements, Intermediate Code for Procedures. Case Study: Study of Debugging tools like GDB		
Unit IV	Code Optimization and Generation	No. of Hours	COs
	Principal sources of optimization, Basic Blocks and Flow Graphs Optimization of basic blocks, Code-improving transformations Issues in the Design of Code Generator, Target Language, Next-use information, Peephole optimization, Simple Code Generator.	6	CO4
Unit V	Assembler and Macro Processor	No. of Hours	COs
	Elements of Assembly Language Programming, A simple Assembly scheme, Pass Structure of Assembler. Design of two pass assembler: Processing of declaration statements, Assembler Directives and imperative statements, Advanced Assembler Directives, Intermediate code forms, Pass I and Pass II of two pass Assembler. Macro Processor: Macro instructions, Features of macro facility, Design of two-pass macro processor. Case Study: GNU M4 Macro Processor	6	CO5
Unit VI	Linkers and Loaders	No. of Hours	COs
	Loader schemes: Compile and go, General Loader Scheme, Absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, overlay structure. Design of an absolute loader. Linkers: Relocation and linking concepts, self relocating programs, Static and dynamic link libraries.	6	CO6
Books:			
Text Books(T):			
1. Dhamdhare D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 – 4 2. John Donovan, "System Programming", McGraw Hill, ISBN 978-0--07-460482-3. 3. Alfred V.Aho, Monica S.Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers-Principles, Techniques			

and Tools”, Pearson,ISBN:978-81-317-2101-8

Reference Books(R):

John R. Levine, Tony Mason, Doug Brown, “Lex and Yacc”,O’Reilly & Associates,Inc,ISBN:1-56592-000-7

Leland Beck, “System Software: An Introduction to Systems Programming”, Pearson

K. Loudon, "Compiler Construction: Principles and Practice", Cengage Learning, ISBN 978-81-315-0132-0

e-Books :

7. <https://www.elsevier.com/books/systems-programming/anthony/978-0-12-800729-7>

8. <https://www.kobo.com/us/en/ebook/linux-system-programming-1>

9. <https://www.e-booksdirectory.com/details.php?ebook=9907>

MOOCs Courses Links:

T3. <https://www.udemy.com/course/system-programming/>

T4. https://onlinecourses.nptel.ac.in/noc20_cs13/preview

T5. <https://www.udemy.com/course/compiler-design-n/>

T6. <https://www.mygreatlearning.com/academy/learn-for-free/courses/compiler-design>

CO314: DATA MINING AND WAREHOUSING			
Teaching Scheme	Examination Scheme		
Lectures: 3 hrs/week		Continuous Assessment:	40 Marks
Credits:3		End-Sem Exam:	60 Marks
		Total:	100 Marks

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Prerequisite Course: (if any) Database Management System

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Course Objectives:

1. To understand the fundamentals of Data Mining.
2. To identify the appropriateness and need of mining the data.
3. To learn the pre-processing, mining and post processing of the data.
4. To understand various Distant Measures techniques in data mining.
5. To understand clustering techniques and algorithms in data mining.
6. To understand classification techniques and algorithms in data mining.

Course Outcomes (COs):

On completion of the course, student will be able to–

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
Apply basic, intermediate and advanced techniques to mine the data.	3	Apply
Analyze the output generated by the pre-processing of data.	2	Understand
Ability to explore the data warehouse and its design.	4	Analyze
Examine the hidden patterns in the data	4	Analyze
Apply the mining process by frequent pattern analysis techniques.	3	Apply
Demonstrate the Classification techniques for realistic data.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
										0	1	2	1	2	3

CO1	3	2	2	3	2	--	--	--	--	2	--	--	3	2	2
CO2	3	2	2	3	2	--	--	--	--	--	--	--	3	2	2
CO3	1	2	3	1	2	--	--	--	--	--	--	--	1	3	2
CO4	2	2	2	3	2	--	--	--	--	--	--	--	3	2	2
CO5	3	2	2	3	2	3	2	--	--	2	--	--	2	2	2
CO6	2	2	2	3	2	3	2	--	--	2	--	--	2	2	3

Unit-I	Introduction to Data Mining	No.of Hours	COs
	Data Mining, Kinds of pattern and technologies, Data Mining Task Primitives, issues in mining, KDD vs data mining, OLAP, knowledge representation, data pre-processing - cleaning, integration, reduction, transformation and discretization, Data: Data, Information and Knowledge; Attribute Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes.	7 Hrs.	CO1
Unit-II	Data Pre-processing	No.of Hours	COs
	Introduction to Data Pre-processing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score normalization and decimal scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data Discretization: Binning, Histogram Analysis.	6 Hrs.	CO2
Unit-III	Data Warehouse	No.of Hours	COs

	Data Warehouse, Operational Database Systems and Data Warehouses(OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model, Concept Hierarchies, Data Warehouse Architecture, The Process of Data Warehouse Design, A three-tier data warehousing architecture, Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP.	6 Hrs.	CO3
Unit-IV	Cluster Analysis: Measuring Similarity & Dissimilarity	No.of Hours	COs
	Measuring Data Similarity and Dissimilarity, Proximity Measures for Nominal Attributes and Binary Attributes, interval scaled; Dissimilarity of Numeric Data: Minkowski Distance Euclidean distance and Manhattan distance Proximity Measures for Categorical, Ordinal Attributes, Ratio scaled variables; Dissimilarity for Attributes of Mixed Types, Cosine Similarity, partitioning methods- k-means, k-medoids.	7 Hrs.	CO4
Unit-V	Frequent Pattern Analysis	No.of Hours	COs
	Market Basket Analysis, Frequent item set, closed item set & Association Rules, mining multilevel association rules, constraint based association rule mining, Generating Association Rules from Frequent Item sets, Apriori Algorithm, Improving the Efficiency of Apriori, FP Growth Algorithm. Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rules.	6 Hrs.	CO5
Unit-VI	Classification	No.of Hours	COs

	Introduction, classification requirements, methods of supervised learning, decision trees- attribute selection, tree pruning, ID3, scalable decision tree techniques, rule extraction from decision tree, Regression, Bayesian Belief Networks, Training Bayesian Belief Networks, Classification Using Frequent Patterns, Associative Classification, Lazy Learners-k-Nearest-Neighbour Classifiers, Case-Based Reasoning, Multiclass Classification, Metrics for Evaluating Classifier Evaluating the Accuracy of a Classifier.	8 Hrs.	CO6
Books:			
Text Books:			
<p>T1. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers, ISBN:9780123814791, 9780123814807.</p> <p>T2. Mohammed J. Zaki, Wagner Meira Jr., “Data Mining and Analysis”, Cambridge University Press, ISBN:9781316614808.</p>			
Reference Books:			
<p>R1. Vipin Kumar, “Introduction to Data Mining”, Pearson, ISBN-13: 978-0321321367 ISBN-10: 0321321367</p> <p>R2. Ikhvinder Singh, “Data Mining & Warehousing”, Khanna Publishing House, ISBN-10: 9381068704, ISBN-13: 978-9381068700</p> <p>R3. Charu C. Aggarwal, “Data Mining: The Textbook”, Springer, ISBN 978331914141-1, 978331914142-8</p> <p>R4. Ian H. Witten, Eibe Frank, “Data Mining: Practical Machine Learning Tool and Techniques”, Elsevier Publishers, ISBN: 0-12-088407-0</p> <p>R5. Luís Torgo, “Data Mining with R, Learning with Case Studies”, CRC Press, Talay and Francis Group, ISBN9781482234893</p> <p>R6. Carlo Vercellis, “Business Intelligence - Data Mining and Optimization for Decision Making”, Wiley Publications, ISBN: 9780470753866</p>			

CO315A: Digital Forensics			
Teaching Scheme		Examination Scheme	
Lectures:	4 Hrs. / Week	Continuous Internal Assessment:	40 Marks
Credits:	4	End-Sem Exam:	60 Marks
		Total:	100 Marks

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Prerequisite Course: (if any) Operating system, Computer organization

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Course Objectives:

1. To emphasize the fundamentals and importance of digital forensics.
2. To learn different techniques and procedures that enables them to perform a digital investigation
3. To conduct a digital investigation in an organized and systematic way
4. To learn open-source forensics tools to perform digital investigation and understand the underlying theory behind these tools.
5. To emphasize theoretical and practical knowledge, as well as current research on Digital Forensics
6. To learn programming for Computer Forensics.

Course Outcomes (COs): On completion of the course, student will be able to

Course Outcomes		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand basic software and hardware requirement for digital forensics.	2	Understand
CO2	Describe the representation and organization of data and metadata within modern computer systems.	2	Understand
CO3	Understand the trade off and differences between various forensic tools.	2	Understand
CO4	Analyze network based evidence and mobile network forensic.	4	Analyze
CO5	Investigate software reverse engineering.	4	Analyze
CO6	Demonstrate forensics of hand held devices.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	2	--	--	--	--	--	2	3	2	1	2	--
CO2	2	--	--	2	--	--	--	--	--	2	2	2	1	2	--
CO3	1	--	--		--	--	--	--	--	3	2	2	2	2	--
CO4	2	--	--	2	--	--	--	--	--	3	2	2	2	3	1
CO5	2	--	--	2	--	--	--	--	--	3	2	2	2	3	2
CO6	2	--	--	2	--	--	--	--	--	3	2	3	1	3	--

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	Introduction to digital Forensics	No.of Hours	COs
	Digital crimes, evidence, extraction, preservation, etc. Overview of hardware and operating systems: structure of storage media/devices; windows/Macintosh/ Linux -- registry, boot process, file systems, file metadata.	06 Hrs.	CO1
Unit-II	Data recovery and Digital evidence controls	No.of Hours	COs
	Data recovery: identifying hidden data, Encryption/Decryption, Steganography, recovering deleted files. Digital evidence controls: uncovering attacks that evade detection by Event Viewer, Task Manager, and other Windows GUI tools, data acquisition, disk imaging, recovering swap files, temporary & cache files.	06 Hrs.	CO2
Unit-III	Computer Forensics analysis and validation	No.of Hours	COs
	Computer Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network	06 Hrs.	CO3

	forensics, using network tools, examining the honeynet project. Computer Forensic tools: Encase, Helix, FTK, Autopsy, Sleuth kit Forensic Browser, FIRE, Found stone Forensic ToolKit, WinHex, Linux dd and other open source tools.		
Unit-IV	Network Forensic	No.of Hours	COs
	Network Forensic: Collecting and analysing network-based evidence, reconstructing web browsing, e-mail activity, and windows registry changes, intrusion detection, tracking offenders, etc. Mobile Network Forensic: Introduction, Mobile Network Technology, Investigations, Collecting Evidence, Where to seek Digital Data for further Investigations, Interpretation of Digital Evidence on Mobile Network.	06 Hrs.	CO4
Unit-V	Software Reverse Engineering	No.of Hours	COs
	Software Reverse Engineering: defend against software targets for viruses, worms and other malware, improving third-party software library, identifying hostile codes-buffer overflow, provision of unexpected inputs.	06 Hrs.	CO5
Unit-VI	Computer crime and Legal issues	No.of Hours	COs
	Computer crime and Legal issues: Intellectual property, privacy issues, Criminal Justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation, and deposition of legal evidence in a court of law.	06 Hrs.	CO6
Text Books:			

1. Digital Forensics with Open Source Tools. Cory Altheide and Harlan Carvey, ISBN: 978-1-59749-586-8, Elsevier publication, April 2011.
2. Guide to Computer Forensics and Investigations (4th edition). By B. Nelson, A. Phillips, F. Enfinger, C. Steuart. ISBN 0-619-21706-5, Thomson, 2009.
3. Computer Forensics and Cyber Crime: An Introduction (3rd Edition) by Marjie T. Britz, 2013.

Reference Books:

1. Network Forensics: Tracking Hackers Through Cyberspace, Sherri Davidoff, Jonathan Ham Prentice Hall, 2012
2. Computer Forensics: Hard Disk and Operating Systems, EC Council, September 17, 2009
3. Computer Forensics Investigation Procedures and response, EC-Council Press, 2010
4. EnCase Computer Forensics., 2014
5. File System Forensic Analysis. By Brian Carrier. Addison-Wesley Professional, March 27, 2005.
6. NIST Computer Forensic Tool Testing Program (www.cfft.nist.gov/)
7. Computer Forensics: Investigating Data and Image Files (Ec-Council Press Series: Computer Forensics) by EC-Council (Paperback - Sep 16, 2009)
8. Digital Evidence and Computer Crime, Third Edition: Forensic Science, Computers, and the Internet by Eoghan Casey, 2011
9. The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory. Michael Hale Ligh, Andrew Case, Jamie Levy, Aaron Walters, ISBN: 978-1-118-82509-9, July 2014

CO315B: DIGITAL IMAGE PROCESIING			
Teaching Scheme		Examination Scheme	
Lectures:	3Hrs. / Week	Continuous Internal Assessment:	40 Marks
Credits:	3	End-Sem Exam:	60 Marks
		Total:	100 Marks

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Prerequisite Course: Engineering Mathematics

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Course Objectives:

1. To learn fundamentals of Image Processing.
2. To learn image enhancement and restoration techniques.
3. To learn image compression techniques.
4. To learn image segmentation techniques.
5. To study different edge and object detection techniques.
6. To study different applications in areas of Image Processing.

Course Outcomes:

After completion of the course, students are able to -

COs	Course Outcomes	BTL	Discriptor
CO1	Understand basics of Image Processing.	2	Understand
CO2	Learn and Understand Image Enhancement and Restoration techniques.	2	Understand
CO3	Describe and apply Image Compression techniques.	3	Apply
CO4	Describe and apply Image Segmentation techniques.	3	Apply
CO5	Understand and apply different Edge and Object Detection techniques.	3	Apply
CO6	Develop applications in the area of Image processing and Machine Learning	4	Evaluate

Course Contents

Unit-I	Introduction to Image Processing	No. of Hrs	COs
	Fundamental steps in Digital Image processing, Components of an Image Processing System, Image sampling and Quantization: Basic concept in Sampling and Quantization, Representing Digital Images, Spatial and Gray Level resolution. Basic relationships between pixels.	7 Hrs.	CO1
Unit-II	Image Enhancement and Restoration	No. of Hrs	COs
	Image Enhancement: Introduction, Contrast Intensification, Smoothing and Image Sharpening Restoration: Introduction, Minimum mean square error restoration, Least square error restoration, Restoration by: Singular value decomposition, Maximum a Posterior estimation, Homomorphic Filtering.	7 Hrs.	CO2
Unit-III	Image Compression	No. of Hrs	COs
	Image Compression: Introduction, Coding Redundancy, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, Run length coding. Image Compression Models: Lossy Compression methods, Lossless Compression methods.	7 Hrs.	CO3
Unit-IV	Image Segmentation	No. of Hrs	COs
	Segmentation: Introduction, Region extraction, Pixel based approach, Segmentation using Threshold - Multi level Thresholding Local Thresholding, Region based approach, Region based segmentation- Region growing, split and merge technique, local processing, regional	7 Hrs.	CO4

	processing, Hough transform		
Unit-V	Edge and Line Detection	No. of Hrs	COs
	Introduction, Edge detection, Derivative (difference) operators, Morphologic edge detection, Pattern fitting approach, Edge linking and Edge following, Edge element extraction by thresholding, Edge detector performance, Line detection, Corner detection..	7 Hrs.	CO5
Unit-VI	Image Processing Applications	No. of Hrs	COs
	Applications of image enhancement and analysis, Object Detection and Recognition (Preprocessing, Feature Extraction and Machine Learning)	7 Hrs.	CO6
Books:			
Text Books:			
1.Rafel Gonzallez and R. Woods,” Digital Image Processing”, Pearson Education, 3d Edition, ISBN 0-201-18075-8			
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson Education, 3d Edition, ISBN-13: 978-0133361650			
Reference Books:			
1. B. Chanda and D. Dutta Majumder,” Digital Image Processing And Analysis”, PHI Edition, ISBN-13: 978-8120343252			
2. William K. Pratt, “Digital Image Procesing”, John Wiley Publication, 4 th Edition, ISBN: 978-0-471-76777-0 1.			
3. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis, and Machine Vision”, Thomson Publication, Second Edition, ISBN-13: 978-0495082521			
Web Resources:			
https://www.coursera.org/learn/introduction-image-processing			
https://www.coursera.org/specializations/image-processing			

<https://www.coursera.org/projects/image-processing-with-python>

https://onlinecourses.nptel.ac.in/noc23_ee118/preview/digital image processing

CO315 C: Advanced Java Programming		
Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs. / Week	Continuous Assessment:	40 Marks
Credits: 4	End-Sem Exam:	60 Marks
	Total:	100 Marks

Prerequisite Course: Core Java, Web Technology.

Course Objectives:

1. To understand Strut Framework.
2. To understand Object Relational Mapping (ORM).
3. To study Hibernate.
4. To equip students with the knowledge and skills to effectively use the Spring Framework's core features.
5. To study Spring Model View Controller (MVC) Framework.
6. To understand Spring ORM.

Course Outcomes (COs): On completion of the course, students will be able to-

Course Outcomes	Blooms Taxonomy	
	Level	Descriptor
1. Develop web application using Struts Framework.	3	Apply
2. Develop Java applications that interact with relational database using Hibernate.	3	Apply
3. Understand relationships, caching mechanism and transaction management in Hibernate.	2	Understand
4. Understand Spring Core and its Feature.	2	Understand
5. Develop Web application using Spring MVC effectively employing MVC pattern.	3	Apply
6. Develop Java applications that interact with relational database using Spring ORM.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	-	3	-	2	-	-	-	-	2	3	3	3
CO2	3	1	3	-	3	-	2	-	-	-	-	2	3	3	3
CO3	2	-	2	-	-	-	2	-	-	-	-	2	2	2	2
CO4	2	-	2	-	-	-	2	-	-	-	-	2	2	2	2
CO5	3	1	3	-	3	-	2	-	-	-	-	2	3	3	3
CO6	3	1	3	-	3	-	2	-	-	-	-	2	3	3	3

COURSE CONTENTS

Unit I	STRUTS	No. of Hours	COs
	MVC, Struts architecture, Setting up the environment, Registration application, ValueStack and Object-Graph Navigation Language (OGNL), Interceptors, Form Validation, Struts 2 Tag, Database application using Struts.	8	1
Unit II	HIBERNATE: FROM SETUP TO ADVANCED QUERIES	No. of Hours	COs
	ORM, Hibernate Architecture, Mapping and Configuration files, Installation, Hibernate Application Requirements, CRUD operations, State of Objects, Annotations, Session Interface, Hibernate Query Language, Criteria API, Native SQL Query, Named Queries.	7	2
Unit III	RELATIONSHIPS, CACHING IN HIBERNATE	No. of Hours	COs
	Relationships: One to One, One to Many, Many to One, Many to Many, Collection Mapping. Hibernate Caching Mechanism: First Level Cache, Second Level Cache. Transaction Management, Integration of Hibernate with Servlets and Struts.	7	3

Unit IV	SPRING CORE	No. of Hours	COs
	Spring Container, Inversion of Control, Dependency Injection, Environment Setup, Beans Definition, Scope, Life Cycle, Properties, Injecting Collections, Auto-Wiring, Component-Scan, Annotations, DevTools, Configuration, Repository.	8	4
Unit V	SPRING MVC	No. of Hours	COs
	DispatchServlet, Spring MVC Controller, View Resolver, Configurations, Annotations, Templating, JSP Views, Resource Mapping, Form Field Definitions and Validations.	8	5
Unit VI	SPRING ORM	No. of Hours	COs
	Comparison of Spring ORM with Hibernate, Integration of Hibernate with Spring, Spring Data JPA, Transaction Management, Data Access Objects, Mapping, Caching.	8	6
Books:			
Text Books(T):			
<p>T1. Donald Brown, Chad Michael Davis, and Scott Stanlick, “Struts 2 in Action”, Dreamtech Press, ISBN-13 : 978-8177228755.</p> <p>T2. Ramin Rad, “Mastering Hibernate”, Packt Publishing, ISBN: 9781782175339.</p> <p>T3. Iuliana Cosmina, Rob Harrop, Chris Schaefer, and Clarence Ho, “Pro Spring 5: An In-Depth Guide to the Spring Framework and Its Tools”, 5th ed. Apress, ISBN-13: 978-1-4842-2807-4.</p>			
Reference Books(R):			
<p>R1.Chuck Cavaness, “Programming Jakarta Struts ”, O'Reilly Media, Inc, ISBN:9780596003289.</p> <p>R2. Craig Walls, “Spring in Action “, 6th ed. Manning Publications Co., ISBN: 9781617297571.</p> <p>R3. Christian Bauer, Gavin King, “Java Persistence with Hibernate”, 2nd ed. Manning Publications Co., ISBN 9781617290459.</p>			
E-Resources(E):			
1. https://www.coursera.org/specializations/spring-framework			

2. <https://www.ebooks.com/en-us/book/540793/hibernate-a-developer-s-notebook/james-elliott/>
3. <https://www.ebooks.com/en-ae/book/210726026/introducing-spring-framework-6/felipe-gutierrez/>

PR316 : Intellectual Property Rights and Entrepreneurship Development			
Teaching Scheme		Examination Scheme	
Theory	2 Hrs. / Week	Continuous Assessment:	20 Marks
Credits:	2	In-Sem Exam:	-
		End-Sem Exam:	30 Marks
		Total:	50 Marks

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Prerequisite Course: NIL

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Course Objectives:

1. To introduce student with IPR
2. To explain IPR procedure in India such as Patents, Designs and Trademarks
3. To make aware of the economic importance of IPRs.
4. To develop the ability to search and analyse the IPRs.
5. To Instill a spirit of entrepreneurship among the student participants.
6. To give insights into the Management of Small Family Business.

Course Outcomes (COs): After learning the course the learners will be able to,

Course Outcome(s)	Blooms Technology	
	Level	Descriptor
1. Understand patenting system	2	Create
2. Understand the procedure to file patent in India	2	Apply
3. Understanding of financial importance of IPR	2	Understand
4. Search and analyse the patents, designs and Trademarks	4	Analyse
5. Identify the Skill sets required to be an Entrepreneur.	4	Analyse
6. Understand the Role of supporting agencies and Governmental initiatives to promote Entrepreneurship.	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2			2			3		
CO2						2			2			3		
CO3						2			2			3		
CO4						2			2			3		
CO5						2	2	2			3			
CO6						2	2	2			3			

Unit 1	Introduction to IPR	No.of Hours	COs
	<ul style="list-style-type: none"> · Concepts of IPR · The history behind development of IPR · Necessity of IPR and steps to create awareness of IPR · Concept of IP Management · Intellectual Property and Marketing · IP asset valuation • Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Cooperation Treaty, TRIPS, The World Intellectual Property Organization (WIPO) and the UNESCO 	4	1
Unit-2	Patents	No.of Hours	COs

	<ul style="list-style-type: none"> · Introduction to Patents · Procedure for obtaining a Patent · Licensing and Assignment of Patents <ul style="list-style-type: none"> i. Software Licensing ii. General public Licensing iii. Compulsory Licensing · Infringement of Patents · Software patent and Indian scenario 	4	2
Unit-3	Designs	No. of Hours	COs
	<ul style="list-style-type: none"> ● Registrable and non-Registrable Designs ● Novelty & Originality ● Procedure for Registration of Design ● Copyright under Design ● Assignment, Transmission, License ● Procedure for Cancellation of Design ● Infringement ● Remedies 	4 Hrs.	3
Unit 4	Trademarks and Copyrights	No.of Hours	COs
	<p>A) Trademarks</p> <ul style="list-style-type: none"> · Concept of trademarks · Importance of brands and the generation of “goodwill” · Trademark registration procedure · Infringement of trademarks and Remedies available · Assignment and Licensing of Trademarks <p>B) Copyright Right</p> <ul style="list-style-type: none"> ● Concept of Copyright Right · Assignment of Copyrights 	4 Hrs.	4

	<ul style="list-style-type: none"> · Registration procedure of Copyrights · Infringement (piracy) of Copyrights and Remedies · Copyrights over software and hardware 		
Unit 5	Entrepreneurship: Introduction	No.of Hours	COs
	<p>5.1 Concept and Definitions: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs.</p> <p>5.2 Entrepreneurial Competencies: The Entrepreneur's Role, Entrepreneurial Skills: creativity, problem solving, decision making, communication, leadership quality; Self-Analysis, Culture & values, Risk-taking ability, Technology knowhow.</p> <p>5.3 Factor Affecting Entrepreneurial Growth: Economic & Non-Economic Factors, EDP Programmes.</p> <p>5.4 Steps in Entrepreneurial Process: Deciding Developing Moving Managing Recognizing.</p>	4	5
Unit 6	Resources for Entrepreneurship	No.of Hours	COs
	<p>6.1 Project Report Preparation: Specimen Format of Project Report; Project Planning and Scheduling using PERT / CPM; Methods of Project Appraisal – Feasibility Study both</p>	4	6

	<p>Economic and Market</p> <p>Preparation projected financial statement.</p> <p>6.2 Role of Support Institutions and Management of Small Business:</p> <p>Director of Industries, DIC, SIDO, SIDBI,</p> <p>Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED,</p> <p>State Financial Corporation (SFC) EPC, ECGC.</p> <p>6.3 Various Governmental Initiatives:</p> <p>Make in India, Startup India, Stand Up India, Digital India, Skill India</p> <p>6.4 Case Studies of Successful Entrepreneurs</p>		
Text Books:			
	<ol style="list-style-type: none"> 1. Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI, New Delhi 2. The Indian Patent act 1970. 3. The copyright act 1957 4. Manual of patent office practice and procedure of Govt. of India. 5. Manual of Designs Practice and Procedure of Govt. India 6. Manual of Trademarks Practice and Procedure of Govt. 		

	<p>India</p> <ol style="list-style-type: none"> 7. Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India 8. Intellectual Property Rights- A Primer, R. Anita Rao & Bhanoji, Rao, Eastern BookCo. 9. The Dynamics of Entrepreneurial Development & Management by Desai, Vasant, Himalaya Publishing House, Delhi. 10. Managing Small Business by Longenecker, Moore, Petty and Palich, Cengage Learning, India Edition. 11. Cases in Entrepreneurship by Morse and Mitchell, Sage South Asia Edition. 12. Entrepreneurship – Indian Cases on Change Agents by K Ramchandran, TMGH. 		
Reference Books:			
	<ol style="list-style-type: none"> 1. Handbook of Indian Patent Law and Practice, 2. : New Venture Creation by David H. Holt 3. Entrepreneurship Development New Venture Creation by Satish Taneja, S.L.Gupta 4. Project management by K. Nagarajan. 		

CO317: IOT Lab			
Teaching Scheme		Examination Scheme	
Practical:	2 Hrs. / Week	Oral Examination	50
Credits:	1	Total	50

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Prerequisite Course: Digital Electronics, Computer Network

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Course Objectives:

1. To understand functionalities of various single board embedded platforms fundamentals
2. To explore a comprehensive approach towards building small low cost embedded IoT system.
3. To implement the assignments based on sensory inputs.
4. To explore the use of Cloud of Things in IoT applications.
5. To understand remote handling of IoT applications using Web Interface.
6. To recognize importance of IoT in real-time application implementation

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Understand embedded platform fundamentals, operating systems for IoT systems.	2	Understand
2. Use IoT embedded platforms for low cost IoT system implementations	3	Apply
3. Describe various IoT devices, embedded platforms, programming environments for IoT systems	2	Understand
4. Demonstrate the small system for sensor-based application.	3	Apply
5. Solve the problems related to the primitive needs using IoT.	3	Apply
6. Demonstrate IoT application for distributed environment.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO4	3	3	3	-	-	-	-	-	-	3	-	-	-	3	-
CO5	3	2	2	-	-	-	-	-	-	3	-	-	-	3	-
CO6	3	3	3	-	-	-	-	-	-	3	-	3	-	3	3

Suggested List of Assignment

[Students have to complete at list 7 assignment towards the successful completion of project work, where all the implementation and design assignments are compulsory]

Group A [All assignments are compulsory]

1. **Identify different boards like Raspberry-Pi, Beagle board, Arduino and other microcontrollers.**
2. **Basic IoT setup with Arduino and ESP8266.**

- Connection of Arduino board with ESP8266 Wi-Fi module, interfacing Arduino with ESP8266 using AT commands like UART, CWMODE, CWLAP, CWJAP, CIPMUX, CIPSERVER, CIFS. Connecting Arduino to access-point with LAN/internet with static IP. Checking TCP connection with Arduino over LAN/internet.

3. **Writing first IoT based Program on Arduino:**

To control an LED connected to an Arduino: Write a basic program (i.e., html code) in a PC for creating command buttons on a browser window. -Write and upload the Arduino code for ON/OFF control of the LED. -Run the program of Arduino and give the browser-based command to control the LED.

4. **Survey of different commercial and open-source clouds, create a report on it.**

Group B [All assignments are compulsory]

5. **Implementation of temperature control using Arduino Uno as master and ESP8266 sensor as slave and upload the data on think speak.**

6. **Cloud based data logging:**

IoT based Temperature logger using ThingSpeak (Or any other cloud service) Arduino, LM35 and ESP8266.

- Connection of LM35 with Arduino board (which is already connected to internet/intranet with the help of ESP8266)
- Setting up a cloud-based account (Thingspeak etc.) or any other IoT cloud service / server.
- Write and upload an Arduino temperature data logger program using LM35, given IoT cloud service and ESP8266.
- View and verify the temperature logs on the IoT cloud service.

Group C [Any one project implementation and documentation]

7. Home Automation:

IoT-based home automation

- Connection of relays with Arduino board (which is already connected to internet/intranet with the help of ESP8266)
- Writing cloud based or local executable code (i.e., plain html code) to communicate with the above Arduino board.
- Execute the above code to send the ON/OFF control commands via internet/intranet to the relays connected to different pins of the Arduino board which ultimately will switch ON/OFF the electrical/electronic appliances.

8. Street Light Control

IoT Based Street Light Control

- Connection of LDR and relays (connected to street lights) with Arduino board (which is already connected to internet/intranet with the help of ESP8266)
- Writing cloud based or local executable code (i.e., plain html code) to communicate with the above Arduino board.
- Execute the above code to sense the ambient light near the street light and if it is less/greater than the predefined threshold level then sends the ON/OFF control commands via internet/intranet to the relays connected to different pins of the Arduino board which ultimately will switch ON/OFF the street lights

9. Speed Control of DC Motor

IoT based Speed Control of DC Motor with PWM signals

- Connection of L293D motor driver (connected to and DC motor) with Arduino board (which is already connected to the internet/intranet with the help of ESP8266)
- Writing cloud-based or local executable code (i.e., plain HTML code) to communicate with the above

Arduino board.

- Executing the above code to send the instructions to the above Arduino board which in turn generates PWM signals to be fed to the motor driver and hence control the speed of the DC motor.

10. Selecting any project from the list and implementing it.

- Documents list

- Planning and Research
- Components Survey and selection.
- Hardware Assembly
- Software Development
- Integration and testing of project.
- Presentation of the project.

CO318: System Software Lab

CO318: System Software Lab			
Teaching Scheme		Examination Scheme	
Lectures:	2 Hrs. / Week	OR Exam:	25 Marks
Credits:	1	TW:	Marks
		Total:	25 Marks

Prerequisite Course: System Software, Computer Organization and Architecture, Data Structures

Course Objectives:

1. To learn and understand Lexical and Syntax Analysis
2. To get familiar with tools like LEX & YACC.
3. To understand the Intermediate code forms and generate Intermediate Code for given input statement
4. To understand design of two pass assembler.
5. To learn and understand design of two pass macroprocessor.

Course Outcome (COs): On completion of the course, students will be able to-

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. Use LEX tool to generate lexical analyzer	3	Apply
2. Use YACC tool to generate syntax analyzer	3	Apply
3. Use YACC specifications to implement semantic analysis	3	Apply
4. Use LEX and YACC specifications to generate Intermediate code in various forms	3	Apply
5. Design and Understand Two Pass Assembler	3	Apply
6. Design and Understand Two Pass Macroprocessor	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

C02	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
C03	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
C04	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
C05	1	2	3	2	3	-	-	-	-	-	-	1	2	1	-
C06	1	2	3	2	3	-	-	-	-	-	-	1	2	1	-

Guidelines for Student

The laboratory assignments are to be submitted by students in the form of journal. Journal consists of Certificate, Table of Contents, and **Handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Inputs and Outputs, Theory -Concept in brief, algorithm, flowchart, test cases, mathematical model (if applicable), conclusion/analysis). **Program codes with sample output of all performed assignments are to be submitted as softcopy**

Suggested List of Laboratory Assignments

4. Write a program using LEX specifications to implement lexical analysis phase of compiler to generate tokens of subset of 'C' program.
5. Write a LEX program to display word, character and line counts for a sample input text file
6. Write a program using YACC specifications to implement syntax analysis phase of compiler to validate type and syntax of variable declaration in C program.
7. Write a program using YACC specifications to implement syntax analysis phase of compiler to recognize simple and compound sentences given in input file.
8. Write a program to implement recursive descent parser(RDP) for sample language.
9. Write a program using YACC specifications to implement calculator to perform various arithmetic operations
10. Write a program using LEX and YACC to generate a symbol table
11. Write a program using LEX and YACC to generate Intermediate code in the form of Three addresss and Quadruple form for assignment statement
12. Study of data structures and algorithms used for design and implementation of pass-I and pass-II of a two-pass assembler for a pseudo-machine using OOP features.
13. Study of data structures and algorithms used for design and implementation of pass-I and pass-II of a two-pass macroprocessor using OOP features.
Books:

Text Books(T):
John Donovan, “System Programming”, McGraw Hill, ISBN 978-0--07-460482-3.
Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 – 4
John R. Levine, Tony Mason, Doug Brown, “Lex and Yacc”, O’Reilly & Associates, Inc, ISBN:1-56592-000-7
Reference Books(R):
10. Alfred V.Aho,Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, “Compilers-Principles,Techniques and Tools”, Pearson,ISBN:978-81-317-2101-8
11. Leland Beck, “System Software: An Introduction to Systems Programming”, Pearson
12. Dick Grune, Bal, Jacobs, Langendoen, “Modern Compiler Design”, Wiley, ISBN 81-265-0418-8

CO319: DATA MINING AND WAREHOUSING LAB		
Teaching Scheme	Examination Scheme	
Practical: 2 Hrs./ Week	OR Exam:	50 Marks
Credits: 1	Total:	50 Marks

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Prerequisite Course: (if any) Database Management System

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Course Objectives:

1. To understand the fundamentals of Data Mining.
2. To identify the appropriateness and need of mining the data.
3. To learn the pre-processing, mining and post processing of the data.
4. To understand various Distant Measures techniques in data mining.
5. To understand clustering techniques and algorithms in data mining.
6. To understand classification techniques and algorithms in data mining.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Title	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply basic, intermediate and advanced techniques to mine the data.	3	Apply
CO2	Analyze the output generated by the pre-processing of data.	2	Understand
CO3	Ability to explore the data warehouse and its design.	4	Analyze
CO4	Examine the hidden patterns in the data	4	Analyze
CO5	Apply the mining process by frequent pattern analysis techniques.	3	Apply
CO6	Demonstrate the Classification techniques for realistic data.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO4	2	2	2	3	2	--	--	--	--	--	--	--	3	2	2
CO5	3	2	2	3	2	3	2	--	--	2	--	--	2	2	2
CO6	2	2	2	3	2	3	2	--	--	2	--	--	2	2	3

List of Assignments	
1. Implement Data pre-processing tasks.	
2. Implement Frequent pattern analysis using Apriori algorithm.	
3. Implement Frequent pattern analysis using FP-Growth algorithm.	
4. Visualize the Clusters Using Suitable tool (Weka).	
5. Visualize the Decision tree classification algorithm Using Suitable tool (Weka).	
6. Consider a suitable text dataset. Remove stop words, apply stemming and feature selection techniques to represent documents as vectors. Classify documents and evaluate precision, recall. (For Ex: Movie Review Dataset)	
Books:	
Text Books: (Max. 2-3 Books with details as per given example)	
1. Luís Torgo, “Data Mining with R, Learning with Case Studies”, CRC Press, Talay and Francis Group, ISBN9781482234893	
2. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers, ISBN:9780123814791, 9780123814807.	
3. Mohammed J. Zaki, Wagner Meira Jr., “Data Mining and Analysis”, Cambridge University Press, ISBN:9781316614808.	
Reference Books:(Min. 04 Books with details as per given example)	
1. Vipin Kumar, “Introduction to Data Mining”, Pearson, ISBN-13: 978-0321321367 ISBN-10: 0321321367	
2. Ikhvinder Singh, “Data Mining & Warehousing”, Khanna Publishing House, ISBN-10: 9381068704, ISBN-13: 978-9381068700	
3. Charu C. Aggarwal, “Data Mining: The Textbook”, Springer, ISBN 978331914141-1, 978331914142-8	
4. Ian H. Witten, Eibe Frank, “Data Mining: Practical Machine Learning Tool and Techniques”, Elsevier Publishers, ISBN: 0-12-088407-0	
5. Luís Torgo, “Data Mining with R, Learning with Case Studies”, CRC Press, Talay and	

Francis Group, ISBN9781482234893

6. Carlo Vercellis, “Business Intelligence - Data Mining and Optimization for Decision Making”, Wiley Publications, ISBN: 9780470753866

CO320 : Creational Activity			
Teaching Scheme		Examination Scheme	
Practical:	2 Hrs. / Week	Termwork	50
Credits:	1	Total	50

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Prerequisite Course: Basic knowledge of Programming and Computer Systems

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Course Objectives:

1. To encourage students to be member of professional bodies/clubs/chapters.
2. To enhance mini project developed by students in the view of product development.
3. To validate and test enhanced mini project.
4. To motivate students for participation and interaction in extra-curricular or co- curricular activities.

Course Outcome (COs): On completion of the course, students will be able to-

CO	Course Outcomes	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand working of professional bodies and participate in events organized by such bodies.	2	Understand
CO2	Analyze implemented code and create a working product.	4	Analyze
CO3	Apply different testing methods and tools.	3	Apply
CO4	Apply their knowledge to participate in extra-curricular or co-curricular activities.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	1	2	-	-	-	3	-	2	2	-	-	1	-	-	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO4	1	2	-	-	-	3	-	2	2	-	-	1	-	-	2

Subject Description:

- The course will acquaint students with a variety of technical activities and skills which help to develop their employability skills required for placement. The course will focus on skill and personality development of students.
- Course is divided in two categories i.e compulsory activities and elective activities organized in different buckets. From elective activities students have to select one bucket.
- Groups of students will be same as Semester-V Mini Project groups.

Guidelines

I] Compulsory Activities

1. Membership of Professional body (ex. CSI,IEEE etc) or Member of Coding groups like geeks for geeks and participation in at least one event organized by respective body.
2. Completion of project in view of product development.
3. Testing of Mini Project performed in SEM-V (Test cases with sufficient data set).

II] Group of students have to select one Bucket from Following

Bucket 1: Certification

Standard certification like salesforce, NPTEL, Coursera, AWS, SAP, any other certification or international certification which help to develop their employability skills required for placement.

Bucket 2: Publication

Publication of paper in reputed journal in association with expert faculty.

OR

Presentation and Publication in National or International conference.

Bucket 3: Achievement

State /National level winner in extra-curricular or co- curricular activities, which includes Sports, Arts, Coding or Hackathon Competition, Idea or Innovation.

Bucket 4: Product Development and Projects

End product development and Patent

OR

Winner in State or National project competition.

OR

Project Presented at National Level competition.

Bucket 5: Any other domain chosen by student in consult with faculty member.

MC321: Mandatory Learning Course-VI			
Teaching Scheme		Examination Scheme	
Lectures:	1 Hrs. / Week	In-Sem Exam:	-
Credits:	Non Credit	End-Sem Exam:	-
		Continuous Assessment:	-
		Total:	-

Each individual has behavior patterns that are shaped by the context of his or her past. Most often, adapting the behavior to the changing context of the reality a person lives in becomes difficult which may lead to the reduction in personal effectiveness and natural self-expression.

The main focus of this course is to equip the students with useful approaches to help in the deeper understanding of self and help individuals empower themselves to be the source of their own growth and development. The course will help students to learn effective communication skills, Group and team building skills and will help them learn the goal setting process and thus become more effective in achieving their goals.

The broader objective of this course is to make the students aware about the different facets of self and to help them learn skills to strengthen their inner capacities. So that they are able to understand themselves, think and act effectively, to be able to communicate in an effective manner and to learn to lead and to form an effective team.

The specific objectives, however, are as follows.

1. To help the students to understand their real self by recognizing different aspects of their self-concept that will lead to an increased self-confidence.
2. To train the students for communicating effectively in both formal as well as in informal settings.
3. To help the students to understand the importance of non-verbal aspects of effective communication.
4. To help the students to understand Emotion and emotional intelligence, Managing one's own emotional reservoirs, effective dealing with emotions at work
5. To facilitate the students in understanding the formation and function of group and team and to help them to learn the skills of a successful leader.
6. To help the students in understanding and practicing the goal setting process by recognizing the importance of each step involved in goal setting.

The activities involved are designed to facilitate their career goal decision making. The activities to achieve the above objectives can be suggested as follows.

- Motivational lectures
- Group Discussions/activities
- Case Study
- Games/Stimulation Exercises
- Role-Playing
- Mindfulness training.

Suitable Technical / Non-Technical Activities finalized by Department: Department has flexibility to decide suitable activities.

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopergaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)



B. Tech. Computer Engineering
2021 Pattern

Curriculum

(B. Tech. Sem-VII & VIII with effect from Academic Year 2024-2025)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopergaon Dist. Ahmednagar,
Maharashtra State, India PIN 423603.


Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute affiliated to SPPU, Pune)

D E C L A R A T I O N

We, the Board of Studies (Computer Engineering), hereby declare that, we have designed the Curriculum of Final Year Computer Engineering Program Curriculum Structure and Syllabus for semester VII and VIII of Pattern 2021 w.e.f. from A.Y 2024-25 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by


(Dr.D.B.Kshirsagar)

BoS Chairman

Approved by


Dean Academics




Director
Sanjivani College of Engineering,
Kopargaon
Director

SRES's Sanjivani College of Engineering, Kopargaoon

(An Autonomous Institute Affiliated to SPPU Pune)

COURSE STRUCTURE- 2021 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING

LIST OF ABBREVIATIONS			
Abbreviation	Full Form	Abbreviation	Full Form
PCC	Professional Core courses	CIA	Continuous Internal Assessment
PEC	Professional Elective courses	OR	End Semester Oral Examination
OEC	Open Elective courses	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	MLC	Mandatory Learning Course
PROJ	Project	L	Lecture
LC	Laboratory course	P	Practical
T	Tutorial	NC	Non-Credit
Cat	Category		

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COURSE STRUCTURE- 2021 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING (A.Y. 2024-25)

SEMESTER VII

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme					
			L (hrs)	T (hrs)	P (hrs)	Credits	Theory		TW	Practical		Grand Total
							CIA	ESE		OR	PR	
PCC	CO401	High Performance Computing	3	-	-	3	40	60	-	-	-	100
PCC	CO402	Machine Learning	4	-	-	4	40	60	-	-	-	100
PCC	CO403	Cryptography and Network Security	3	-	-	3	40	60	-	-	-	100
PEC	CO404	Professional Elective – III	3	-	-	3	40	60	-	-	-	100
PEC	CO405	Professional Elective – IV	3	-	-	3	40	60	-	-	-	100
LC	CO406	High Performance Computing Laboratory	-	-	2	1	-	-	50	-	-	50
LC	CO407	Machine Learning Laboratory	-	-	2	1	-	-	-	-	50	50
LC	CO408	Cryptography and Network Security Laboratory	-	-	2	1	-	-	-	50	-	50
PROJ	CO409	Project Stage- I	-	-	6	3	-	-	100	50	-	150
MLC	MC410	Mandatory Learning Course-VII	1	-	-	NC	-	-	-	-	-	PASS/ FAIL
Total			17	-	12	22	200	300	150	100	50	800

Mandatory Learning Course-VII: Financially Smart

Professional Elective-III	Professional Elective-IV
CO404 A Natural Language Processing	CO405A Deep Learning and Soft Computing
CO404 B DevOps and Cloud	CO405B Advanced Databases
CO404 C Data Analytics (DA)	CO405C Blockchain Technology

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COURSE STRUCTURE- 2021 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING (A.Y. 2024-25)

SEMESTER VIII

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme						
			L (hrs)	T(hrs)	P (hrs)	Credits	Theory			Practical			Grand Total
							CIA	ISE	ESE	TW	OR	P R	
PCC	CO411	Open Elective -I	3	-	-	3	25	-	75	-	-	-	100
PCC	CO412	Open Elective -II	3	-	-	3	25	-	75	-	-	-	100
PCC	CO413	Open Elective –III	2	-	-	2	25	-	75	-	-	-	100
PROJ	CO414	Professional Internship			8	4				100	50		150
PROJ	CO415	Project Stage- II	-	-	4	2	-	-	-	-	50	-	50
Total			8	-	12	14	75	-	225	100	100	-	500

Open Elective-I

CO411 A Ethical Hacking

CO411 B Introduction to Game Theory and Mechanism Design

CO411 C Design and Implementation of Human-Computer Interfaces

CO411 D Learning Analytics Tools

Open Elective-II

CO412 A Parameterized Algorithm

CO412 B Deep Learning for Computer Vision

CO412 C Introduction to Industry 4.0 and Industrial IOT

Open Elective-III

CO413 A Innovation, Business Models and Entrepreneurship

CO413 B Knowledge Management

CO413 C Services Marketing: Integration People, Technology, Strategy

SEMESTER VII

CO401: High Performance Computing	
Teaching Scheme	Evaluation Scheme
Lectures: 3 Hrs. / Week	Continuous Internal Assessment (CIA): 40 Marks
Credits: 3	End-Sem Exam (ESE): 60 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Computer Organization and Architecture, Systems Programming and Operating System, Design and Analysis of Algorithms.

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Course Objectives:

1. To study parallel computing hardware and programming models
2. To be conversant with performance analysis and modelling of parallel programs
3. To understand the different principles and paradigms for parallelism.
4. To know the operating system requirements to qualify in handling the parallelization.
5. To understand and explore different parallel programming platforms.
6. To learn and understand implementation of different parallel algorithms.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Describe different parallel architectures, inter-connect networks, programming models	2	Understand
CO2	Apply an efficient parallel algorithm to solve given problem	3	Apply
CO3	Understand the different communication operation involved in parallel computing	2	Understand
CO4	Analyze and measure performance of modern parallel computing systems	4	Analyze
CO5	Apply parallel algorithms for different algorithms using concurrent or parallel environments.	3	Apply
CO6	Understanding different, recent open source distributed computing frameworks.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	2	3	2	2	--	--	--	--	--	3	--	2	3	2	3
CO 2	2	2	3	2	--	--	--	--	--	3	--	2	3	2	3
CO 3	2	1	3	3	--	--	--	--	--	3	--	2	3	2	3
CO 4	2	3	3	2	--	--	--	--	--	2	--	2	3	2	3
CO 5	2	2	3	3	--	--	--	--	--	2	--	2	3	2	3
CO 6	2	3	3	2	3	--	3	--	--	1	--	2	3	2	3

Course Contents

Unit-I	Introduction to Parallel Computing	No.of Hours	COs
	Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: N-wide superscalar architectures, Multi-core architecture.	6Hrs.	CO1
Unit-II	Principles of Parallel Algorithms Design	No.of Hours	COs
	Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance	6Hrs.	CO2

	computing architecture examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Micro architecture and Intel Nehalem micro-architecture Memory hierarchy and transaction specific memory design, Thread Organization		
Unit-III	Basic Communication Operations	No.of Hours	Cos
	Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.	6Hrs.	CO3
Unit-IV	Analytical Models of Parallel Programs	No.of Hours	COs
	Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and The effect of Granularity on Performance, Scalability of Parallel Systems, Minimum execution time and minimum cost, optimal execution time. Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix-Matrix Multiplication.	6Hrs.	CO4
Unit-V	Parallel Algorithms- Sorting and Graph	No.of Hours	Cos
	Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Parallelizing Quick sort, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel Best-First Search.	6Hrs.	CO5
Unit-VI	HPC enabled Programming Frameworks	No.of Hours	Cos
	CUDA Architecture, Using the CUDA Architecture, Applications of CUDA Introduction to CUDA C-Write and	6Hrs.	CO6

launch CUDA C kernels, Manage GPU memory, Manage communication and synchronization, Parallel programming in CUDA- C. Apache Hadoop, Apache Spark, Apache Flink, OpenCL,		
Books:		
Text Books:		
1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2 2. Jason sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3.		
Reference Books:		
1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984 2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884 3. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann,1999, ISBN 978-1-55860-343-1 4. Rod Stephens, " Essential Algorithms", Wiley, ISBN: ISBN: 978-1-118-61210-1.		
E-Resources:-		
1. https://nptel.ac.in/courses/106102163		

CO402: Machine Learning		
Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs. / Week	Continuous Internal Assessment (CIA): 40 Marks	
Credits: 4	End-Sem Exam (ESE): 60 Marks	
	Total: 100 Marks	

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Prerequisite Course: (if any) Data Mining, Discrete Mathematics, Databases

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Course Objectives:

1. To understand the need for machine learning for various problem solving
2. To understand the nature of the problem and apply machine learning algorithms.
3. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
4. To understand the latest trends in machine learning
5. To design appropriate machine learning algorithms for problem solving

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand different learning based applications.	2	Understand
CO2	Apply different pre-processing methods to prepare training data set for machine learning	3	Apply
CO3	Apply the Regression Techniques to various problems	3	Apply
CO4	Apply the Bayesian algorithm to various problems	3	Apply
CO5	Apply the classification & ensemble techniques.	3	Apply
CO6	Ability to apply Clustering techniques for data.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	2	1	2	3	--	--	--	--	--	2	--	--	3	--	--
CO 2	3	2	3	2	--	--	--	--	--	--	--	--	2	--	--
CO 3	2	2	3	1	--	--	--	--	--	--	--	--	--	3	2
CO 4	3	1	3	3	--	--	--	--	--	--	--	--	3	2	2
CO 5	3	1	2	2	--	--	--	--	--	--	--	--	3	2	2
CO 6	3	1	2	3	--	3	2	--	--	--	--	--	2	--	3

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	INTRODUCTION TO MACHINE LEARNING	No.of Hours	COs
	Classic and adaptive machines, Machine learning matters, beyond machine learning-deep learning and bio inspired adaptive systems, Machine learning and Big data. Important Elements of Machine Learning- Data formats, Learn ability, Statistical learning approaches, Elements of information theory.	07 Hrs.	CO1
Unit-II	FEATURE SELECTION	No.of Hours	COs
	Scikit- learn Dataset, Creating training and test sets, managing categorical data,. Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principle Component Analysis (PCA)-non-negative matrix factorization, Sparse PCA, Kernel PCA. Atom Extraction and Dictionary Learning	7 Hrs	CO 2
Unit-III	REGRESSION TECHNIQUES	No.of Hours	COs
	Linear regression- Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Ridge, Lasso and Elastic Net, Robust regression with random sample consensus, Polynomial regression, Isotonic regression, Logistic regression- Linear classification, Logistic regression,	7 Hrs.	CO 3

	Implementation and Optimizations, Stochastic gradient descent algorithms, Finding the optimal hyper-parameters through grid search, Classification metric, ROC Curve.		
Unit-IV	BAYESIAN AND SVM TECHNIQUES	No.of Hours	COs
	<p>Bayes Theorem, Naïve Bayes Classifiers, Naïve Bayes in Scikit-learn- Bernoulli Naïve Bayes, Multinomial Naïve Bayes, and Gaussian Naïve Bayes.</p> <p>Support Vector Machine(SVM)- Linear Support Vector Machines, Scikit- learn implementation Linear Classification, Kernel based classification, Non- linear Examples. Controlled Support Vector Machines, Support Vector Regression.</p>	7 Hrs.	CO 4
Unit-V	CLASSIFICATION AND ENSEMBLE LEARNING	No.of Hours	COs
	<p>Decision Trees- Impurity measures, Feature Importance. Decision Tree Classification with Scikitlearn, Ensemble Learning-Random Forest, AdaBoost, Gradient Tree Boosting, Voting Classifier. Introduction to Meta Classifier: Concepts of Weak and eager learner, Ensemble methods, Bagging, Boosting, Random Forests.K-NN Algorithms</p>	7 Hrs.	CO 5
Unit-VI	CLUSTERING TECHNIQUES		
	<p>Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index. Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering- Dendrograms, Agglomerative clustering in Scikit- learn, Connectivity Constraints</p>	7 Hrs	CO 6
Books:			
Text Books:			
<ol style="list-style-type: none"> Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622 Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 			

2013.

3. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioners Approach”, O’REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.

Reference Books:

1. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3. Ethem Alpaydin, “ Introduction to Machine Learning”, PHI 2nd Edition-2013, ISBN 978-0262-01243-0
4. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, Cambridge University Press, Edition 2012, ISBN-10: 1107422221; ISBN-13: 9781107422223
5. Tom Mitchell “Machine Learning” McGraw Hill Publication, ISBN : 0070428077 9780070428072
6. Nikhil Buduma, “Fundamentals of Deep Learning”, O’REILLY publication, second edition 2017, ISBN: 149192561

e-Resources:

1. <https://machinelearningbook.com/>

MOOC/ Video Lectures available at:

1. https://onlinecourses.nptel.ac.in/noc22_cs97/preview
2. <https://nptel.ac.in/courses/106106139>

CO403: Cyber Security		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	Continuous Internal Assessment (CIA): 40 Marks	
Credits: 3	End-Sem Exam(ESE): 60 Marks	
	Total: 100 Marks	

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Prerequisite Course: (if any) Computer Network, Discrete Mathematics

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Course Objectives:

1. To offer an understanding of principle concepts, central topics and basic approaches in information and cyber security.
2. To know the basics of cryptography.
3. To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.
4. To apply algorithmic strategies for Cyber security.
5. To develop problem solving abilities using Cyber Security.
6. To enhance awareness about Personally Identifiable Information (PII), Information Management, Cyber forensics.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Discuss the security protections and limitations provided by today's technology.	2	Understand
CO2	Identify and describe information security and Cyber security threats.	2	Understand
CO3	Apply cryptographic algorithms to provide security to real time applications.	3	Apply
CO4	Apply appropriate security solutions against cyber-attacks.	3	Apply
CO5	Apply security tools in various environments for network security.	3	Apply
CO6	Identify and apply tools for Identity and Access management.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	--	--	--	--	--	--	--	--	--	--	--	2	--	1
CO2	--	--	2	2	--	--	--	--	--	--	2	--	--	3	--
CO3	1	--	--	2	--	--	--	--	--	--	--	--	--	1	--
CO4	--	--	--	--	--	--	2	--	--	--	--	--	--	1	--
CO5	2	--	2	3	--	--	1	--	--	--	2	--	--	2	2
CO6	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	Security Basics	No. of Hours	COs
	Introduction, Elements of Information Security, Security Policy, Techniques, Steps, Categories, Operational Model of Network Security, Basic Terminologies in Network Security. Threats and Vulnerability, Difference between Security and Privacy.	06 Hrs.	CO1
Unit-II	Data Encryption Techniques and Standards	No. of Hours	COs
	Introduction, Encryption Methods: Symmetric, Asymmetric, Cryptography, Substitution Ciphers. Transposition Ciphers, Steganography, Block Ciphers and methods of operations, Feistel Cipher, Data Encryption Standard (DES), Triple DES, DES Design Criteria, Weak Keys in DES Algorithms, Advanced Encryption Standard (AES).	07 Hrs.	CO2
Unit-III	Authentication Techniques	No. of Hours	COs
	Public Key Cryptography, RSA Algorithm: Working, Key length, Security, Key Distribution, Diffie-Hellman Key Exchange, Elliptic Curve: Arithmetic, Cryptography, Security, Authentication methods, Message Digest, Kerberos, X.509 Authentication service. Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.	07 Hrs.	CO3
Unit-IV	Security Layer Protocols	No. of Hours	COs

	IP Security: Introduction, Architecture, IPV6, IPv4, IPSec protocols, and Operations, VPN. WEB Security: Introduction, Secure Socket Layer (SSL), Electronic Mail Security: Introduction, Pretty Good Privacy, MIME, S/MIME, Comparison. Secure Electronic Transaction (SET).	06 Hrs.	CO4
Unit-V	Vulnerability Scanning Tools & Analysis	No.of Hours	COs
	DoS and DDoS, Pharming attack, Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting, Virus and Worm Features, Trojan horse, Ransomware, SQL- injection, Sniffing. Introduction to Ethical Hacking, Anonymity, Information Gathering, Scanning Networks and Tools: ZenMAP, SQLMap etc, Vulnerability Analysis. Firewall and Intrusion- Characteristics and types, Benefits and limitations. Firewall architecture, Intrusion detection, IDS: Need, Methods, Types of IDS.	08 Hrs.	CO5
Unit-VI	Identity and Access Management	No.of Hours	COs
	What is Identity and Access Management, How does IAM works, Challenges in implementing Identity Management, benefits, IAM tools, Advantages of IAM frameworks, Introduction to Personally Identifiable Information, Cyber Stalking, PII impact levels with examples, Cybercrime, PII Confidentiality Safeguards.	06 Hrs.	CO6
Books:			
Text Books:			
1. William Stallings; “Cryptography and Network Security-Principles and Practices” 6th Edition , Pearson Education, 2014, ISBN13:9780133354690. 2. Bernard Menezes, “Network Security and Cryptography”, 1st Edition, Cengage Learning, 2010, ISBN 81-315-1349-1. 3. Raef Meeuwisse, “Cybersecurity for Beginners”, 2 nd Edition, Cyber Simplicity, 2017, ISBN-9781911452157.			
Reference Books:			
1. M. Speciner, R. Perlman, C. Kaufman, “Network Security: Private Communications in a Public World”, Prentice Hall, 2002			

2. Michael Gregg, “The Network Security Test Lab: A Step-By-Step Guide”, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.
3. Charlie Kaufman, Radia Perlman and Mike Spencer, “Network security, private communication in a public world”, 2nd Edition, Prentice Hall, 2002, ISBN 9780130460196.
4. V.K. Pachghare, “Cryptography and Information Security”, 2nd Edition, PHI, 2015, ISBN-978-81-203-5082-3.

E-Resources:

1. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview

CO404A: Natural Language Processing			
Teaching Scheme		Examination Scheme	
Lectures:	3 Hrs. / Week	Continuous Internal Assessment (CIA):	40 Marks
Credits:	3	End-Sem (ESE):	60 Marks
		Total:	100 Marks

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Prerequisite Course: Data Mining, Machine Learning, Discrete Mathematics, Data Structure, Artificial Intelligence

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Course Objectives:

1. To study the sentiment analysis with logistic regression.
2. To study sentiment analysis with Naïve Bayes.
3. To study Natural Language Processing with Vector Spaces.
4. To study about auto correct.
5. To study about Part of Speech Tagging and Hidden Markov Models
6. To study Autocomplete and Language Models and Word embeddings with neural networks

Course Outcome: After completion of this course, students are able to

CO No.	Statements of Course Outcomes (CO's)	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand classification using logistic regression	2	Understand
CO2	Apply the Naive Bayes algorithm for classification of tweets	3	Apply
CO3	Understand the Vector space models	2	Understand
CO4	Understand the probabilistic models	2	Understand
CO5	Understand Part of Speech Tagging and Hidden Markov Models	2	Understand
CO6	Apply Autocomplete and Language Models and Word embeddings with neural networks.	3	Apply

Mapping of COs with POs/PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------

CO1	2	1	2	3	-	-	-	-	-	2	-	-	3	-	-
CO2	3	2	3	2	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-	-	2	3
CO4	3	1	3	3	-	-	-	-	-	-	-	-	3	2	2
CO5	3	1	2	2	-	-	-	-	-	-	-	-	3	2	2
CO6	3	1	2	3	-	-	-	-	-	-	-	-	2	-	3

COURSE CONTENTS

Unit-I	Fundamentals of Natural Language Processing	No. of Hours	COs
	History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP, Approaches of NLP: Rule based, Data Based, Knowledge Based approaches	06	CO1
Unit-II	Natural Language Processing with Classification and Vector Spaces	No. of Hours	COs
	<p>Sentiment Analysis with Logistic Regression - Learn to extract features from text into numerical vectors, then build a binary classifier for tweets using a logistic regression!</p> <p>Sentiment Analysis with Naïve Bayes - Learn the theory behind Bayes' rule for conditional probabilities, then apply it toward building a Naive Bayes tweet classifier of your own!</p> <p>Vector Space Models- Vector space models capture semantic meaning and relationships between words. You'll learn how to create word vectors that capture dependencies between words, then visualize their relationships in two dimensions using PCA.</p> <p>Machine Translation and Document Search - Learn to transform word vectors and assign them to subsets using locality sensitive hashing, in order to perform machine translation and document search.</p>	08	CO2
Unit-	Natural Language Processing with Probabilistic Models -1	No. of	COs

III		Hours	
	<p>Autocorrect – Learn about autocorrect, minimum edit distance, and dynamic programming, then build your own spellchecker to correct misspelled words!</p> <p>Part of Speech Tagging and Hidden Markov Models - Learn about Markov chains and Hidden Markov models, then use them to create part-of-speech tags for a Wall Street Journal text corpus!</p>	08	CO3
Unit-IV	Natural Language Processing with Probabilistic Models -2	No. of Hours	COs
	<p>Autocomplete and Language Models – Learn about how N-gram language models work by calculating sequence probabilities, then build your own autocomplete language model using a text corpus from Twitter!</p> <p>Word embeddings with neural networks - Learn about how word embeddings carry the semantic meaning of words, which makes them much more powerful for NLP tasks, then build your own Continuous bag-of-words model to create word embeddings from Shakespeare text.</p>	08	CO4
Unit-V	Natural Language Processing with Machine Translation and Text Summarization	No. of Hours	COs
	<p>Neural Machine Translation- Discover some of the shortcomings of a traditional seq2seq model and how to solve for them by adding an attention mechanism, then build a Neural Machine Translation model with Attention that translates English sentences into German.</p> <p>Text Summarization - Compare RNNs and other sequential models to the more modern Transformer architecture, then create a tool that generates text summaries.</p>	08	CO5
Unit-VI	Applications of Natural Language Processing	No. of Hours	COs
	<p>Question Answering - Explore transfer learning with state-of-the-art models like T5 and BERT, then build a model that can answer questions.</p> <p>Chatbot - Examine some unique challenges transformer models face</p>	08	CO6

	and their solutions, then build a chatbot using a Reformer model.		
Books:			
Text Books:			
<ol style="list-style-type: none"> 1. Christopher D.Manning and Hinrich Schutze,, “Foundations of Statistical Natural Language Processing” , MIT Press, 1999 2. Introduction to Natural Language Processing By Jacob Eisenstein 3. Foundation of Statistical Natural Language Processing - Christopher D Manning and Hinrich Schütze. 4. James Allen, “Natural Language Understanding”, Pearson Publication, ISBN: 978-81-317-0895- 8 2nd Edition 5. Daniel Jurafsky, James H. Martin, “Speech and Language Processing”, Second Edition, Prentice Hall, 2008. 6. Jacob Eisenstein, “An Introduction to Information Retrieval”, Cambridge University Press 			
Reference Books:			
<ol style="list-style-type: none"> 1. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems by Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana (Published on June 17, 2020) 2. Nitin Indurkha and Fred J. Damerau, “Handbook of Natural Language Processing”, 2nd ed. CRC press 3. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit Paperback – 7 July 2009. 			
E-Resources:			
<ol style="list-style-type: none"> 1. https://www.coursera.org/specializations/natural-language-processing 2. https://onlinecourses.nptel.ac.in/noc23_cs45/preview 			

CO404 B : DevOps and Cloud	
Teaching Scheme	Examination Scheme
Lectures: 3 Hrs. / Week	Continuous Internal Assessment 40 Marks (CIA):
Credits: 3	End-Sem (ESE): 60 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Software Engineering, Cloud Computing, Databases

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Course Objectives:

1. The objective is to understand the fundamentals of DevOps culture, its goals, practices and tools for automating the IT infrastructure and manage application life cycle.
2. The overall objective of this course is to provide students with practical experience in applying agile methodology to their work environment.
3. Students will get a range of tools to apply to their work.

Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcome	Bloom's Taxonomy	
	Level	Descriptor
1. Be able to compare and contrast the differences between Agile and other project management methodologies	4	Analyse
2. Be able to interpret and apply various principles, phases and activities of the Scrum methodology	2	Understand
3. Be able to identify and use various tools for Agile development and CI/CD	3	Apply
4. Be able to understand and implement DevOps principles for CI/CD	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS O1	PS O2	PS O3
CO 1	1	--	2	2	2	--	--	--	--		3	2	3	2	1

CO 2	2	--	2	2	2	--	--	--	--		2	2	2	2	--
CO 3	1	--	2		2	--	--	--	--		2	2	2	3	--
CO 4	2	--	--	2	--	--	--	--	--		2	2	1	2	--

COURSE CONTENTS

Unit I	Introduction to DevOps	No. of Hours	COs
	Background of SDLC, Agile, ITIL and Need for DevOps, History of DevOps, Role of a DevOps Engineer, Terminologies in DevOps.	3	1
Unit II	Version Control systems	No. of Hours	COs
	Introduction to Version Control Systems (VCS), Need for using a Version Control Systems, Types of Version Control Systems: Simple VCS, Centralized VCS and Distributed VCS, Introduction to GIT, SVN and Bitbucket, Git Essentials, Git Commandline, Git architecture and versions of Git, Cloning, Check-in and Commit of Git Repositories, Fetching the Repositories, Git Pull and Git Branching Technique	7	2
Unit III	Configuration Management Tools	No. of Hours	COs
	Introduction to Configuration Management tools, Types of Configuration Management Tools : Pushbased & Pull-based, Introduction to Ansible, Puppet, Chef & Salt, Ansible : What is Ansible and its Architecture, Why do we need Ansible, Ansible Terminologies, Advantages, Infrastructure-as-a-code, Writing Ansible Playbooks using YAML, Ansible Case Study : SPLUNK, Best practices	8	2
Unit IV	Vagrant and Containerization	No. of Hours	COs
	Introduction to Vagrant and its Uses, Installation of Vagrant in Linux and Windows, Understanding the VagrantFile, Provisioning Virtual Machines with Vagrant using Virtualbox, Networking & Port Forwarding with Vagrant Introduction to	8	3

	Containerization, Docker Essentials, What is Docker Hub and Images, Fundamentals of Microservices, Understanding the DockerFile, Docker Compose and Docker Swarm, Difference between Docker Swarm and Kubernetes for Container Orchestration		
Unit V	CI/CD Pipelines and Continuous Monitoring	No. of Hours	COs
	What is Continuous Integration and Continuous Deployment (CI/CD), Need of CI/CD in DevOps, Practical Implementation of CI/CD pipelines using Jenkins, Understanding the Jenkins Plugins, Continuous Testing & E-mail notifications, Benefits of a production-ready software Introduction to Continuous Monitoring, Why Continuous Monitoring is essential, Continuous Monitoring with Nagios, Datadog and AWS CloudWatch, Application Performance Monitoring with New Relic, Centralized Logging with ELK (Elasticsearch-Logstash-Kibana)	7	4
Unit VI	DevOps Capabilities	No. of Hours	COs
	Successful paths to automate the IT processes, Adopting DevOps in organization, Myths about DevOps , Bringing DevOps culture and Team collaboration, Improving the customer feedback and enhancing the Business	4	4
Books:			
Reference Books:			
R1. Emily Freeman, DevOps For Dummies, John Wiley & Sons (2019), ISBN: 1119552222, 9781119552222 2. R2: Joakim Verona, Practical DevOps – Second Edition, May 2018, Packt Publishing, ISBN: 9781788392570 3. R3: Lorin Hochstein & Rene Moser, Ansible : Up and Running, 2nd Edition, O'Reilly Media, ISBN13: 978-1491979808.			
E-Resources(E):			
https://in.coursera.org/learn/DevOps			

CO404 C: Data Analytics		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	Continuous Internal Assessment (CIA): 40 Marks	
Credits: 3	End-Sem Exam (ESE): 60 Marks	
	Total: 100 Marks	

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Prerequisite Course: (if any) Data Mining, Machine Learning, Design and Analysis of Algorithms

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Course Objectives:

1. To study Data Analytical Life cycle model.
2. To study various statistical techniques of data analytics.
3. To study of Predictive data analytics methods
4. To study of various Streams Concepts in Data analytics
5. To study of various practical application of data analytics.
6. To study of different big data visualization techniques.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand lifecycle approach to data science and big data analytics projects	2	Understand
CO2	Apply various analytic techniques and tools in big data project	3	Apply
CO3	Apply the predictive data analytics techniques in big data project	3	Apply
CO4	Understand the Stream Data Model and Architecture	2	Understand
CO5	Apply the various application of Data analytics techniques in real time application	3	Apply
CO6	Apply big data visualization techniques in big data project	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO5	3	1	2	2	--	--	--	--	--	--	--	--	3	2	2
CO6	3	1	2	3	--	3	2	--	--	--	--	--	2	--	3

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	Introduction to Data Analytics	No.of Hours	COs
	Introduction: Big data overview, state of the practice in Analytics- BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Data Analytic Life Cycle: Overview, phase 1- Discovery, Phase 2- Data preparation, Phase 3- Model Planning, Phase 4- Model Building, Phase 5- Communicate Results, Phase 6- Operationalize. Case Study: GINA.	07 Hrs.	CO1
Unit-II	Basic Data Analytics Methods	No.of Hours	COs
	Statistical Methods for Evaluation- Hypothesis testing, difference of means, wilcoxon rank-sum test, type 1 type 2 errors, power and sample size, ANNOVA. Advanced Analytical Theory and Methods: Clustering- Overview, K means- Use cases, Overview of methods, determining number of clusters, diagnostics, reasons to choose and cautions.	7 Hrs	CO 2
Unit-III	Predictive Analytics	No.of Hours	COs
	Sampling distribution – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses of t-distribution, F-distribution, χ^2 distribution - Predictive modeling and Analysis - Regression Analysis, Correlation analysis, Rank correlation coefficient, Multiple correlation.	7 Hrs.	CO 3
Unit-IV	STREAM data model	No.of Hours	COs
	Introduction to Streams Concepts, Stream Data Model and	7 Hrs.	CO 4

	Architecture, Stream Computing, Sampling Data in a Stream Filtering Streams, Counting Distinct Elements in a Stream Real time Analytics Platform(RTAP) applications .		
Unit-V	Data Analytics Applications	No.of Hours	COs
	Application in Industries: Retail, E-commerce, Finance, Sports, Others - healthcare, education, telecom etc. Application in business functions: Marketing Sales, Supply chain management, HR, Others - Finance, IT, Manufacturing and Strategy.	7 Hrs.	CO 5
Unit-VI	Big Data Visualization		
	Introduction to Data visualization, Challenges to Big data visualization, Analytics for unstructured data- Use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem- Pig, HIVE, HBase, Mahout, NoSQL. An Analytics Project-Communicating, operationalizing, creating final deliverables.	7 Hrs	CO 6
Books:			
Text Books:			
<ol style="list-style-type: none"> 1. David Dietrich, Barry Hiller, “Data Science and Big Data Analytics”, EMC education services, Wiley publications, 2012, ISBN0-07-120413-X 2. Ashutosh Nandeshwar , “Tableau Data Visualization Codebook”, Packt Publishing, ISBN 978-1-84968-978-6 3. Alberto Cordoba, —Understanding the Predictive Analytics Lifecycle, Wiley, 2014 4. Eric Siegel, Thomas H. Davenport, —Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2013. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Maheshwari Anil, Rakshit, Acharya, “Data Analytics”, McGraw Hill, ISBN: 789353160258. 2. Mark Gardner, “Beginning R: The Statistical Programming Language”, Wrox Publication, 			

ISBN: 978-1-118-16430-3

3. LuísTorgo, “Data Mining with R, Learning with Case Studies”, CRC Press, Talay and Francis Group, ISBN9781482234893
4. Carlo Vercellis, “Business Intelligence - Data Mining and Optimization for Decision Making”, Wiley Publications, ISBN: 9780470753866.

E-Resources:

1. Google Data Analytics Professional Certificate:
<https://www.coursera.org/instructor/google-career-certificates>
2. IBM Data Science Professional Certificate: <https://www.coursera.org/professional-certificates/ibm-data-science>
3. Data Analytics with Python: https://onlinecourses.nptel.ac.in/noc21_cs45/preview

CO405A: Deep Learning & Soft Computing		
Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs. / Week	Continuous Internal Assessment(CIA): 40 Marks	
Credits: 3	End-Sem Exam(ESE): 60 Marks	
	Total: 100 Marks	

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Prerequisite Course: (if any) Data Mining, Machine Learning

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Course Objectives:

1. To explore the Artificial Neural Networks & Deep Learning.
2. To introduce students to understand, explain, and apply the fuzzy set and fuzzy logic in real life applications
3. To understand the use of genetic algorithm to design and develop various applications
4. To study the concepts of Artificial Neural Networks.
5. To examine the different architectures like Recurrent Neural Networks
6. To understand the CNN in deep learning & examine the case studies of deep learning.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand basics of ANN & Deep learning	2	Understand
CO2	Apply Various (ANN) Deep learning model.	3	Apply
CO3	Apply principles of soft computing to solve problems in varieties of application domains.	3	Apply
CO4	Applying genetic algorithm and its basic principles for real world engineering problems.	3	Apply
CO5	Apply the CNN in deep learning & Applications.	3	Apply
CO6	Apply the Recurrent Neural Network Language Model.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	--	--	--	--	--	--	--	--	--	--	--	2	--	1
CO2	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1
CO3	--	--	2	2	--	--	--	--	--	--	2	--	--	3	--

CO4	1	--	--	2	--	--	--	--	--	--	--	--	--	1	--
CO5	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1
CO6	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	Introduction to Deep Learning	No.of Hours	COs
	History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Multilayer Perceptrons (MLPs), Sigmoid Neurons, Gradient Descent.	07 Hrs.	CO1
Unit-II	Artificial Neural Networks(ANN)	No.of Hours	COs
	Feedforward Neural Networks, Dimension, Deep Vs Shallow Networks, Generative Adversarial Networks (GAN), Semi-supervised Learning Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders.	06 Hrs.	CO2
Unit-III	Soft Computing: Fuzzy Logic	No.of Hours	COs
	Introduction of Soft Computing, Fuzzy Set theory, Fuzzy set versus Crisp set, Membership function, Operations on Fuzzy set, Fuzzy Relation, Fuzzification and Defuzzification, Minmax Composition, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification, Fuzzy controllers, Application of Fuzzy systems(Real life).	07 Hrs.	CO3
Unit-IV	Soft Computing: Genetic Algorithm	No.of Hours	COs
	Evolution of Genetic Algorithms (GA), Basic GA framework and different GA architectures, GA operators: Crossover, Selection, Mutation, Fitness function, Convergence Working Principle, Vncoding methods , Bit wise operation in GA, Multi-level Optimization, Applications of GA in Machine Learning.	06 Hrs.	CO4

Unit-V	Convolutional Neural Networks(CNN)	No.of Hours	COs
	Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation.	07 Hrs.	CO5
Unit-VI	Recurrent Neural Networks(RNN)	No.of Hours	COs
	Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs-Recurrent Neural Network Language Models- Word-Level RNNs	07 Hrs.	CO6
Books:			
Text Books:			
1. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Wiley, 2010 2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016. 3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.			
Reference Books:			
1. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009 2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015. 3. Deep learning, Rajiv Chopra, Khanna book Publishing Co. New Delhi			
e-Resources:			
2. https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html 3. http://www.musaliarcollege.com/e-Books/CSE/introduction-to-soft-computing%20(1).pdf 4. http://www.deeplearningbook.org/ 5. http://deeplearning.net/tutorial/deeplearning.pdf 6. http://www.dkriesel.com/en/science/neural_networks			
MOOC/ Video Lectures available at:			
3. https://nptel.ac.in/courses/106/105/106105173/ 4. https://nptel.ac.in/courses/117/105/117105084/ 5. https://nptel.ac.in/courses/127/105/127105006			

CO405B: Advanced Databases	
Teaching Scheme	Examination Scheme
Lectures: 3 Hrs. / Week	Continuous Internal Assessment (CIA):40 Marks
Credits: 3	End-Sem Exam(ESE): 60 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Database Management System Concepts

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Course Outcomes (COs): On completion of the course, student will be able to–

Course Outcome	Bloom's Taxonomy	
	Level	Descriptor
CO1: Understand the Types of Digital Data and Characteristics of Big Data	2	Understand
CO2: Understand the Hadoop Architecture	2	Understand
CO3: Apply the Mapreduce Programming model for NoSQL Data	3	Apply
CO4: Apply the CQL on Column Oriented Data	3	Apply
CO5: Apply the Redis Query Language on Key-Value Pair Data	3	Apply
CO6: Apply the Neo4j Concepts on Graph Data	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	--	2	2	2	--	--	--	--		3	2	3	2	1
CO2	2	--	2	2	2	--	--	--	--		2	2	2	2	--
CO3	1	--	2		2	--	--	--	--		2	2	2	3	--
CO4	2	--	--	2	--	--	--	--	--		2	2	1	2	--
CO5	2	--	2	2	--	--	--	--	--		2	2	2	3	--
CO6	2	--	3	2	2	--	--	--	--		2	3	2	2	1

COURSE CONTENTS

Unit I	Types of Digital Data	No. of Hours	COs
	Classification of Digital Data. Introduction to Big Data: Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Big Data Analytics: Where do we Begin?, What is Big Data Analytics?, What Big Data Analytics isn't?, Classification of Analytics, Terminologies Used in Big Data Environments.	7	1
Unit II	Hadoop	No. of Hours	COs
	Hadoop Overview, why not RDBMS?, RDBMS versus Hadoop, HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator).	7	2
Unit III	MAPREDUCE	No. of Hours	COs
	MAPREDUCE Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. Word Count example using MAPREDUCE	7	3
Unit IV	Cassandra	No. of Hours	COs
	Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD, Collections, Using a Counter, Time to Live, Alter Commands, Import and Export.	7	4
Unit V	Redis	No. of Hours	COs
	Compared to Other Databases and Software ,Features ,Why Redis ?,Strings ,Lists , Sets, Hashes , Sorted sets , Strings Publish/Subscribe , Transactions , Expiring Keys.	7	5
Unit VI	GraphDB	No. of Hours	COs
	What is GraphDB, GraphDB vs RDBMS, GraphDB vs NoSQL, Data Modelling, Neo4j QL, Neo4j General Clauses, Neo4j Read		

	Clauses, Neo4j Write Clauses, Neo4j Functions.	7	6
Books:			
Text Books:			
<p>T1: Rathinaraja Jeyaraj , Ganeshkumar Pugalandhi, Anand Paul , Big Data with Hadoop MapReduce A Classroom Approach , First Edition , Apple Academic Press, 2020</p> <p>T2: Seema Acharya, Subjashini Chellappan, Big Data and Analytics,First Editon, Wiley, 2015</p>			
Reference Books:			
<p>R1. S.K.Singh, “Database Systems : Concepts, Design and Application”, Pearson, Education, ISBN 978-81-317-6092-5</p> <p>R2. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley, ISBN-10: 0321826620, ISBN-13: 978-0321826626.</p>			
E-Resources(E): https://in.coursera.org/learn/Advanceddatabase			

CO405C: Blockchain Technology	
Teaching Scheme	Examination Scheme
Lectures: 3 Hrs. / Week	Continuous Internal Assessment (CIA):40 Marks
Credits: 3	End-Sem Exam(ISE): 60 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Digital forensics, Cyber security,

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Course Objectives:

1. To give students the understanding of emerging abstract models for blockchain Technology.
2. To familiarise with the functional/operational aspects of cryptocurrency eco-system.
3. To understand the bitcoins and its applications in blockchain technology.
4. To understand the Ethereum basics and smart contract and its applications.
5. To understand the Privacy, Security issues in blockchain and its applications.
6. To apply blockchain technology for different real time applications.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Describe the basic concepts and technology used for blockchain.	2	Understand
CO2	Describe the primitives of the distributed computing and cryptography related to blockchain.	2	Understand
CO3	Illustrate the concepts of Bitcoin and their usage.	3	Apply
CO4	Implement Ethereum block chain contract.	3	Apply
CO5	Apply security features in blockchain technologies.	3	Apply
CO6	Use smart contract in real world applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS O1	PS O2	PS O3
CO 1	3	--	--	2	--	--	--	--	--	2	3	2	1	2	--
CO 2	2	3	--	2	--	--	--	--	--	2	2	2	1	2	--
CO 3	3	3	3	--	3	--	--	--	--	3	2	2	2	2	--

CO 4	2	3	2	2	3	--	--	--	--	3	2	2	2	3	1
CO 5	2	--	3	2	--	--	--	--	--	3	2	2	2	3	2
CO 6	2	3	--	2	2	--	--	--	--	3	2	3	1	3	--

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Course Contents

Unit-I	Introduction to Blockchain	No.of Hours	COs
	Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.	06 Hrs.	CO1
Unit-II	Basic Distributed Computing & Crypto primitives	No.of Hours	COs
	Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems	06 Hrs.	CO2
Unit-III	Bitcoin basics	No.of Hours	COs
	Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use	06 Hrs.	CO3
Unit-IV	Ethereum basics	No.of Hours	COs
	Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript	06 Hrs.	CO4

Unit-V	Privacy, Security issues in Blockchain	No.of Hours	COs
	Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks	06 Hrs.	CO5
Unit-VI	Blockchain Use Cases	No.of Hours	COs
	Block chain in Financial Service, Supply Chain Management and Government Services	06 Hrs.	CO6
Books:			
Text Books:			
1. Imran Bashir, “Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained”, Packt Publishing. Date: March 2018, ISBN: 9781788839044. 2. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction”, Princeton University Press.			
Reference Books:			
1. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017. 2. Merunas Grincalaitis, “Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols”, Packt Publishing. 3. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, “Blockchain Architecture Design And Use Cases”[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/ 4. Melanie Swan ,”Blockchain : Blueprint for a New Economy” O'Reilly.			
E-Resources:			
1. https://nptel.ac.in/courses/106/105/106105184/			

CO406: High Performance Computing Laboratory		
Teaching Scheme	Evaluation Scheme	
Practical: 2 Hrs./ Week	Term Work(TW): 50 Marks	
Credits: 1	Total: 50 Marks	

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Prerequisite Course: (if any) Computer Organization and Architecture, Digital Electronics and Data Communication

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Course Objectives:

1. To understand and apply different parallel programming construct to implement parallel algorithms.
2. To apply parallel programming tools to write parallel algorithms for sorting algorithms.
3. To implement different data mining algorithms using parallel approach.
4. To build a cluster environment for implementation of MPI routines.
5. To write program using MPI routines to implement different algorithms.
6. To understand the GPU architecture and implement CUDA program for real time applications.

Course Outcomes (COs):

On completion of the course, student will be able to—

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Apply parallel algorithms for different algorithms using concurrent or parallel environments.	3	Apply
CO2	Apply parallel algorithms for sorting applications.	3	Apply
CO3	Apply parallel computing techniques for data mining algorithms.	3	Apply
CO4	Demonstrate the different steps involved in building of a simple Cluster.	3	Apply
CO5	Implement message-passing programs in distributed environment.	3	Apply
CO6	Use GPU architecture using CUDA program for solving real-time ap	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS
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	1	2	3	4	5	6	7	8	9	10	11	12	O1	O2	O3
CO1	2	1	2	3	--	--	--	--	--	2	--	--	3	--	--
CO2	3	2	3	2	--	--	--	--	--	--	--	--	2	--	--
CO3	2	2	3	1	--	--	--	--	--	--	--	--	--	3	2
CO4	3	1	3	3	--	--	--	--	--	--	--	--	3	2	2
CO5	3	1	2	2	--	--	--	--	--	--	--	--	3	2	2
CO6	3	1	2	3	--	3	2	--	--	--	--	--	2	--	3

Tools for High Performance Computing Laboratory

Operating System recommended - 64-bit Open source Linux or its derivative

Programming Languages: PYTHON/Java/OpenMP/MPI

Programming tools recommended Anaconda or Miniconda Frameworks/ Apache Hadoop

Online Tools: MPI libraries

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal may consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). **Program codes with sample output of all performed assignments are to be submitted as softcopy.**

Guidelines for Assessment

Continuous assessment of Machine Learning laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness documentation.

List of High Performance Computing Laboratory Assignments (Any Eight)

1. **Parallel sorting Algorithms-** for Bubble Sort and Merger Sort, based on existing sequential algorithms, design and implement parallel algorithm utilizing all resources available.
2. **Vector and Matrix Operations-** Design parallel algorithm to
 - a) Add two large vectors
 - b) Multiply Vector and Matrix
 - c) Multiply two $N \times N$ arrays using n^2 processors.
3. Parallel Implementation of the K Nearest Neighbors Classifier using python/openmp.
4. Study of Cluster building steps - MPI Cluster setup and overview of different routines.
 - a. Different steps to build a MPI cluster over LAN.
 - b. Master-Slave concept and different MPI routines.
5. Parallel implementation of all pair shortest path algorithm using openmp/MPI
6. Program to implement point-to-point communication using MPI routines.

- a. Parallelizing Trapezoidal Rule using MPI_Send and MPI_Receive.
7. Program to implement collective communication using MPI routines.
 - a. Gather, Scatter and Broadcast operations.
 - b. Matrix-Vector multiplication execution.
8. Program to implement Merge sort/ Graph Computation algorithm using MPI routines.
 - a. Steps in parallelizing Merge Sort/ Matrix Partitioning.
9. Program to execute matrix multiplication using CUDA.
 - a. Basic CUDA host, device and memory constructs.
 - b. Thread- warp, block, grid usage.
10. Program to implement Map-Reduce parallelism for Warehouse -Scale Computer.
 - a. Parallelism using Map-Reduce programming model.
 - b. Example of word count process with key-value pair.

Books:
Text Books:
1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2 2. Jason Sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3.
Reference Books:
1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984. 2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884. 3. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann, 1999, ISBN 978-1-55860-343-1. 4. Rod Stephens, "Essential Algorithms", Wiley, ISBN: 978-1-118-61210-1.
E-Resources:-
1. https://nptel.ac.in/courses/106102163

CO407: Machine Learning Laboratory		
Teaching Scheme	Examination Scheme	
Practical: 2 Hrs./ Week	Practical Exam(PR): 50 Marks	
Credits: 1	Total: 50 Marks	

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Prerequisite Course: (if any) Data Mining, Discrete Mathematics, Database

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Machine Learning Lab

Course Objectives:

1. To understand the need for machine learning for various problem solving
2. To understand nature of the problem and apply machine learning algorithm.
3. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
4. To understand the latest trends in machine learning
5. To design appropriate machine learning algorithms for problem solving.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand different learning based applications.	2	Understand
CO2	Apply different pre-processing methods to prepare training data set for machine learning	3	Apply
CO3	Apply the Regression Techniques to various problems	3	Apply
CO4	Apply the Bayesian algorithm to various problems	3	Apply
CO5	Apply the classification & ensemble techniques.	3	Apply
CO6	Ability to apply Clustering techniques for data.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO	2	1	2	3	--	--	--	--	--	2	--	--	3	--	--

1															
CO 2	3	2	3	2	--	--	--	--	--	--	--	--	2	--	--
CO 3	2	2	3	1	--	--	--	--	--	--	--	--	--	3	2
CO 4	3	1	3	3	--	--	--	--	--	--	--	--	3	2	2
CO 5	3	1	2	2	--	--	--	--	--	--	--	--	3	2	2
CO 6	3	1	2	3	--	3	2	--	--	--	--	--	2	--	3

(Specify values as : 3: High Level, 2: Medium Level, 1: Low Level for mapping of Cos to POs)

Tools for Machine Learning Laboratory Practice

Operating System recommended: - 64-bit Open source Linux or its derivative

Programming Languages: PYTHON/R

Programmingtools recommended:Anaconda or Miniconda Frameworks

Online Tools:Google Colab

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal may consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). **Program codes with sample output of all performed assignments are to be submitted as softcopy.**

Guidelines for Assessment

Continuous assessment of Machine Learning laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes,punctuality and neatness documentation.

List of Machine Learning Laboratory Assignments

1. Assignment on Linear Regression:

The following table shows the results of a recently conducted study on the correlation of the number of hours spent driving with the risk of developing acute backache. Find the equation of the best fit line for this data.

Number of hours spent driving (x)	Risk score on a scale of 0-100 (y)
10	95
9	80
2	10
15	50
10	45
16	98
11	38
16	93

2. Apply the **Principal Component Analysis (PCA)** for Feature Reduction Techniques on any dataset. (For ex: IRIS Dataset.)

(Dataset Downloads Link):

https://drive.google.com/file/d/12BY34aCbYLoLjy3gDUMrZEBUf7l5FZsd/view?usp=share_link

3. Assignment on **Decision Tree Classifier**:

A dataset collected in a Cloth shop showing details of customers and whether or not they responded to a special offer to buy a new Sarry is shown in table below. Use this dataset to build a decision tree, with Buys as the target variable, to help in buying lip-sticks in the future. Find the root node of the decision tree. According to the decision tree you have made from the previous training data set, what is the decision for the test data: [Age < 21, Income = Low, Gender = Female, Marital Status = Married]?

ID	Age	Income	Gender	Marital Status	Buys
1	< 21	High	Male	Single	No
2	< 21	High	Male	Married	No
3	21-35	High	Male	Single	Yes
4	>35	Medium	Male	Single	Yes
5	>35	Low	Female	Single	Yes
6	>35	Low	Female	Married	No
7	21-35	Low	Female	Married	Yes
8	< 21	Medium	Male	Single	No
9	<21	Low	Female	Married	Yes
10	> 35	Medium	Female	Single	Yes
11	< 21	Medium	Female	Married	Yes
12	21-35	Medium	Male	Married	Yes
13	21-35	High	Female	Single	Yes
14	> 35	Medium	Male	Married	No

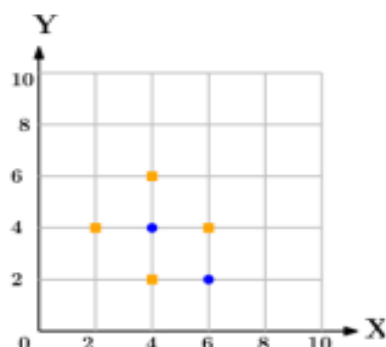
4. Implement **Naive Bayes Classification Algorithm** on any suitable dataset.

(Dataset Downloads Link):

https://drive.google.com/file/d/12BY34aCbYLoLjy3gDUMrZEBUf7l5FZsd/view?usp=share_link

5. Assignment on k-NN Classification:

In the following diagram let blue circles indicate positive examples and orange squares indicate negative examples. We want to use k-NN algorithm for classifying the points. If $k=3$, find the class of the point (6,6). Extend the same example for Distance-Weighted k-NN.



6. Assignment on K-Means Clustering:

We have given a collection of 8 points. $P1=[0.1,0.6]$ $P2=[0.15,0.71]$ $P3=[0.08,0.9]$ $P4=[0.16,0.85]$ $P5=[0.2,0.3]$ $P6=[0.25,0.5]$ $P7=[0.24,0.1]$ $P8=[0.3,0.2]$. Perform the k-mean clustering with initial centroids as $m1=P1 = \text{Cluster\#1}=C1$ and $m2=P8=\text{cluster\#2}=C2$.

Answer the following

- 1] Which cluster does P6 belongs to?
- 2] What is the population of cluster around $m2$?
- 3] What is updated value of $m1$ and $m2$?

7. Implement Gradient Boost Classifier Model on Income Evaluation Data set.

(Dataset Downloads Link) <https://drive.google.com/file/d/1zI-X3zdiuM9u74zQyKIShvAUtPJQ7jUK/view?usp=sharing>

Machine Learning Lab Books:

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing Limited,
a. ISBN10: 1785889621, ISBN-13: 978-1785889622
2. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited,
a. 2013.
3. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioners Approach”, O“REILLY,
a. SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.

Reference Books:

1. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3. Ethem Alpaydin, “ Introduction to Machine Learning”, PHI 2nd Edition-2013, ISBN 978-0262-01243-0
4. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, Cambridge University Press, Edition 2012, ISBN-10: 1107422221; ISBN-13: 9781107422223

- | |
|--|
| 5. Tom Mitchell “Machine Learning” McGraw Hill Publication, ISBN : 0070428077
9780070428072 |
| 6. Nikhil Buduma, “Fundamentals of Deep Learning”, O’REILLY publication, second edition
2017, ISBN: 149192561 |
| e-Resources: |
| 7. https://machinelearningbook.com/ |
| MOOC/ Video Lectures available at: |
| 6. https://onlinecourses.nptel.ac.in/noc22_cs97/preview |
| 7. https://nptel.ac.in/courses/106106139 |

CO408: Cyber Security Laboratory	
Teaching Scheme	Evaluation Scheme
Lectures: 2 Hrs. / Week	Oral Exam (OR): 50 Marks
Credits: 1	Total: 50 Marks

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Prerequisite Course: (if any) Computer Network, Discrete Mathematics

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Course Objectives:

1. To offer an understanding of principle concepts, central topics and basic approaches in information and cyber security.
2. To know the basics of cryptography.
3. To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.
4. To enhance awareness about Personally Identifiable Information (PII), Information Management, Cyber forensics.
5. To develop problem solving abilities using Cyber Security.
6. To apply algorithmic strategies for Cyber security.

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Gauge the security protections and limitations provided by today's technology.	2	Understand
CO2	Identify information security and Cyber security threats.	2	Understand
CO3	Apply cryptographic algorithms to provide security to real time applications.	3	Apply
CO4	Apply appropriate security solutions against cyber-attacks.	3	Apply
CO5	Apply security tools in various environments for network security.	3	Apply
CO6	Analyse various types of cybercrime by detecting the crime.	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	--	--	--	--	--	--	--	--	--	--	--	2	--	1
CO2	--	--	2	2	--	--	--	--	--	--	2	--	--	3	--
CO3	1	--	--	2	--	--	--	--	--	--	--	--	--	1	--
CO4	--	--	--	--	--	--	2	--	--	--	--	--	--	1	--
CO5	2	--	2	3	--	--	1	--	--	--	2	--	--	2	2
CO6	2	--	2	3	--	--	1	--	--	--	2	--	1	2	1

Tools for Cyber Security Laboratory

Operating System recommended - 64-bit Open source Linux or its derivative

Programming Languages: PYTHON/Java

Programming tools recommended Anaconda or Miniconda Frameworks.

Online Tools: -

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal may consists of prologue, Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). **Program codes with sample output of all performed assignments are to be submitted as softcopy.**

Guidelines for Assessment

Continuous assessment of Machine Learning laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness documentation.

List of Cyber Security Laboratory Assignments (Any Eight)

1. Implementation of port scanning operation using java/python/C.
2. Write a program for sniffing the packet and analyse it with Wireshark.
3. Implementation of Diff-Hellman key exchange algorithms.
4. Implementation of RSA Algorithms.
5. Write a program for acquisition of System Information/ RAM/Volume Shadow Copy/Detecting Encryption in information.
6. Write a program for forensic of Disc Image/ Registry/ Meta data/ RAM.
7. Write a program for Simplified DES implementation.
8. Write a program for Simplified AES implementation.
9. Study of different types of vulnerabilities for hacking a websites / Web Applications.
10. Analysis of the security vulnerabilities of E-Mail Applications

List of Mini Projects: (Any one)

1. Design a System to develop a analyser which will differentiate between different vulnerability and packets entered using it. This system will detect the intrusions coming through the vulnerabilities.
2. Securing Video Conferencing App for online meetings
3. Steganography for Image/Video/Files
4. Secure Image display on online social media.
5. Secure transfer of government subsidies to farmers/BPL people/ students etc
6. Authentication of users for various applications for integrity, availability, confidentiality.
7. Implementing a system for detecting the modification of videos/images on social media
8. Secure App for online exams detecting Keystroke and camera movements.
9. A system to detect the difference between the voice edited in the audio/video
10. A System to check the vulnerabilities in the websites.

CO409: Project Stage-I		
Teaching Scheme	Evaluation Scheme	
Practical: 06 Hrs. / Week	Term Work (TW): 100 Marks	
	Oral Presentation (OR): 50 Marks	
Credits: 03	Total: 150 Marks	

Course Objectives:

1. To Apply the knowledge for solving realistic problem
2. To develop problem solving ability
3. To Organize, sustain and report on a substantial piece of team work over a period of several months
4. To Evaluate alternative approaches, and justify the use of selected tools and methods, to Reflect upon the experience gained and lessons learned,
5. To Consider relevant social, ethical and legal issues,
6. To find information for yourself from appropriate sources such as manuals, books, research journals and from other sources, and in turn increase analytical skills.
7. To Work in TEAM and learn professionalism

Course Outcomes (COs):

On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Solve real life problems by applying knowledge.	3	Apply
CO2	Analyze alternative approaches, apply and use most appropriate one for a feasible solution.	3	Apply
CO3	Write precise reports and technical documents in a nutshell.	3	Apply
CO4	Participate effectively in multi-disciplinary and heterogeneous teams exhibiting teamwork, Interpersonal relationships, conflict management and leadership quality.	3	Apply

Guidelines : Project work Stage – I is an integral part of the Project work. In this,

- The student shall complete the partial work of the Project which will consist of problem statement, literature review, SRS, Model and Design.
- The student is expected to complete the project at least up to the design phase.
- As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation

on the advancement in Technology pertaining to the selected project topic.

- The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.
- The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.
- Follow guidelines and formats as mentioned in Project Workbook recommended by the Department Board of Studies.

MC410: Mandatory Learning Course VII- Financially Smart		
Teaching Scheme	Evaluation Scheme	
Theory: 01 Hrs. / Week	Total: PASS/FAIL	
Credits: NC		

This course focuses on the key concepts, tools, and techniques of contemporary personal finance. Financial problems are addressed in the context that they are the result of poor management rather than lack of money. Topics discussed to avoid financial problems include the importance of time value of money and saving, the correct use of credit, and credit cards, the establishment of financial goals, how to reduce the costs of automobile and life insurance, purchase of an automobile, and rent versus purchase of a house.

1. COURSE OBJECTIVE-

The course will enable the student do the following:

- A. Become aware of the importance of financial planning.
- B. Work toward setting life goals to achieve financial and personal success.
- C. Accomplish the following, in line with the purpose of this University:
 - 1. Contribute to the education of the whole person.
 - 2. Place their faith in Jesus Christ at the center of his or her life.
 - 3. Encourage the synthesis and integration of the common bond of knowledge provided by the university into a unified whole.
 - 4. Sharpen the communication, computation, and critical analysis skills of each student.
 - 5. Develop appreciation for differing cultures.
 - 6. Increase the student's recognition of God's order, diversity, and creativity and their consequences in the social and historical sciences.
 - 7. Demonstrate that knowledge and experience are related, not separated.
 - 8. Reveal God's purpose and glory as evident in this course of study.
 - 9. Develop basic skills, acquire basic knowledge, and formulate a world vision.
 - 10. Advocate the examination of this field of knowledge in the context of its influence upon and its being influenced by others.
- D. Prepare a student for an active role in the general area of business administration (in line with the purpose of the business administration program).
- E. Prepare the student in the following areas (in line with the departmental objectives):

1. Critical thinking skills in reasoning, objectivity, analysis, interpretation, research, or decision making relevant to the discipline.
2. Broad comprehensive foundational knowledge for the professional standards of the intended major.
3. Broad interpretation of the dynamics of business within the social and professional context.
4. Internalization of Christian business ethics and professionalism.

2. COURSE OBJECTIVES

After successfully completing this course, I should be able to:

A. Discuss the following areas of personal finance and financial planning.

1. The investment decision-making process
2. How to make a personal budget
3. The importance of the time value of money
4. The importance of deferring taxes
5. The effect of paying off a mortgage early (in 25 years, in 20 years, in even 15 years)
6. How to purchase a new automobile at a substantial savings
7. What an IRA is and the rules associated with an IRA

B. Differentiate between the following types of insurance and determine which best fits the student's needs.

1. Term life insurance
2. Whole life insurance
3. Automobile insurance

C. Explain how good money management affects one's marriage.

D. Answer the following questions about credit:

1. How do credit and debt differ?
2. How does credit affect you personally?
3. How can you get out of debt and stay out of it?

E. Explain how to reduce one's expenses without reducing one's standard of living.

F. Discuss various money and capital market instruments, such as stocks, bonds, mutual funds, and money market accounts.

SEMESTER VIII

CO411 E : Privacy and Security in Online Social Media

Teaching Scheme

Evaluation Scheme

Lectures: 12 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 3	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Basic / Intermediate programming course. Understanding of Python will be necessary for the course. Should be able to quickly learn APIs, and to collect data from social networks.

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Course Contents

Week No	Content
Week 1	What is Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs
Week 2	Collecting data from Online Social Media.
Week 3	Trust, credibility, and reputations in social systems.
Week 4	Trust, credibility, and reputations in social systems.
Week 5	Online social Media and Policing.
Week 6	Information privacy disclosure, revelation and its effects in OSM and online social networks
Week 7	Phishing in OSM & Identifying fraudulent entities in online social networks
Week 8	Refresher for all topics
Week 9 to 12	Research paper discussion
E-Resources:-	
https://onlinecourses.nptel.ac.in/noc24_cs04/preview	

CO411 F : Advanced Computer Networks

Teaching Scheme	Evaluation Scheme
Lectures: 12 Week	Continuous Internal Assessment (CIA): 25 Marks

Credits: 3	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Computer Networks and Computer Architecture Courses are Prerequisites

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Course Contents

Week No	Content
Week 1	High Performance Switching and Routing: Introduction, performance considerations, IP address lookup.
Week 2	Algorithms for IP address lookup and optimization, hardware implementation of address lookup.
Week 3	Packet Classification: Need for packet classification and methods for packet classification.
Week 4	Differentiated Service, Quality of Service, Traffic Polishing, Traffic Shaping.
Week 5	Network Softwarization – Introduction.
Week 6	Software Defined Networking (SDN) - Deep Dive (Northbound and Southbound interface) , Working with Mininet + Lab Exercises with Mininet
Week 7	Network Function Virtualization (NFV) - Architecture and Concepts
Week 8	Programmable Networks - Introduction to P4, SmartNICS and P4 switches. + Lab Exercise with Mininet and BMV2 switches.
Week 9	Data Center Networking (DCN) – Introduction
Week 10	DCN - Deep Dive (Network topologies, Container Network Interfaces)
Week 11	Content Distribution on the Internet, Architectures for Information Centric Networking
Week 12	Content Naming, Routing and Caching, Security in Named Data Networking.

Books:-

1. High Performance Switches and Routers, H. Jonathan Chao, Bin Liu, 2007, John Wiley & Sons, Inc. ISBN-10: 0-470-05367-4
2. Information-Centric Networks: A New Paradigm for the Internet (Focus Series in Networks and Telecommunications), Gabriel M. de Brito, Pedro B. Velloso, Igor M. Moraes, Wiley-ISTE; 1st edition, 2013, ISBN: 9781848214491
3. Information-Centric Networking (ICN): Content Centric Networking (CCNx) and Named Data Networking (NDN) Terminology, B. Wissingh, C. Wood, A. Afanasyev, L.

Zhang, D. Oran and C. Tschudin, RFC 8793, June 2020

4. Software-Defined Networks: A Systems Approach, Peterson, Cascone, O'Connor, Vachuska, and Davie, Online Free Reference Book available at <https://sdn.systemsapproach.org/index.html>

5. Cloud Networking: Understanding Cloud-based Data Centre Networks, Gary Lee (Author), Morgan Kaufmann (Publisher), 2014, ISBN-139780128007280

E-Resources:

https://onlinecourses.nptel.ac.in/noc24_cs11/preview

CO411 G : Getting Started with Competitive Programming

Teaching Scheme

Evaluation Scheme

Lectures: 12 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 3	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Data Structures and Algorithms, Familiarity with a programming language (ideally C++ or Python)

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Course Contents

Week No	Content
Week 1	Sorting and Searching Algorithms.
Week 2	Greedy Algorithms – I.
Week 3	Greedy Algorithms – II.
Week 4	Week 4: Disjoint Set Union with Path Compression.
Week 5	Minimum Spanning Tree.
Week 6	Shortest Paths: Dijkstra and Beyond.
Week 7	Network Flows – I.
Week 8	Network Flows - II, Divide and Conquer
Week 9	Dynamic programming – I.
Week 10	Dynamic programming – II.
Week 11	Dynamic programming – III.
Week 12	Dynamic programming – IV.
Books:-	
1.Algorithms by Jeff Erickson (freely available online) 2.Algorithms Illuminated by Tim Roughgarden 3.Algorithm Design by Jon Kleinberg and Éva Tardos 4.Introduction to Algorithms by Cormen, Leiserson, Rivest, Stein 5.Competitive Programming 4: The Lower Bound of Programming Contests in the 2020s by Steven Halim and Felix Halim 6.Guide to Competitive Programming: Learning and Improving Algorithms Through Contests Antti Laaksonen	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_cs29/preview	

CO411 H : Business Intelligence & Analytics

Teaching Scheme

Evaluation Scheme

Lectures: 12 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 3	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) A core course on Business statistics desirable

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Course Contents

Week No	Content
Week 1	<p>Introduction to Business Intelligence & Analytics (BIA), drivers of BIA, types of analytics: descriptive to prescriptive, vocabulary of business analytics, course plan and resources.</p> <p>Books to refer : Text 1: Han et al. (2023) Chapter 1, Introduction</p>
Week 2	<p>Technical architecture of BIA, case analysis of AT&T Long distance, fundamentals of data management, OnLine Transaction Processing (OLTP), design process of databases</p> <p>Books to refer : Text 1: Han et al. (2023) Chapter 4, Data Warehouse and Online Analytical Processing (pp. 85-108).</p>
Week 3	<p>Relational databases, normalisation, SQL queries, ShopSense case of management questions, data warehousing, OnLine Analytical Processing (OLAP), data cube</p> <p>Books to refer : Tutorial: SQL tutorial on MySQL (https://www.mysqltutorial.org)</p>
Week 4	<p>Descriptive analytics, and visualization, customer analytics, survival analysis, customer lifetime value, case study</p> <p>Books to refer :</p> <p>a. Knowing When to Worry: Using Survival Analysis to Understand Customers: https://learning.oreilly.com/library/view/data-mining-techniques/9780470650936/9780470650936c10.xhtml#c10_level1_1</p> <p>b. Customer Lifetime Value (CLV): A Critical Metric for Building Strong Customer Relationships, https://www.gartner.com/en/digital-markets/insights/what-is-customer-lifetime-value</p>
Week 5	<p>Data mining process, introduction to statistical learning, data pre-processing, data quality, overview of data mining techniques, case study using regression analysis</p>

	<p>Books to refer :</p> <p>a. Text 2: James et al. (2013) Chapter 1, Statistical learning, ISL</p> <p>b. Text 2: James et al. (2013) Chapter 2, Linear regression, ISL</p>
Week 6	<p>Introduction to classification, classification techniques, scoring models, classifier performance, ROC and PR curves</p> <p>Books to refer : Text 1: Han et al. (2023) Chapter 6, Classification: Basic concepts and methods</p>
Week 7	<p>Introduction to decision trees, tree induction, measures of purity, tree algorithms, pruning, ensemble methods</p> <p>Books to refer : Text 2: James et al. (2013) Chapter 8, Tree- based models</p>
Week 8	<p>Tree implementation in Python: problem of targeted mailing</p> <p>Books to refer :</p> <p>a. https://scikit-learn.org/stable/modules/model_evaluation.html#roc-metrics</p> <p>b. https://scikit-learn.org/stable/visualizations.html</p>
Week 9	<p>Cluster analysis, measures of distance, clustering algorithms, K-means and other techniques, cluster quality</p> <p>Books to refer : Text 2: James et al. (2013) Chapter 10, Unsupervised learning (pp. 385-400)</p>
Week 10	<p>A store segmentation case study using clustering, implementation in Python, profiling clusters, cluster interpretation and actionable insights, RFM sub-segmentation for customer loyalty</p> <p>Books to refer : What Is Recency, Frequency, Monetary Value (RFM) in Marketing?: https://www.investopedia.com/terms/r/rfm-recency-frequency-monetary-value.asp</p>
Week 11	<p>Machine learning, Artificial Neural Networks (ANN), topology and training algorithms, back propagation, financial time series modelling using ANN,</p>

	<p>implementation in Python</p> <p>Books to refer : Kaastra & Boyd (1996) Designing a neural network for forecasting financial and economic time series, JNC: https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=bcbb8ca9d6a6ce6017710ebf6143da76b6edf98b</p>
Week 12	<p>Text mining, process, key concepts, sentiment scoring, text mining using R-the case of a movie discussion forum, summary</p> <p>Books to refer : Silge and Robinson, Text Mining with R, A Tidy Approach: O'reilly: www.tidyttextmining.com/index.html</p>
Books:-	
<ol style="list-style-type: none"> 1. Text 1: Han, J., Pei, J. & Tong H. (2023). Data Mining Concepts and Techniques, 4th ed, New Delhi: Elsevier. 2. Text 2 : James, G., Witten, D., Hastie, T. and Tibshirani,R. (2013) An Introduction to Statistical Learning with Applications in R, Springer: NY 	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_cs65/preview	

CO412 D : Affective Computing

Teaching Scheme

Evaluation Scheme

Lectures: 12 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 3	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) 1.Programming, 2.Artificial Intelligence, 3.Machine Learning
Desirable Prerequisites: 4.Human-Computer Interaction, 5.Deep Learning

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Course Contents

Week No	Content
Week 1	Fundamentals of Affective Computing.
Week 2	Emotion Theory and Emotional Design
Week 3	Experimental Design: Affect Elicitation; Research and Development Tools
Week 4	Emotions in Facial Expressions
Week 5	Emotions in Voice
Week 6	Emotions in Text
Week 7	Emotions in Physiological Signals
Week 8	Multimodal Emotion Recognition
Week 9	Emotional Empathy in Agents/Machines/Robots
Week 10	Online and Adaptive Recognition of Emotions: Challenges and Opportunities
Week 11	Case Study: Updated from Time to Time
Week 12	Ethical Issues: Ethical, legal and Social Implications of Affective Computing
Books:-	
1. Affective Computing. MIT Press 2. The Oxford Handbook of Affective Computing. Oxford University Press 3. The Encyclopedia of Human-Computer Interaction, 2nd Ed. 4. Interaction Design: Beyond Human-Computer Interaction. 2019. (5th Edition) by Jenny Preece, Helen Sharp, Yvonne Rogers (Wiley)	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_cs12/preview	

CO412 E : Blockchain and its Applications

Teaching Scheme	Evaluation Scheme
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Lectures: 12 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 3	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Computer Networks; Operating Systems; Cryptography and Network Security.

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Course Contents

Week No	Content
Week 1	Introduction to Blockchain Technology and its Importance
Week 2	Basic Crypto Primitives I – Cryptographic Hash
Week 3	Basic Crypto Primitives II – Digital Signature
Week 4	Evolution of the Blockchain Technology
Week 5	Elements of a Blockchain
Week 6	Blockchain Consensus I – Permissionless Models
Week 7	Blockchain Consensus II – Permissioned Models
Week 8	Smart Contract Hands On I – Ethereum Smart Contracts (Permissionless Model)
Week 9	Smart Contract Hand On II – Hyperledger Fabric (Permissioned Model)
Week 10	Decentralized Identity Management
Week 11	Blockchain Interoperability
Week 12	Blockchain Applications

Books:-

1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020, ISBN: 9781839213199, book website: <https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199>
2. Hyperledger Tutorials - <https://www.hyperledger.org/use/tutorials>
3. Ethereum Development Resources - <https://ethereum.org/en/developers>
4. Online materials and case studies

E-Resources:

https://onlinecourses.nptel.ac.in/noc24_cs15/preview

CO412 F : Introduction to Industry 4.0 and Industrial IOT

Teaching Scheme	Evaluation Scheme
Lectures: 12 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 3	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Basic knowledge of computer and internet

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Course Contents

Week No	Content
Week 1	Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II.
Week 2	Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.
Week 3	Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis.
Week 4	Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.
Week 5	IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.
Week 6	Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.
Week 7	Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.
Week 8	Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.
Week 9	Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.
Week 10	Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11	Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.
Week 12	Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies : Case study - I : Milk Processing and Packaging Industries Case study - II: Manufacturing Industries - Part I Case study - III : Manufacturing Industries - Part II Case study - IV : Student Projects - Part I Case study - V : Student Projects - Part II Case study - VI : Virtual Reality Lab Case study - VII : Steel Technology Lab.
Books:-	
1. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. Availability: https://www.amazon.in/Introduction-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1 2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. Availability: https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3 3. Research Papers.	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_cs34/preview	

CO412 G : Object Oriented System Development Using UML, Java And Patterns

Teaching Scheme	Evaluation Scheme
Lectures: 12 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 3	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Programming Using Java, Software Engineering.

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Course Contents

Week No	Content
Week 1	Introduction.
Week 2	Life Cycle Models for OO Development.
Week 3	Use Case Diagram.
Week 4	Class Diagram I.
Week 5	Class Diagram II.
Week 6	Sequence Diagram.
Week 7	State chart diagram.
Week 8	Design process.
Week 9	Introduction to design patterns.
Week 10	GRASP patterns.
Week 11	GoF pattern I.
Week 12	GoF Pattern II
Books:-	
1. Robert Martin, UML for Java Programmers, Pearson, Ali Bahrami, Object-oriented System Development, TMH, 1999	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_cs40/preview	

CO413 D : Project Management

Teaching Scheme	Evaluation Scheme
Lectures: 8 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 2	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any)

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Course Contents

Week No	Content
Week 1	Part-I Project Initiation Lecture 1 - Introduction to project management - I Lecture 2 - Introduction to project management -II Lecture 3 - Agile project management Lecture 4 - Project strategy and selection overview Lecture 5 - Project selection models.
Week 2	Part-I Project Initiation Lecture 6 - Project manager Lecture 7 - Attributes of Effective Project Manager Lecture 8 - Managing for stakeholders Lecture 9 - Resolving Conflicts Lecture 10 - Negotiation
Week 3	Part-I Project Initiation Lecture 11 - Project in the organization structure Lecture 12- Human factors and the project team Part-II Project Planning Lecture 13 - Traditional project activity planning Lecture 14 - Agile project planning, Project charter Lecture 15 - Coordination through integration management.
Week 4	Part-II Project Planning Lecture 16 - Project feasibility analysis, Lecture 17 - Estimating project budgets Lecture 18 - Project risk management

	Lecture 19 - Quantitative risk assessment methodologies Lecture 20 - Critical path method (CPM).
Week 5	Part-II Project Planning Lecture 21 - Programme evaluation and review technique (PERT) Lecture 22 - Risk analysis with simulation for scheduling Lecture 23 - Gantt Chart, Scheduling with scrum Lecture 24 - Crashing a project Lecture 25 - Resource loading.
Week 6	Part-II Project Planning Lecture 26 - Resource levelling, Case study on Statue of Unity Lecture 27 - Goldratt's critical chain Part-III Project Execution Lecture 28 - Planning-monitoring-controlling cycle Lecture 29 - Earned value analysis Lecture 30 - Agile tools for tracking project.
Week 7	Part-III Project Execution Lecture 31 - Three types of project-controlling Lecture 32 - Control of change scope and scope creep Lecture 33 - Project audit, Lecture 34 - Essentials of an audit/evaluation Lecture 35 - When to close a project.
Week 8	Part-III Project Execution Lecture 36 - Benefits realisation, Case study on the success of Chandrayan-3 Part-IV IT for Project Management Lecture 37 - Software for project management Lecture 38 - Demo on project management software Lecture 39 - Simulations software for project management Lecture 40 - Course Summary.
Books:-	
1. Project Management (A Strategic Managerial Approach) by Meredith	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_mg01/preview	

CO413 E : Ethics In Engineering Practice

Teaching Scheme	Evaluation Scheme
Lectures: 8 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 2	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Basic understanding of business management.

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Course Contents

Week No	Content
Week 1	Introduction to Ethical Reasoning and Engineer Ethics.
Week 2	Professional Practice in Engineering.
Week 3	Ethics as Design - Doing Justice to Moral Problems.
Week 4	Central Professional Responsibilities of Engineers.
Week 5	Computers, Software, and Digital Information.
Week 6	Rights and Responsibilities Regarding Intellectual Property.
Week 7	Workplace Rights and Responsibilities.
Week 8	Responsibility for the Environment.
Books:-	
1.Ethics in Engineering practice and Research (2nd Edition) by Caroline Whitbeck Cambridge 2.Ethics in Engineering MW Martin and R Schinzinger MC Graw Hill 3.Engineering Ethics and Environment P a Vesilind and AS Gunn Cambridge	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_mg17/preview	

CO413 F : Supply Chain Analytics

Teaching Scheme	Evaluation Scheme
Lectures: 8 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 2	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Basic knowledge of Operations management will be desirable.

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Course Contents

Week No	Content
Week 1	Context of today's supply chains (SC) analytics Understanding and defining the supply chain analytics (SCA) Revisions of Basic Lessons of Supply Chain Management Why is Analytics Important in a supply chain? Relating Operations Management with Supply chain concepts with SC Analytics The importance of supply chain analytics in the flows involving material, money, information and ownership.
Week 2	Supply chain analytics Key issues in supply chain analytics What involves in supply chain analytics Concept of Descriptive Analytics in a Supply Chain Discussion on a Few Supply Chains Analytics applications in India (students participation is expected) Decision Domains in in supply chain analytics.
Week 3	Foundation of Business Analytics (BA) E2: Introduction to Modelling, Approaches for Optimization and Simulation, Modelling software, Supply Chain (SC) Decisions that requires mathematical or interpretative modelling Understanding of Data and its role in Analytics Analytics of a Transportation problem in a Supply Chain Managerial implication of results of analytics.
Week 4	A CASE STUDY OF SUPPLY CHAIN ANALYTICS.
Week 5	Foundation of PRESCRIPTIVE ANALYTICS IN NETWORK PLANNING IN A SUPPLY CHAIN

	<p>Network Planning in a Supply Chain</p> <p>Importance of Network Planning</p> <p>Design of Logistics Network using Heuristics/optimization (Exercise 3.4 Levi (2008))</p> <p>Concept of 3PL/4PL in a Supply Chain</p> <p>Case Study: GATI.</p>
Week 6	Foundation of Modeling Coordination Decisions in SUPPLY CHAIN MANAGEMENT.
Week 7	Foundation of PERFORMACE MANAGEMENT IN SUPPLY CHAIN MANAGEMENT.
Week 8	<p>IT ENABLEMENT OF SUPPLY CHAINS</p> <p>Role of ICT in Supply chains.</p>
Books:-	
<ol style="list-style-type: none"> 1. Supply chain management by Sunil Chopra, and Peter Meindl, Pearson 2. Jeremy F. Shapiro. Modeling the Supply Chain. Duxbury Thomson Learning 3. D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi, and Ravi Shankar, Designing and Managing the Supply Chain concepts, Strategies and Case studies, Third Edition, Tata McGraw Hill, New Delhi, 2008. 4. Rahul Saxena • Anand Srinivasan, Business Analytics 	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_mg58/preview	

CO413 G : Business Forecasting

Teaching Scheme	Evaluation Scheme
Lectures: 8 Week	Continuous Internal Assessment (CIA): 25 Marks
Credits: 2	End-Sem Exam (ESE): 75 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Basic Probability and Statistics.

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Course Contents

Week No	Content
Week 1	Lecture 1: Introduction to Business forecasting Lecture 2: Data Driven Decision Making and Essentials of Predictive Analytics Lecture 3: Types of Forecasting: Qualitative Approaches and Quantitative Approaches.
Week 2	Lecture 4: Components of a Time Series and Measures of Forecast Accuracy Lecture 5: Moving Average Methods: Simple, Weighted, and Exponential Moving Average.
Week 3	Lecture 6: Exponential Smoothing Lecture 7: Trend Projections and Holt Model.
Week 4	Lecture 8: Regression Analysis Lecture 9: Measure of Goodness and Standard Error.
Week 5	Lecture 10: Seasonality, Seasonal Index, and Quarterly Average Method Lecture 11: Seasonality and Trend: Holt Winter Method Lecture 12: Decomposition Method.
Week 6	Lecture 13: ACF and PACF Lecture 14: ARIMA.
Week 7	Lecture 15: Introduction to Machine Learning Lecture 16: Logistic Regression Lecture 17: Human Judgement in Time Series Analysis.
Week 8	Lecture 18: Monte Carlo Simulation and Risk Analytics Lecture 19: Predictive Analytics using @Risk software/Python.
Books:-	
1. Business Forecasting: John E Hanke and Dean Wichern, Pearson, 9th Edition	

2. Business Analytics, (PART 4: Regressions Analysis and Time Series Forecasting), Albright and Winston, Cengage Learning, 5th Edition, 2015
3. Essentials of Business Analytics- Descriptive, Predictive and Prescriptive Analytics, (Chapter 1,4,5,6 and 11), Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, Cengage Learning, 2nd Edition, 2016
4. Forecasting Methods and Applications, Makridakis et al., 3rd Edition, 2017, Willey.
5. An introduction to Management Science, Chapter 15, Anderson and Williams, Cengage Learning, 13th Edition, 2015
6. Quantitative Analysis for Management, Render and Stair, Chapter 5, Pearson, 10th Edition.

E-Resources:

https://onlinecourses.nptel.ac.in/noc24_mg66/preview

O414 : Professional Internship

Teaching Scheme	Evaluation Scheme
Lectures: -12 Hrs./Week	Term Work (TW):100 Marks
Tutorials: - Hrs./ week	Oral Exam (OR): 50 Marks
Credits: 6	Total : 50 Marks

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Prerequisite Course: (if any) -

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Course Objectives:

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the working environment of industry organizations.

Course Outcomes (COs):

On completion of the course, student will be able to—

CO No.	Title	Bloom's Taxonomy	
		Level	Descriptor
CO1	To demonstrate professional competence through industry internship.	3	Demonstrate
CO2	To apply knowledge gained through internships to complete academic activities in a professional manner.	3	Apply
CO3	To choose appropriate technology and tools to solve given problem.	3	Solve
CO4	To demonstrate abilities of a responsible professional and use ethical practices in day today life.	3	Demonstrate
CO5	Creating network and social circle, and developing relationships with industry people.	6	Create
CO6	To analyze various career opportunities and decide carrier goals.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	2	2	2	2	3	1	1	1	1	2	1	1	2	1	1
CO2	1	2	2	2	3	2	1	1	1	2	2	1	2	1	1
CO3	-	-	-	-	-	1	-	-	2	2	1	1	-	2	-
CO4	2	-	-	-	-	2	2	3	-	1	-	2	2	-	1
CO5	-	-	-	-	-	1	2	1	1	1	2	1	1	-	2
CO6	-	-	-	-	-	1	-	-	2	1	-	1	1	-	2

Guidelines:

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

Duration:

Internship is to be completed after semester 6 and before commencement of semester 7 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 7.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry[1].

Students must register at Internshala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the VI th semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their VIth semester examination and before academic schedule of semester VII.

Student can take internship work in the form of the following but not limited to:

1. Working for consultancy/ research project,
2. Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /

3. Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
4. Development of new product/ Business Plan/ registration of start-up,
5. Industry / Government Organization Internship,
6. Internship through Internshala,
7. In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
8. Research internship under professors, IISc, IIT's, Research organizations,
9. NGOs or Social Internships, rural internship,
10. Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship).

Evaluation through Seminar Presentation/Viva-Voce at the Department-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

1. Depth of knowledge and skills
2. Communication & Presentation Skills
3. Team Work
4. Creativity
5. Planning & Organizational skills
6. Adaptability
7. Analytical Skills
8. Attitude & Behavior at work
6. Societal Understanding

7. Ethics
8. Regularity and punctuality
9. Attendance record
10. Diary/Work book
11. Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

1. Proper and timely documented entries
2. Adequacy & quality of information recorded
3. Data recorded
4. Thought process and recording techniques used
5. Organization of the information

The report shall be presented covering following recommended fields but limited to,

1. Title/Cover Page
2. Internship completion certificate
3. Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
4. Index/Table of Contents
5. Introduction
6. Title/Problem statement/objectives
7. Motivation/Scope and rationale of the study
8. Methodological details
9. Results / Analysis /inferences and conclusion
10. Suggestions / Recommendations for improvement to industry, if any
11. Attendance Record
12. Acknowledgement
13. List of reference (Library books, magazines and other sources)

Feedback from internship supervisor (External and Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership.....

Reference:

- <https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf>
- <https://internship.aicte-india.org/>

CO415: PROJECT STAGE-II	
Teaching Scheme	Evaluation Scheme
Practical: 04 Hrs. / Week	Oral Presentation (OR): 50 Marks
Credit: 2	Total: 150 Marks

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Prerequisite Course: —Project Stage-I

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Course Objectives:

1. To follow SDLC meticulously and meet the objectives of proposed work
2. To test rigorously before deployment of system
3. To validate the work undertaken
4. To consolidate the work as furnished report

Course Outcomes (COs): On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Show evidence of independent investigation critically analyse the results and their interpretation.	3	Apply
CO2	Report and present the original results in an orderly way and placing the open questions in the right perspective.	3	Apply
CO3	Link techniques and results from literature as well as actual research and future research lines with the research.	3	Apply
CO4	Appreciate practical implications and constraints of the specialist subject	3	Apply

Guidelines:

In Project Work Stage–II, the student shall complete the remaining project work which consists of

- Selection of Technology and Tools,
- Installations,
- UML implementations, testing,
- Results,
- Performance discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems,
- Comparative analysis and validation of results and conclusions.

- The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is duly certified by the concerned guide and head of the Department/Institute.
- Follow guidelines and formats as mentioned by the Department Board of Studies.
- Students must submit and preferably publish at least one technical paper in the conferences.
- Students must participate in at least one project competition.
- Final term work submissions in the prescribed format given by the guides consisting of a project report consisting of a preliminary report prepared in term-I, detailed design (all necessary UML diagrams) document, User Interface design, Laboratory assignments on test cases and test results generated by selected project testing tool, conclusions, appendix (if necessary), glossary, tools used and references at the end of Term-II after checking, removing/ avoiding the plagiarism.

Term-II Project Laboratory Assignments:

1. Review of design and necessary corrective actions taking into consideration the feedback report of Term I assessment, and other competitions/conferences
2. Project workstation selection, installations along with setup and installation report preparations.
3. Programming of the project functions, interfaces and GUI (if any) as per 1st Term termwork submission using corrective actions recommended in Term-I assessment of Term-work.
4. Test tool selection and testing of various test cases for the project performed and generate various testing result charts, graphs etc. including reliability testing.

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