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 (Rev) Pattern

Curriculum

(Second Year B. Tech. Sem-III & IV with effect from Academic Year 2023-2024)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon 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 Second Year Computer Engineering Program Curriculum Structure and Syllabus for semester III & IV of Pattern 2021 (Rev) 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, Kopargaon

(An Autonomous Institute)

Department of Computer Engineering

COURSE STRUCTURE- 2021 (Rev)PATTERN

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

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					
							Theory		Practical			Grand Total
			L (hrs)	T (hrs)	P (hrs)		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**

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute)

Department of Computer Engineering

COURSE STRUCTURE- 2021 (Rev) PATTERN

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

SEMESTER-IV

Cat.	Code	Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks					
							Theory		Practical			Grand Total
			L (hrs)	T (hrs)	P (hrs)		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**

SEMESTER III

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

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Prerequisite: Basic Mathematics

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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, Divsion Greatest common divisior, Euclidean Algorithm, Least common Multiple, Congruence Relation, Properties of congruence relation, Congruence Arithematics, 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

– 8 R3. Dr. K. D. Joshi, "Foundations of Discrete Mathematics", New Age International Limited, Publishers, January 1996, ISBN: 8122408265, 9788122408263. R4. Seymour Lipsehutz 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

Home

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**

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Prerequisite Course: Fundamental concept of C Language

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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	PO 9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	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
	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. 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. 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.	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. BjarneStroustrup, "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++", 4th Edition, Tata McGraw-Hill,ISBN-13:978-0-07-066907-9

Reference Books(R):

R1. Robert Lafore, ―Object-Oriented Programming in C++‖, fourth edition, Sams Publishing, ISBN:0672323087 (ISBN 13: 9780672323089)
R2. Herbert Schildt, ―C++ The complete reference‖, Eighth Edition, McGraw Hill Professional, 2011,ISBN:978-00-72226805
R3. Cox Brad, Andrew J. Novobilski, ―Object –Oriented Programming: An Evolutionary Approach‖, 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

Home

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**

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Prerequisite Course: Basics of Electronic Engineering

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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
	Logic gates: NOT , AND , OR , NAND , NOR, EX-OR, EX-NOR **Boolean Function Representation:** Sum of Product (SOP) and Product of Sum (POS) form of Boolean expression, Standard SOP and POS form. **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. **Codes:** Binary code, BCD code, Excess-3 code, Gray code, Alphanumeric code, Error Detecting and Correcting code	8	1
Unit II	**COMBINATIONAL LOGIC DESIGN**	**No. of Hours**	**COs**
	Introduction, **Adder**: Half and Full Adder, **Subtractor:** Half subtractor, Full Subtractor, Parallel Adder, Look ahead carry adder, BCD Adder, 4-bit Subtractor, Code Converters. **Multiplexer:** Design examples using Multiplexer IC 74151, Multiplexer Tree. **Demultiplexer:** Design examples using Demultiplexer, Demultiplexer Tree. **Comparator**: One and Two bit Comparator, IC 7485. Encoder, Priority Encoder, Decoder, **Case Study (Any one):** IC 74181 (ALU), BCD to 7-Segment display controller, Calender Subsystem	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", 4th ed. Tata McGraw-Hill Education, ISBN–13: 978-0-07-066911-6.

T2.Forouzan B. A., "Data Communications and Networking",5th 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", 8th ed. Prentice Hall,ISBN-978-0-13-700510-9 R2. Leach D.P., Malvino A.P., Saha G., "Digital Principles and Applications", 8th 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

Home

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**

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Prerequisite Course: Digital Electronics, Computer Fundamentals and Programming.

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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 RICS 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", 2nd Edition, Pearson, ISBN-10: 8131708403.
R4. Patterson and Hennessy, "Computer Organization and Design", 4th Edition, Morgan Kaufmann Publishers, ISBN 978-0-12-374750-1.
R5. C. William Gear, "Computer Organization And Programming: With An Emphasis", 4th 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

Home

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

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Prerequisite Course: Fundamental concept of C Language

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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	PO10	PO11	PO12	PSO1	PSO2	PSO3
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.

Home

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

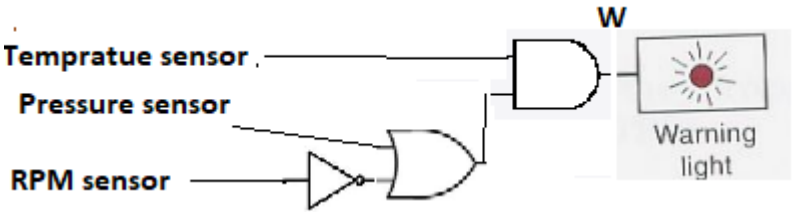
P sensor output = 0 only when pressure <220 psi

T sensor output = 0 only when temperature $<200^0$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 x1x0 and y1y0 as a input and produces binary output z3z2z1z0 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.

Home

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

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: HRML/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 Powel 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,ISBM 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**
	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. **JDBC** 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	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
	Governor: Appointment of governor, powers and functions of governor, constitutional position **Chief minister:** Appointment of CM, powers and functions of CM, relationship with governor **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	1	6
Text Books:			
1. M Laxmikanth, Indian Polity for Civil Service Examination, Mc GrawHill Education, 5th Edition. **2.** Durga Das Basu, LexisNexis, Introduction to the Constitution of India, 22nd Edition			

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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**

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Prerequisite Course:

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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 ∅, 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

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

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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

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Prerequisite:

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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	PO 10	PO11	PO 12	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 scriptingPythonScripting, 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. Abraham Silberschatz , Peter B.Galvin, Greg Gagne, 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 Dhamdhere, 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

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Prerequisite: Fundamentals of Data Structure, Computer Fundamentals and Programming

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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	PO 10	PO 11	PO 12	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- Prims and Kruskal Algorithm, Dijktra'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. SartajSahani,Data Structures, Algorithms and Applications in C++, 2nd edition, Universities Press,ISBN-81-7371-522			
Reference Books(R):			
R1. A. Aho, J. Hopcroft, J. Ulman, Data Structures and Algorithms,2nd 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			

Home

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

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Prerequisite Course: Computer Fundamentals and Programming

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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**
	Software Engineering Fundamentals: Introduction to software engineering, The Nature of Software, Defining Software, Software Engineering Practice. 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.	6	1
Unit II	**S/W REQUIREMENTS ENGINEERING & ANALYSIS**	**No. of Hours**	**COs**
	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.	6	2

Unit III	ESTIMATION AND SCHEDULING	No. of Hours	COs
	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. Project Scheduling: Project Scheduling, Defining a Task for the Software Project, Scheduling.	6	3
Unit IV	**DESIGN ENGINEERING**	**No. of Hours**	**COs**
	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, Architectural Design: Software Architecture, What is Architecture, Why is Architecture Important, Architectural Styles, A brief Taxonomy of Architectural Styles.	6	4
Unit V	**RISKS AND CONFIGURATION MANAGEMENT**	**No. of Hours**	**COs**
	Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan. Software Configuration Management: Software Configuration Management, The SCM Repository The SCM Process, Configuration Management for any suitable software system	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 Engineerin", 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			

Home

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)

1. Write a program to perform following operations on Singly Linked List for Employee data with fields: Emp_id, Name, Designation, Mobile_No and Salary

a) Create SLL for N employees.

b) Perform insertion at front, middle and end of SLL

c) Perform deletion at front, middle and end of SLL

d) Display status of SLL and count no of employees present in SLL

2 .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.

3. Write a program for storing binary number using doubly linked lists. Write functions to:

a) Compute 1s and 2s complement

b) Add two binary numbers

Group B:(At least 2)

4. 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 , ... , 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 = k1 <k2< ... <kn of n sorted keys, with a search probability pi for each key ki. 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

Home

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	PO10	PO11	PO12	PSO1	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 un-mount 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

Home

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	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:- Schema: 1. Borrower(Rollin, Name, DateofIssue, NameofBook, Status) 2. Fine(Roll_no,Date,Amt) ● 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. **Frame the problem statement for writing PL/SQL block inline with above statement.**
4	Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) 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.

	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	PL/SQL Stored Procedure and Stored Function. 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 and900 category is first class, if marks 899 and 825 category is Higher Second Class Write a PL/SQL block for using procedure created with above requirement. Stud_Marks(name, total_marks) Result(Roll,Name, Class) **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.**
6	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. **Frame the problem statement for writing Database Triggers of all types, in-line with above statement. The problem statement should clearly state the requirements.**
Group B Large Scale Databases	
7	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution).
8	Implement aggregation and indexing with suitable example using MongoDB. Use Zipcode Dataset (download from url https://media.mongodb.org/zips.json) and import in mongoDB and perform following operations a. Return States with Populations above 10 Million. b. Return Average City Population by State c. Return Largest and Smallest Cities by State d. Return States with Population e. Create single field index f. Create a compound index
9	Implement Map reduce operation with suitable example using MongoDB. 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.
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	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: **Requirement Gathering and Scope finalization**

	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, "MangoDB: The Definitive Guide", O'Reilly Publications
3. http://www.tutorialspoint.com/json/ & http://docs.mongodb.org/manual/

Home

HS216: CORPORATE READINESS	
Teaching Scheme	**Examination Scheme**
Lectures: 2Hrs. / Week	**Term Work: 50 Marks**
Credits: 2	**Total: 50 Marks**

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

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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	C05
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

Home

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

Home

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

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

TY B. Tech. Computer Engineering

2021(Rev) Pattern

Curriculum

(T Y B. Tech. Sem-V & VI with effect from Academic Year 2024-2025)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon 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 Third Year Computer Engineering Program Curriculum Structure and Syllabus for semester V & VI of Pattern 2021 (Rev) 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

Dr. A.B. Pawar

Dean Academics

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON Approved

Director
Sanjivani College of Engineering
Kopargaon

Director

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute)

Department of Computer Engineering

COURSE STRUCTURE- 2021 (Rev) PATTERN

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

SEMESTER V

Cat.	Code	Design and Analysis of Algorithms	Teaching Scheme				Evaluation Scheme					
							Theory		Practical			
			L (hrs)	T (hrs)	P (hrs)	Credits	CIA	ESE	TW	OR	PR	Grand Total
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 (Rev) PATTERN

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

SEMESTER VI

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme					
							Theory		Practical			
			L (hrs)	T (hrs)	P (hrs)	Credits	CIA	ESE	TW	OR	PR	Grand Total
PCC	CO312	Internet of Things	4	-	-	4	40	60	-	-	-	100
PCC	CO313	System Software	4	-	-	4	40	60	-	-	-	100
PCC	CO314	Data Mining and Warehousing	3	1	-	4	40	60	-	-	-	100
PCC	CO315	Professional Elective - II	4			4	40	60				100
PROJ	PR316	IPR and EDP	2	-	-	2	20	30	-	-		50
LC	CO317	Internet of Things Laboratory	-	-	2	1	-	-	-	50	-	50
LC	CO318	System Software Laboratory	-	-	2	1	-	-	25	-	50	75
LC	CO319	Data Mining and Warehousing Laboratory	-	-	2	1			25	-	50	75
PROJ	CO320	Creational Activity Lab			2	1			50			50
MLC	MC321	Mandatory Learning Course-VI	1	-	-	NC	-	-	-	-	-	**Pass/ Fail**
Total			18	1	08	22	180	270	100	50	100	**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**

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

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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**
	Problem Solving: Definition of Problem, Problem solving principles, Classification & Strategies to solve problems, **Algorithm:** Definition, Asymptotic Notations, Time Complexities, Best, Worst & Average Case Analysis. **Types of algorithms:** Randomized, Approximate & Exact. **Case study**: Brute Force Method. **Application:** Medical Domain Problem (MRI Scanner) and Algorithm for the MRI Scanner.	6	CO1
Unit II	**Divide-&-Conquer and Greedy Strategy**	**No. of Hours**	**Cos**
	Divide and Conquer Strategy: Principle, Control Abstraction, Time complexity Analysis, Binary search algorithm. **Case study**: Merge Sort. **Application**: Google's Binary Search to Identify Malware. **Greedy Strategy:** Principle, Control Abstraction, Time Complexity Analysis, Knapsack Problem, **Case study**: Scheduling Algorithms-Job Scheduling. **Application**: Finding the Shortest Path on Google Map	6	CO2
Unit III	**Dynamic Programming**	**No. of Hours**	**Cos**
	Dynamic Programming: Principle, Control Abstraction, Time Complexity Analysis, Binomial Coefficients, 0/1 Knapsack, **Case study**: Optimal Binary Search Tree (OBST) **Application** of DP: Path Finder GPS Application-Uber.	6	CO3
Unit IV	**Backtracking and Branch & Bound**	**No. of Hours**	**Cos**
	Backtracking: Principle, Control Abstraction, Time Complexity Analysis, 8-Queen Problem. **Case Study**: Sum of Subsets Problem.	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, Louden, " Mastering Algorithms", O" Reily Media Inc			
Reference Books(R):			
R1. Fayez Gebali, "Algorithms and Parallel Computing", Willy Publication. R2. Thomas H. Coreman 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

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

Books:

Textbooks:

1. Andrew S. Tenenbaum, “Computer Networks”, PHI, ISBN 81-203-2175-8.
2. Fourauzan B., "Data Communications and Networking", 5th 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.

E-Resources:

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**:IntroductionBootstrap ,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 Biding, Working with Directives, Conditional Directives, Styles Directives, Mouse and Keyboard Events	7	CO3 CO4

	DirectivesControllers, Filters, Forms, Modules, Ajax in AngularJS, Routing, Introduction to SPA, Creating HTML Templates, Configuring Route Provider.		
Unit IV	**ReactJs**	**No. of Hours**	**Cos**
	What is React Js, Advantages of React Js, Limitation of React Js, Installation. Overview of JSX, Rendering an Element into the DOM, Naming Conventions. Overview of Components, Props, State.Life Cycle of component and reusing of Component.Props Validation, API Calls Using WebApi. Overview of Flux,,Flux Elements, Limitations of Flux, Advantages of Flux	8	CO3 CO4
Unit V	**Server side Technologies**	**No. of Hours**	**Cos**
	Servlet: Introduction, life cycle of servlet, servlet directory structure, servlet example, form handling, cookies and session tracking. **JSP :** life cycle, JSP tags, built in objects, Directives, File uploading and page redirecting. Database connectivity using servlet and JSP	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):			

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. AllanCole," 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-javacript

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**

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Prerequisite Course: Discrete Mathematics, Data Structures

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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**
	Introduction to Formal language, Alphabets, Strings and languages, Finite representation of language, **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 **FA with output:** Moore and Mealy machines -Definition, models, inter-conversion. **Case Study:** FSM for Traffic Signal Controller, Vending Machine	6	1
Unit II	**REGULAR EXPRESSIONS**	**No. of Hours**	**COs**
	Operators of RE, Building RE, Precedence of operators, Algebraic laws for RE, Equivalence of two RE's **Conversions:** RE to NFA, NFA to DFA, DFA to RE using Arden's theorem. **Pumping Lemma** for Regular languages, Closure and Decision properties. **Case Study :** RE in Text Search and Replace, Lexical analysis	6	2
Unit III	**CONTEXT FREE GRAMMAR**	**No. of Hours**	**COs**
	Context Free Grammar- Definition, sentential forms, Derivations, Parse trees, Context Free Language. Ambiguous Grammar, writing a grammar for language. **Simplification of CFG**, Eliminating Є-productions, unit	6	3

	productions, useless production, useless symbols **Normal Forms**- Chomsky normal form, Greibach normal form, Closure properties of CFL, Decision properties of CFL's, Chomsky Hierarchy **Case Study**: CFG for Parenthesis Match, Palindrome Strings, Parsers		
Unit IV	**PUSHDOWN AUTOMATA & LINEAR BOUNDED AUTOMATA**	**No. of Hours**	**COs**
	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. **Case Study:** Use of PDA in Top-Down and Bottom-up Parser Design	6	4
Unit V	**TURING MACHINES**	**No. of Hours**	**COs**
	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,	6	5
Unit VI	**UNDECIDABILITY & INTRACTABLE PROBLEMS**	**No. of Hours**	**COs**
	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	6	6
Books:			
Text Books(T):			
T1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, "Introduction to Automata Theory Languages and Computation", Addison-Wesley, ISBN 0-201-44124-1.			

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 Pre ss, 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**

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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 Pugalendhi, 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

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Prerequisite Course: Software Engineering.

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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	

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, LoopTesting, 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**
	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. **Cloud Service Models:** SaaS, PaaS, IaaS. **Case Study :** Cloud Computing Model of IBM.	6	CO1
Unit II	**VIRTUALIZATION**	**No. of Hours**	**COs**
	Introduction: Definition of Virtualization, Adopting Virtualization, types of virtualization, types of hypervisors, virtualization tools and mechanisms- Xen,VMware. **Types of Virtualization:** Server Virtualization, OS Virtualization, Storage Virtualization, Network Virtualization, Virtualization Architecture and Software, The Virtualization Architecture, Virtual Clustering. **Web services:** AJAX and Mashups, SOAP and REST **Case Studies:** Microsoft Hyper-V.	6	CO2
Unit III	**SECURITY IN CLOUD COMPUTING**	**No. of Hours**	**COs**
	Risks in Cloud Computing: Risk Management, Enterprise-Wide Risk Management, Types of Risks in Cloud Computing. **Data Security in Cloud:** Security Issues, Challenges, advantages,	6	CO3

	Disadvantages, Cloud Digital persona and Data security, Content Level Security. **Cloud Security Services:** Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud, Secure Cloud Software Requirements, Secure Cloud Software Testing. **Case Study :**Cloud Security Tool: Acunetix.		
Unit IV	**DATA STORAGE AND CLOUD COMPUTING**	**No. of Hours**	**COs**
	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. **Cloud Storage:** Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing. **Cloud Storage from LANs to WANs:** Introduction, Cloud Characteristic, Distributed Data Storage, Applications Utilizing Cloud Storage. **Cloud file systems:** GFS and HDFS, BigTable, HBase and Dynamo, Cloud data stores: Datastore and SimpleDB.	6	CO4
Unit V	**CLOUD PLATFORMS**	**No. of Hours**	**Cos**
	Amazon Web Services(AWS): 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. Creating an account and instance on EC2, Working with Amazon Storage Systems, Amazon Simple Storage System (S3) , Amazon Elastic Block Store (EBS) , **Using Microsoft Cloud Services:**	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**
	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. Kubernets: Introduction, Architecture, Monitoring and Management, Orchestration. **Docker at a Glance:** Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow. **Case studies on DevOps:** DocuSign, Forter, Gengo.	6	CO6

Books:

Text Books(T):

T1. A. Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning and Implementation", Pearson, 2014, ISBN: 9788131776513.

T2. Gautam Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications" Cambridge University Press , ISBN 978-0-521-13735-5.

Reference Books(R):

R1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039.

R2. Buyya, "Mastering Cloud Computing", Tata McGraw Hill, ISBN-13: 978-1-25-902995-0.

R3. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press.

E-Books:

- 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**

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

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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

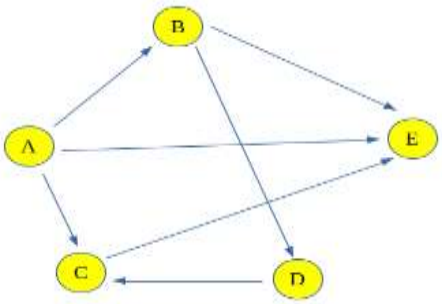
GENERAL INSTRUCTIONS:

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: • 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

		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. **Input**: arr[] = {2, 3, 5} **Output**: 5 **Input**: arr[] = {8, 5, 1} **Output**: 0	
	3.	**Implement a problem of minimum work to be done per day to finish given tasks within D days problem.** **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. **Input**: task[] = [3, 4, 7, 15], D = 10 **Output**: 4 **Input**: task[] = [30, 20, 22, 4, 21], D = 6 **Output**: 22	CO2
C	1.	**Implement Coin Change problem.** **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[]. Note: Assume that you have an infinite supply of each type of coin. ***Input**: sum = 4, coins[] = {1,2,3},* ***Output**: 4* ***Input**: sum = 10, coins[] = {2, 5, 3, 6}* ***Output**: 5*	CO3
	2.	**Implement Subset Sum Problem.** **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. ***Input**: set[] = {3, 34, 4, 12, 5, 2}, sum = 9* ***Output**: True* ***Input**: set[] = {3, 34, 4, 12, 5, 2}, sum = 30* ***Output**: False*	CO3
	3.	**Implement Check if it is possible to transform one string to another.** **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. 1. Make some lowercase letters uppercase. 2. Delete all the lowercase letters. ***Input:** s1 = daBcd s2 = ABC* ***Output:** yes* ***Input:** s1 = argaju s2 = RAJ* ***Output:** yes*	CO3
D	1.	**Implement program to find all distinct subsets of a given set using Bit Masking Approach.** **Statement** Given an array of integers arr[], The task is to find all its subsets. The subset cannot contain	CO4

		duplicate elements, so any repeated subset should be considered only once in the output**.** ***Input**: S = {1, 2, 2} **Output**: {}, {1}, {2}, {1, 2}, {2, 2}, {1, 2,2}* ***Input**: S = {1, 2} **Output**: {}, {1}, {2}, {1, 2}*	
	2.	**Implement program Count all possible Paths between two Vertices.** **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.  ***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*	CO4
	3.	**Implement program to print all subsets of a given Set or Array** **Statement** Given a set of positive integers, find all its subsets. ***Input**: array = {1, 2, 3}* ***Output**: // this space denotes null element.* *1 1 2 1 2 3 1 3 2 2 3 3* ***Input**: 1 2* ***Output**: 1 2 1 2*	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. Fayez 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**

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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 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. AllanCole," 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-javacript

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 andTechnology 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 instituteguide.
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 isessential.

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 ofthe 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 atdepartmental level only.

● The departments are informed to finalize MLC for SEM I and SEM II immediately and will take itsapproval 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 socialharmony 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**

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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

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**
	Introduction: Introduction to Systems software, Goals of System Software, System Programs, Machine Structure. **Components of System Software:** Assembler, Macro processor, Compiler, Interpreter, Linker, Loader, Debugger, Operating System. **Language Processors:** Language Processing Activities, Fundamentals of Language Processing.	6	CO1
Unit II	**Introduction to Compiler**	**No. of Hours**	**COs**
	Structure of a Compiler, Compiler and Interpreter. **Lexical Analysis:** Role of the lexical analyzer, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator LEX. **Syntax Analysis:** Role of Parser, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Parser Generators YACC. **Case Study : LEX and YAAC specification and features.**	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. Dhamdhere 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. Louden, "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 **e**xplore 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**

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 versusContinuous 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 anddecimal 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: Minskowski 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 decisiontree, 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:

T1. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers, ISBN:9780123814791, 9780123814807.

T2. Mohammed J. Zaki, Wagner Meira Jr., "Data Mining and Analysis", Cambridge University Press, ISBN:9781316614808.

Reference Books:

R1. Vipin Kumar, "Introduction to Data Mining", Pearson, ISBN-13: 978-0321321367 ISBN-10: 0321321367

R2. Ikhvinder Singh, "Data Mining & Warehousing", Khanna Publishing House, ISBN-10: 9381068704, ISBN-13: 978-9381068700

R3. Charu C. Aggarwal, "Data Mining: The Textbook", Springer, ISBN 978331914141-1, 978331914142-8

R4. Ian H. Witten, Eibe Frank, "Data Mining: Practical Machine Learning Tool and Techniques", Elsevier Publishers, ISBN: 0-12-088407-0

R5. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893

R6. Carlo Vercellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications, ISBN: 9780470753866

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.cftt.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, 4th 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

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Prerequisite Course: Core Java, Web Technology.

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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):

T1. Donald Brown, Chad Michael Davis, and Scott Stanlick, “Struts 2 in Action”, Dreamtech Press, ISBN-13 **:** 978-8177228755.

T2. Ramin Rad, “Mastering Hibernate”, Packt Publishing, ISBN: 9781782175339.

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.

Reference Books(R):

R1.Chuck Cavaness, “Programming Jakarta Struts ”, O'Reilly Media, Inc, ISBN:9780596003289.

R2. Craig Walls, “Spring in Action “, 6th ed. Manning Publications Co., ISBN: 9781617297571.

R3. Christian Bauer, Gavin King, “Java Persistence with Hibernate”, 2nd ed. Manning Publications Co., ISBN 9781617290459.

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**
	· 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

	· Introduction to Patents · Procedure for obtaining a Patent · Licensing and Assignment of Patents 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
	• 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**
	A) **Trademarks** · 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 **B) Copyright Right** • Concept of Copyright Right · Assignment of Copyrights	4 Hrs.	4

	· Registration procedure of Copyrights · Infringement (piracy) of Copyrights and Remedies · Copyrights over software and hardware		
Unit 5	**Entrepreneurship: Introduction**	**No.of Hours**	**COs**
	5.1**Concept and Definitions**: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs. **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. **5.3 Factor Affecting Entrepreneurial Growth:** Economic & Non-Economic Factors, EDP Programmes. **5.4 Steps in Entrepreneurial Process:** Deciding Developing Moving Managing Recognizing.	4	5
Unit 6	**Resources for Entrepreneurship**	**No.of Hours**	**COs**
	6.1 Project Report Preparation: Specimen Format of Project Report; Project Planning and Scheduling using PERT / CPM; Methods of Project Appraisal – Feasibility Study both	4	6

	Economicand Market Preparation projected financial statement. **6.2 Role of Support Institutions and Management of Small Business:** Director of Industries,DIC, SIDO, SIDBI , Small Industries Development Corporation (SIDC),SISI, NSIC, NISBUED , State Financial Corporation (SFC) EPC, ECGC. **6.3 Various Governmental Initiatives:** Make in India, Startup India, Stand Up India, Digital India, Skill India **6.4 Case Studies of Successful Entrepreneurs**		
Text Books:			
	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.		

	India 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, HimalayaPublishing 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:			
	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, CIFSR. 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			
Teaching Scheme		**Examination Scheme**	
Lectures:	**2 Hrs. / Week**	**OR Exam:**	**25 Marks**
Credits:	**1**	**TW:**	**Marks**
		Total:	**25 Marks**

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

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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	-

CO2	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
CO3	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
CO4	1	2	2	2	3	-	-	-	-	-	-	1	2	1	-
CO5	1	2	3	2	3	-	-	-	-	-	-	1	2	1	-
CO6	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 calulator 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 WAREHOUSIG 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 **e**xplore 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**	**PO1 0**	**PO1 1**	**PO1 2**	**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.