Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

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

SY B. Tech. Computer Engineering

2020 Pattern

Curriculum

(SY B. Tech. Sem-III & IV with effect from Academic Year 2021-2022)

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 2020 w.e.f. from A.Y 2021-22 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by

(Dr.D.B.Kshirsagar)

BoS Chairman

Approved by

Dr. A.B. Pawar

Dean Academics

Director
Sanjivani College of Engineering
Kopargaon

Director

SANJIVANI COLLEGE OF ENGINEERING, KOPARGAON
Approved

COURSE STRUCTURE- 2020 PATTERN

SECOND YEAR B. TECH: COMPUTER ENGINEERING

SEMESTER-III

Cat.	Code	Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks						
			L (hrs)	T (hrs)	P (hrs)		Theory			OR	PR	TW	Total
							ISE	ESE	CA				
PCC	CO201	Discrete Mathematics	3	1	-	4	30	50	20	-	-	-	**100**
PCC	CO202	Data Structures I	4	-	-	4	30	50	20	-	-	-	**100**
PCC	CO203	Digital Electronics and Data Communication	3	-	-	3	30	50	20	-	-	-	**100**
PCC	CO204	Computer Organization and Architecture	3	-	-	3	30	50	20	-	-	-	**100**
HSMC	HS205	Universal Human Values and Ethics	3	-	-	3	30	50	20	-	-	-	**100**
LC	CO206	Data Structures Laboratory-I	-	-	2	1	-	-	-	-	50	50	**100**
LC	CO207	Digital Electronics Laboratory	-	-	2	1	-	-	-	-	50	-	**50**
LC	CO208	Computer Organization Laboratory	-	-	2	1	-	-	-	50	-	-	**50**
MC	MC209	Mandatory Course – III	2	-	-	NC	-	-	-	-	-	-	-
		Total	18	1	6	**20**	150	250	100	50	100	50	**700**

MC209	**Mandatory Course - III**	**Constitution of India – Basic features and fundamental principle**

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	MC	Mandatory Course
LC	Laboratory course	L	Lecture
T	Tutorial	P	Practical
Cat	Category		

SEMESTER-IV

Cat.	Code	Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks						
			L (hrs)	T (hrs)	P (hrs)		Theory			OR	PR	TW	Total
							ISE	ESE	CA				
BSC	BS202	Engineering Mathematics-III	3	1	-	4	30	50	20	-	-	-	**100**
PCC	CO210	Object Oriented Programming	3	-	-	3	30	50	20	-	-	-	**100**
PCC	CO211	Operating System and Administration	4	-	-	4	30	50	20	-	-	-	**100**
PCC	CO212	Data Structures-II	4	-	-	4	30	50	20	-	-	-	**100**
PROJ	CO213	Seminar	1	-	2	2	-	-	-	-	-	50	**50**
LC	CO214	Data Structure Laboratory -II	-	-	2	1	-	-	-	-	50	-	**50**
LC	CO215	Operating System and Administration Laboratory	-	-	2	1	-	-	-	-	-	50	**50**
LC	CO216	Object Oriented Programming Laboratory	-	-	2	1	-	-	-	-	50	-	**50**
PROJ	CO217	Mini Project / Choice Based Subject	-	-	4	2	-	-	-	50	-	50	**100**
MC	MC218	Mandatory Course – IV	2	-	-	NC	-	-	-	-	-	-	-
		Total	17	1	12	**22**	120	200	80	50	100	150	**700**

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MC218	**Mandatory Course - IV**	**Innovation - Project based – Sc., Tech, Social, Design & Innovatio**

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	MC	Mandatory Course
LC	Laboratory course	L	Lecture
T	Tutorial	P	Practical
Cat	Category		

SEMESTER III

CO201: Discrete Mathematics		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Tutorial: 1 Hrs./ Week	**End-Sem Exam:**	**50 Marks**
Credits: 4	**Teacher Assessment:**	**20 Marks**
	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.
4. To learn the concept of graph & terminology associated with graph theory.
4. To study the concept of tree & algorithms for construction of tree.
5. To acquire the knowledge algebraic system & coding theory.
6. To learn & understand the significance of number theory.

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Apply** set theory, propositional logic to formulate the solution and able construct proofs using mathematical induction.	3	Apply
2. **Apply** properties of relation and function to formulate the solution for the given problem.	3	Apply
3. **Model and solve** the computing problems using graph theory by applying appropriate algorithm.	3	Apply
4. **Apply** the various kinds of algorithms for construction of tree.	3	Apply
5. **Apply** the properties of the binary operations to classify the algebraic system.	3	Apply
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	2	1	2	1	-	-	1	-	-	1	1	3	3	3
CO2	3	2	1	2	1	-	-	1	-	-	1	1	3	3	3
CO3	3	3	1	2	1	-	-	1	-	-	1	1	3	3	3
CO4	3	3	1	2	1	-	-	1	-	-	1	1	3	3	3
CO5	3	2	-	2	1	-	-	1	-	-	1	1	3	3	3
CO6	3	2	-	2	1	-	-	1	-	-	1	1	3	3	3

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	6	3

	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		
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: 013207845?, 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.

Home

CO202: Data Structures-I		
Teaching Scheme	**Examination Scheme**	
Lectures: 4 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 4	**End-Sem Exam:**	**50 Marks**
	Continuous Assessment:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: Computer Fundamentals and Programming

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Course Objectives:

1. To know about problem solving tools and basics of Data Structures.
2. To be acquainted with the concept of an array, its operations and constraints.
3. To understand various types of linked lists and operations on linked list.
4. To understand the concept of stack, performing its operations and applications of stack.
5. To be familiar with the concept of queue, types of queue and performing operations on queue.
6. To learn various data searching and sorting techniques.

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

Course Outcomes	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. **Interpret** different tools and strategies for solving the problems and basics of Data Structures	2	Understand
2. **Understand** an array concept, operations on it and its constraints	2	Understand
3**. Operate** on various types of linked lists	3	Apply
4. **Apply** the concept of stack to solve a given problem	3	Apply
5. **Understand** the different types of queue and its operations	2	Understand
6. **Apply** appropriate searching and sorting technique for the specified 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	PSO 1	PSO2	PSO3
CO1	3	2	2	2	3	-	1	1	1	1	-	3	3	3	3
CO2	3	2	2	2	3	-	1	1	1	1	-	3	3	3	3
CO3	3	2	2	2	3	-	1	1	1	1	-	3	3	3	3
CO4	3	2	2	2	3	-	1	1	1	1	-	3	3	3	3
CO5	3	2	2	2	3	-	1	1	1	1	-	3	3	3	3
CO6	3	2	2	2	3	-	1	1	1	1	-	3	3	3	3

COURSE CONTENTS

Unit I	INTRODUCTION TO DATA STRUCTURE	No. of Hours	COs
	Problem Solving, Introduction to Algorithms, Characteristics of Algorithms, Algorithm Design Tool: Pseudo code, Algorithm Analysis: Time and Space complexity, Asymptotic notations-Big- O, Theta and Omega, Algorithmic strategies. Data Structures-Introduction to Data Structures, Classification of Data Structures, Abstract Data Type	8	1
Unit II	**ARRAY**	**No. of Hours**	**COs**
	Array as an ADT, Storage Representation of an Array- one dimensional array, memory representation and calculation, operations on one dimensional array, Multidimensional Arrays, Two dimensional, Row major and Column major 2D array. Concept of Ordered List, Sparse Matrix, Sparse matrix representation, Sparse matrix addition, Transpose of sparse matrix String– Representation of Strings and operations on Strings using array Case Study: SET as an ADT	8	2
Unit III	**LINKED LIST**	**No. of Hours**	**COs**
	Introduction, Comparison of sequential and linked organizations, Representation of Linked List, Realization of linked list using arrays, Dynamic Memory Management, Linked list using dynamic memory management, Implementation of Linked List, Types of linked list: Circular Linked List, Doubly Linked List and operations. Application–Polynomial Representation and Addition.	8	3
Unit IV	**STACK**	**No. of Hours**	**Cos**
	Concept, operations on stack, Stack as an ADT, Sequential Implementation of Stack, Multiple Stacks, Expression conversion and Evaluation, Need for prefix and postfix expressions, Linked Stack and Operations, Reversing a String, Recursion-concept	8	4

	Applications of Stack– Well form-ness of Parenthesis		
Unit V	**QUEUE**	**No. of Hours**	**Cos**
	Concept, Queue as an ADT, Sequential implementation of Linear Queue, Circular Queue, Priority Queue, Double Ended Queue, Multiple Queues, linked Queue. Applications of Queue– Job scheduling, Queue simulation, Categorizing data.	8	5
Unit VI	**SEARCHING AND SORTING**	**No. of Hours**	**COs**
	Searching: Search Techniques, Sequential search, Binary search, Fibonacci search. **Sorting:** Types of sorting-Internal and external sorting, General sort concepts-sort order, stability, efficiency, number of passes, Sorting methods- Bubble sort, Insertion sort, Selection sort, Quick sort, Shell sort, Merge sort, Bucket sort.	8	6
Books:			
Text Books(T):			
T1**.** Sartaj Sahni, Data Structures, Algorithms and Applications in C++, 2nd edition, Universities Press,ISBN-13: 978-81-7371-522-8 T2. Horowitz, Sahani, Mehta, Fundamentals of Data Structures in C++, 2nd edition, Universities Press			
Reference Books(R):			
R1. Langsam, Augenstein, Tenenbaum, Data Structures using C and C++, 2nd Edition, PHI publicaton,ISBN-978-81-203-1177-0 R2. A. Aho, J. Hopcroft, J. Ulman, Data Structures and Algorithms, 9th impression, Pearson Education, ISBN-9780-07-066-726-6. R3.Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 3rd edition, Pearson publications,ISBN-978-81-317-1474-4			

Home

CO203: Digital Electronics and Data Communications		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End-Sem Exam:**	**50 Marks**
	Continuous Assessment:	**20 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	2	2	1	2	2	2	2	1	3	3	-	2	2	2	1
CO2	2	3	3	2	2	2	2	1	3	3	-	2	2	3	1
CO3	2	3	3	2	2	2	2	1	3	3	-	2	2	3	1
CO4	2	3	1	2	2	2	1	1	-	3	-	1	1	1	1
CO5	3	3	2	2	2	2	1	1	-	3	-	1	1	1	1

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	7	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	7	1, 2

	74181 (ALU), BCD to 7-Segment display controller, Calender Subsystem		
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	7	1, 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.	7	1, 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	6	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	6	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

Home

CO204: Computer Organization and Architecture		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End-Sem Exam:**	**50 Marks**
	Continuous Assessment:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course: Digital Logic Design, Computer Fundamentals and Programming.

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Course Objectives:

1. To understand 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** basic structure of the computer system.	2	Understand
2. **Apply / Identify** arithmetic algorithms for solving ALU operations.	3	Apply
3. **Analyze** processor organization and pipeline architecture.	4	Analyze
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	1	-
CO2	3	2	2	-	-	-	-	-	1	1	-	1	3	1	-
CO3	2	1	1	-	-	1	1	-	1	1	-	1	1	1	-
CO4	2	1	1	-	-	1	1	-	1	1	-	1	1	1	-
CO5	1	-	1	-	-	-	1	-	1	1	-	1	1	2	-
CO6	1	-	1	-	-	-	1	-	1	1	-	1	1	2	-

COURSE CONTENTS

Unit I	INTRODUCTION	No. of Hours	COs
	Overview of Computer Architecture and Organization Basic Organization of Computers, Structure, Functions and Instruction cycle. 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, division. **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: Functional Block Diagram, Programming Model, Addressing Modes, Instruction Formats. Instruction Pipelining- Pipelining Strategy, Pipeline Performance: CPI, Speed Up, Efficiency, Throughput, Analysis. Data Dependencies, Data Hazards, Branch Hazards. Introduction to FPGA Accelerator.	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, Locality of Reference **Cache Memory:** Cache memory Concepts, Design Problems Based on Mapping Techniques, Cache	7	4

	Replacement Algorithm, Cache Coherency, Write Policies. Introduction to Associative memory and SCM (Storage Class Memory).		
Unit V	**RISC PROCESSOR ARCHITECTURE**	**No. of Hours**	**COs**
	Characteristics of RICS Processor, Use of Large Register File, Register Window, 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.

Home

HS205: Universal Human Values and Professional Ethics		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End-Sem Exam:**	**50 Marks**
	Continuous Assessment:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course:

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Course Objectives:

1. To make the students aware about the concept and need of value education.
2. To help the students appreciate the essential complementarity between values and skills to ensure sustained happiness and prosperity.
3. To facilitate the development of a holistic perspective among the students towards life and profession.
4. To facilitate the understanding of harmony at various levels staring from self and going towards family, society and nature.
5. To make the students aware about the correlation between engineering ethics and social experimentation in various situations.
6. To highlight the importance of professional ethics in the wake of global realities.

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Recognize** the concept of self-exploration as the process of value education.	2	Remember
2. **Interpret** the human being as the coexistence of self and body.	2	Understand
3. **Apply** the holistic approach for fulfilling human aspirations for the humans to live in harmony at various levels.	3	Apply
4. **Organize** the universal human order in correlation with professional ethics.	4	Analyze
5. **Implement** ethical practices in the engineering profession.	3	Apply
6.**Outline** the importance of various ethical practices in the wake of global realities.	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	-	3	2	1	-	3	-	-	-
CO2	-	-	-	-	-	2	-	3	2	1	-	3	-	-	-
CO3	-	-	-	-	-	3	2	3	3	1	-	3	-	-	-
CO4	-	-	-	-	-	3	2	3	3	1	-	3	-	-	-
CO5	-	-	-	-	-	3	2	3	3	1	-	3	-	-	-
CO6	-	-	-	-	-	3	2	3	3	1	-	3	-	-	-

COURSE CONTENTS

Unit-I	INTRODUCTION TO VALUE EDUCATION	No. of Hours	COs
	Values, Morals and Ethics; Concept and need of value education; Self-exploration as the process for value education; Guidelines for value education; Basic human aspirations and their fulfilment.	6	1
Unit-II	**HARMONY IN HUMAN BEING**	**No. of Hours**	**COs**
	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	6	2
Unit-III	**HARMONY IN THE FAMILY, SOCIETY AND NATURE**	**No. of Hours**	**COs**
	Harmony in the family- The basic unit of human interaction; Values in the human to human relationship; Harmony in the society; Vision for the universal human order; Harmony in the nature; Realizing existence as coexistence at all levels	6	3
Unit-IV	**PROFESSIONAL ETHICS**	**No. of Hours**	**COs**
	Natural acceptance of human values; Definitiveness of ethical human conduct; Humanistic education and universal human order; Competence in professional ethics; Transition towards value-based life and profession	6	4

Unit-V	ENGINEERING ETHICS AND SOCIAL EXPERIMENTATION	No. of Hours	COs
	Need of engineering ethics; Senses of engineering ethics; Variety of moral issues; Moral autonomy; Utilitarianism; Engineering as experimentation; Engineers as responsible experimenters; Codes of ethics	6	5
Unit-VI	**GLOBAL ISSUES**	**No. of Hours**	**COs**
	Globalization and multi-national corporations; Cross-cultural issues; Business ethics; Environmental ethics; Computer ethics; Bio-ethics; Ethics in research; Intellectual property rights and plagiarism	6	6

Books:

Text Books(T):

T1. R. R. Gaur, R. Sangal, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books Pvt. Ltd.

T2. R. S. Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International (P) Ltd. Publishers

Reference Books(R):

R1. B. P. Banerjee, "Foundations of Ethics and Management", Excel Books Pvt. Ltd.

R2. P. L. Dhar, R. R. Gaur, "Science and Humanism", Commonwealth Publishers

R3. M. K. Gandhi, "The Story of my Experiments with Truth", Discovery Publisher

R4. http://uhv.org.in/

Home

CO206: Data Structures Laboratory-I		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**50 Marks**
Credits: 1	**Practical Exam:**	**50 Marks**
	Total:	**100 Marks**

Course Objectives:

1. To know the representation of data in various data structures.
2. To realise the memory representation of different data structures.
3. To get familiar with ADTs of Data structures.
4. To analyse the time and space complexity of given problem solution.
5. To study various searching and sorting techniques.

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

Course Outcomes	Blooms Taxonomy	
	Level	**Descriptor**
1. **Represent** data in various Data structure formats.	1	Remember
2. **Select** appropriate data structure to solve a given problem.	2	Understand
3. **Execute** operations like insertion, deletion, searching and traversing on linear Data Structure.	3	Apply
4. **Analyze** solutions using time and space complexity.	4	Analyze
5. **Implement** various searching and sorting techniques.	3	Apply

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO2	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO3	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO4	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO5	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3

Suggested List of Assignments

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, 2 from Group C and Group D Assignments are mandatory. 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.

Group A: (At least 2)

1. Supermarket keeps a record for different products purchased by customers on a day. Select appropriate data structure and write a program to perform various operations on given product information.

2. Write a program for storing matrix. Write functions to:

i) Add, subtract and multiply two matrices

ii) Compute transpose of matrix

iii) Check whether given matrix is upper triangular or not

iv) Compute summation of diagonal elements

3. Write a program for sparse matrix realization and operations on it- Transpose, Fast Transpose.

4. Write a program for string operations- copy, concatenate, check substring, equal, reverse and length without using library functions.

5. Second year Computer Engineering class, set A of students like Vanilla Ice-cream and set B of students like butterscotch ice-cream. Write a program to store two sets using array. Compute and display- i. Set of students who like either vanilla or butterscotch or both, ii. Set of students who like both vanilla and butterscotch, iii. Set of students who like only vanilla not butterscotch, iv. Set of students who like only butterscotch not vanilla, v. Number of students who like neither vanilla nor butterscotch

Group B: (At least 2)

6. 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

7. 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.

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

a) Compute 1‘s and 2‘s complement

b) Add two binary numbers

Group C (At least 2)

9. Write a program to implement STACK as an ADT using array. Use same ADT to compute string reverse and to check given expression is well parenthesized.

10. Write a program to convert expression from infix to postfix and evaluate postfix expression using stack.

11. Write a program to implement Queue as an ADT using array.

12. In job scheduling operating system maintains jobs in job queue. If the operating system uses priorities, then the jobs are processed based on their priorities, job with higher priority will be scheduled first. Write a program for simulating job queue.

13. Write a program to implement Circular Queue as an ADT using array.

Group D: (Mandatory)

14. Department Library maintains records of books. Write a program to implement Linear and Binary Search operations on it. Use appropriate data structure and analyse its complexity.

15. Write a program to store first year percentage of students in an array. Sort array of floating point Numbers in ascending order using bubble sort and quick sort display three topmost scores.

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.	6	Create
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.	6	Create
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	2	1	-	-	2	1	-	3	3	-	-	-	1	-
CO2	2	3	3	2	2	2	2	1	3	3	-	2	2	3	1
CO3	2	3	3	2	2	2	2	1	3	3	-	2	2	3	1
CO4	2	3	3	2	2	2	2	1	3	3	-	2	2	3	1
CO5	2	3	2	2	2	2	1	1	-	3	-	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

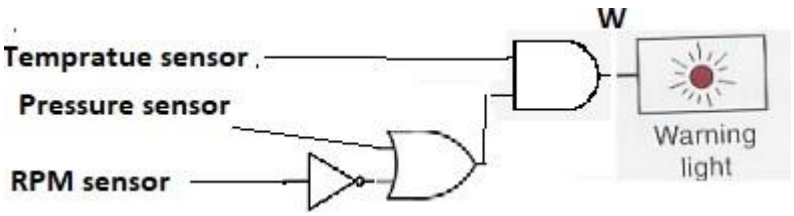
P sensor output = 0 only when pressure <220 psi

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: Computer Organization Laboratory		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**----**
Credits: 1	**Oral Exam:**	**50 Marks**
	Total:	**50 Marks**

Course Objectives:

1. To understand basic structure and operation of hardware system.
2. To learn implementation of fixed-point arithmetic operations.
3. To understand design and analysis of K- Stage pipeline.
4. To learn Assembly language.
5. To understand memory management system.
6. To study architecture of Raspberry-Pi and Arduino board.

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Illustrate** basic structure of the computer system.	2	Understand
2. **Perform** fixed point operation using arithmetic algorithms	3	Apply
3. **Analyze** K – Stage pipeline	4	Analyze
4. **Implement** basic assembly language programs.	3	Apply
5. **Apply** cache replacement algorithms and memory mapping techniques.	3	Apply
6. **Explain** architecture of Raspberry-Pi and Arduino board	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	1	-
CO2	2	1	1	-	-	-	-	-	-	-	-	1	2	1	-
CO3	2	1	2	-	-	-	-	-	-	-	-	1	2	1	-
CO4	2	1	2	-	-	-	-	-	-	-	-	1	1	1	-
CO5	2	1	2	-	-	-	-	-	-	-	-	1	1	1	-
CO6	1	-	1	-	1	-	-	-	-	-	-	1	1	1	-

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy needs to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Use of open source software is encouraged.

Operating System: Latest 64-bit Version and update of Microsoft Windows 10/ Microsoft Windows 7/ Windows 8 Operating, System onwards or 64-bit Open source Linux or its derivative.

Programming Tools: TASM, C or C++ editor, DOSBOX tools for dos support.

Suggested List of Assignments:

[Students have to complete total 10 assignments towards the successful completion of Term Work, where all the programming assignment are compulsory.]

1. **Identify Hardware Components of the Computer System and Explore different types of Motherboards.**

   [*1.1Students have to identify Hardware Components of the computer system,*

   *1.2 Student should explore different types of motherboard and various components which are attached to a motherboard.***]**

2. **Identify types of Buses in Computer System and Explore POST, Boot process and configure BIOS settings**.

   [*2.1 Students should know the types of Buses and working of the initialization phase of the Computer systems.*

   2.2. Students should know how POST is executed and configuring the BIOS setup to improve the utility of the system.]

3. **Implementation of Booth's Algorithm**.

   [*Use any programming language (preferable C or C++) to implement Booth's Algorithm which will work for Multiplication of Signed and Unsigned numbers. Here, understanding the concept of Booth's Algorithm is essential.***]**

4. **Study of Restoring and Non-Restoring Division Algorithms**.

   [*Learn and understand the algorithms to apply it to the given problems.***]**

5. **Design and Analysis of K – Stage Pipeline.**

   [*Study of pipeline architecture and design for analysis of given K - stage pipeline for n instructions and analyse performance parameters.***]**

6. **Study of Instruction Format.**

   [*Study of 8086 format, design of an instruction format for typical instruction set, giving num. of instructions, number of opcodes and possible addressing modes.***]**

7. **Write a program in Assembly Language to display string and 16-bit numbers.**

   [*The string and number can be defined in the Data Segment. Use of a 16-bit register is expected.***]**

8. Write a program in Assembly Language to perform Signed Multiplication and Division of two 8-bit numbers.

[*The numbers can be defined in the Data Segment. Make your program user friendly to accept the choice from user for: a) Multiplication, b) Division, c) EXIT.*

Use of a 16-bit register is expected. The program should be able to accept two 8-bit num. and display in Hexadecimal.]

9. Write a program in Assembly Language to perform Addition of N numbers in a given Array.

[*The array can be defined in the data segment. Use of a 16-bit register is expected* and display addition in Hexadecimal.**]**

10. Study of Cache Replacement Algorithms.

[*Study and compare the following cache replacement algorithms – FIFO, LRU, LFU]*

11. Study and design of Memory Mapping Techniques.

[*Study the memory mapping techniques - direct mapping, associative mapping and set – associative mapping and apply it to a given problem.]*

12. Study of Raspberry-Pi and Arduino board.

[*Study and understand the use of these Raspberry-Pi boards, Arduino boards and exploration of Organization and Architecture in IOT.***]**

Home

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

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**NA**
Credits: Non Credit	**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		
CO2	The student will get aware about the fundamental rights.		
CO3	The student will get aware about directive principle of state policy and fundamental duties.		
CO4	The student will understand the system of government through parliamentary and federal system,		
CO5	The student will understand structure, formation and legislative framework of central government.		
CO6	The student will understand structure, formation and legislative framework of state government.		

Course Contents

Unit-I	**INTRODUCTION TO CONSTITUTION OF INDIA**	**No. of Hours**	**COs**
	Historical background, Salient features, Preamble of constitution, Union and its territory		
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		
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		
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		
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		
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		

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	**In-Sem Exam:**	**30 Marks**
Tutorial: 1 Hrs./Week	**End-Sem Exam:**	**50 Marks**
Credits: 4	**Continuous Assessment:**	**20 Marks**
	Total:	**100 Marks**

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Prerequisite Course:

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Course Objectives:

1. To describe and recall the basics of Vector Calculus and differential equations.
2. To understand the concept for solving problems based on vector and differential calculus in the universe.
3. To apply core concepts for the solution of engineering problems based on Vector calculus and differential equations.
4. To analyze the problems of which kind and their solution methods available in Vector and differential calculus and use a particular method for finding a solution in the engineering field.

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Know** and recall the basics of Vector Calculus and differential equations	1	Remember
2. **Understand** the concept used for solving problems based on vector and differential calculus in the universe	2	Understand
3. **Apply** core concepts for the solution of engineering problems based on Vector calculus and differential equations	3	Apply
4. **Analyze** the problems of which kind and their solution methods available in Vector and differential calculus and use a particular method for finding a solution in the engineering field	4	Analyse

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

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

CO2	3	2	-	-	1	-	-	2	2	1	-	1		-	
CO3	3	2	-	-	1	-	-	2	2	1	-	1	-	-	
CO4	3	2	-	-	1	-	-	2	2	1	-	1	-	-	
CO5	3	2	-	-	1	-	-	2	2	1	-	1	-	-	
CO6	3	2	-	-	1	-	-	2	2	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.	08	1,3
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.	08	3,4
Unit-III	**HIGHER ORDER DIFFERENTIAL EQUATION**	**No.of Hours**	**COs**
	Homogeneous and non-homogeneous linear differential equation of n^{th} order and its solution, Method of variation of parameter, operator method for particular integral, solution of certain types of linear differential equation:-Cauchy's and Legendre's differential equation, Applications branch wise (Simple Electrical circuit, Mass spring system and Bending Movement).	08	1,2,3
Unit-IV	**SERIES SOLUTION OF DIFFERENTIAL EQUATION**	**No.of Hours**	**COs**
	Linear differential equations with variable coefficients, solution about ordinary point, about singular point (Frobenius method) series solution of Bessel's equation, series solution of Legendre's equation,	08	3,4
Unit-V	**PARTIAL DIFFERENTIAL EQUATION**	**No.of Hours**	**COs**

	Formation of partial differential equation, Partial differential equation of order one (linear and nonlinear), Charpit method, PDE of higher order with constant coefficient	08	2,3,4
Unit-VI	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION**	**No.of Hours**	**COs**
	One dimensional heat equation, Wave equation, Two dimensional heat equation (Laplace equation), Telephone equation, Radio equations	08	1,3,4

Books:

Text Books(T):

T1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012, ISBN-13: 978-8174091154.

T2. N. P. Bali and Manish Goyal, A Text Book of Engineering, Mathematics, 8/e, Lakshmi Publications, 2012. ISBN: 9788131808320.

T3. H. K. Das, Engineering Mathematics, S Chand, 2006, ISBN-8121905209

Reference Books (R):

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. Robert C. Wrede, Introduction to vector and tensor analysis, Dover, 2013, ISBN-048661879X

R4. W. E. Boyce, R. C. Diprima, Elementary differential equation and boundary value problems.

R5. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 2014. ISBN-13: 978-1842653418.

R6. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 9/e, 2013, ISBN-13: 978-0471488859.

Home

CO210: Object Oriented Programming		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 3	**End-Sem Exam:**	**50 Marks**
	Teacher Assessment:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite: Fundamental concept of C Language

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Course Objectives:

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

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

Course Outcome (s)	Bloom's Taxonomy	
	Level	**Descriptor**
1**. Describe** the strengths of object oriented programming	1	Remember
2. **Understand** the concept of Operator overloading and inheritance.	2	Understand
3. **Demonstrate** the use of Polymorphism and virtual function.	3	Apply
4. **Apply** the concept of Template and Exception Handling mechanism for program development.	3	Apply
5. **Analyze** the OOP system using File handling in C++.	4	Analyze
6. **Develop** programming application using Standard Template Library.	6	Design

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

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, 2
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 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.	8	2, 3

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	2, 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, 5

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	2, 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	2, 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

Home

CO211: Operating System and Administration		
Teaching Scheme	**Examination Scheme**	
Lectures: 4 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 4	**End-Sem Exam:**	**50 Marks**
	Teacher Assessment:	**20 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):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	2	-	-	1	1	1	1	1	-	1	2
CO2	2	1	-	-	1	-	-	1	1	1	1	1	-	-	1
CO3	2	2	1	2	3	-	-	1	2	1	1	1	2	2	3
CO4	2	1	-	1	1	-	-	1	1	1	1	1	-	-	1
CO5	2	3	1	2	3	-	-	1	2	1	1	1	1	2	2
CO6	2	1	-	-	2	-	-	1	2	2	1	1	1	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,	8	4

	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, 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.

Home

CO212: Data Structures-II		
Teaching Scheme	**Examination Scheme**	
Lectures: 4 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
Credits: 4	**End-Sem Exam:**	**50 Marks**
	Teacher Assessment:	**20 Marks**
	Total:	**100 Marks**

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Prerequisite: Data Structures- I

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Course Objectives:

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

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

Course Outcomes	Blooms Taxonomy	
	Level	**Descriptor**
1. **Interpret** various operations on trees for given problem statement.	2	Understand
2. **Construct** solution for given specific problem using Graph data structure.	3	Apply
3. **Illustrate** various hashing techniques to represent data in hash table	2	Understand
4. **Understand** and **Design** symbol tables using static and dynamic strategy.	3	Apply
5. **Construct** different types of search trees.	3	Apply
6. **Understand** and **Represent** data in various structured format.	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	1	1	1	1	-	3	3	3	3
CO2	3	2	2	2	3	2	1	1	1	1	-	3	3	3	3
CO3	3	2	2	2	3	2	1	1	1	1	-	3	3	3	3
CO4	3	2	2	2	3	2	1	1	1	1	-	3	3	3	3
CO5	3	2	2	2	3	2	1	1	1	1	-	3	3	3	3
CO6	3	2	1	2	3	-	1	-	1	1	-	1	3	3	3

COURSE CONTENTS

Unit I	TREE	No. of Hours	COs
	Analysis of Algorithms: Recurrences, Master Method Tree: Introduction, Tree Terminologies, Binary Tree, Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, operations on BST, Threaded binary tree, Applications – Expression Tree, Huffman Encoding.	9	1
Unit II	**GRAPH**	**No. of Hours**	**COs**
	Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Introduction to Greedy Strategy, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prims and Kruskal Algorithm, Dijktra's Single source shortest path, Topological ordering. Applications- Data structure used in World Wide Web, Facebook, Google map.	9	2
Unit III	**HASHING**	**No. of Hours**	**COs**
	Hash Table- Concepts-hash table, hash function, bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- Open Hashing and open addressing and chaining, extendible hashing.	8	3
Unit IV	**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	8	4

	Binary Search Tree (OBST), Height Balanced Tree- AVL tree.		
Unit V	**SEARCH TREES**	**No. of Hours**	**COs**
	Multiway-Search Trees: B-Tree, B+Tree, String Trees: Trie Tree, Suffix tree, Self-adjusted Tree: Splay Tree, Red-Black Tree, K-dimensional tree, AA tree. Heap-Basic concepts, realization of heap and operations, Heap as a priority queue, heap sort, Binomial Heaps.	8	5
Unit VI	**FILE ORGANIZATION**	**No. of Hours**	**COs**
	Sequential file organization- concept and primitive operations, Direct Access File- Concepts and Primitive operations, Indexed sequential file organization-concept, types of indices, structure of index sequential file, Linked Organization- multi list files, coral rings, inverted files and cellular partitions. External Sort- Consequential processing and merging two lists, multiway merging- a k way merge algorithm.	6	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			

Home

CO213: Seminar		
Teaching Scheme	**Examination Scheme**	
Lectures: 1 Hrs. / Week	**Term Work:**	**50 Marks**
Practical : 2 Hrs. / Week	**Oral Exam:**	**-----**
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	1	-	2	-	2	-	-	2
CO2	-	3	-	2	-	3	2	3	-	3	-	3	-	-	1
CO3	1	-	-	-	-	-	1	3	-	-	-	2	2	-	1
CO4	-	1	1	-	-	3	3	3	-	3	-	3	1	-	2
CO5	-	-	-	-	2	3	1	1	1	3	-	3	-	-	2
CO6	-	-	-	-	-	3	1	1	-	3	-	3	-	-	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

Home

CO214: Data Structure Laboratory- II		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**-----**
Credits: 1	**Practical Exam:**	**50 Marks**
	Total:	**50 Marks**

Course Objectives:

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

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

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

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	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO2	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO3	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO4	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO5	3	3	2	3	3	2	1	1	1	1	-	3	3	3	3
CO6	3	3	2	3	3	2	1	1	1	1	-	3	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 2)

1. Construct Tree for representing Vehicles Type Hierarchy and print the nodes. Find the time and space requirements of your method.

2. 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.

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

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

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

Group B: (At least 2)

6. 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.

7. 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.

8. 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.

9. 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 C (At least 3)

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

11. 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)

12. 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.

13. 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

Group D (At least one)

14. Department maintains student information. The file contains roll number, name, division and address. Allow user to add, delete information of student. Display information of particular employee. If record of student does not exist an appropriate message is displayed. If it is, then the

system displays the student details. Use sequential file to maintain the data.

15. Implement the Heap sort algorithm demonstrating heap data structure.

16. Assume we have two input and two output tapes to perform the sorting. The internal memory can hold and sort m records at a time. Write a program in java for external sorting. Find out time complexity.

Home

CO215: Operating System and Administration Laboratory		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**50 Marks**
Credits: 1	**Practical Exam:**	**----**
	Total:	**50 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	2	1	-	1	3	-	-	3	2	3	2	2	-	1	3
CO2	2	3	-	2	3	-	-	3	2	3	2	2	1	2	3
CO3	2	2	1	2	3	-	-	3	2	3	2	2	2	2	3
CO4	2	2	1	1	3	-	-	1	2	3	2	2	-	1	2
CO5	2	3	1	1	3	-	-	1	2	3	2	2	1	2	2
CO6	2	-	-	-	2	-	1	1	2	3	2	1	-	-	1

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: Object Oriented Programming Laboratory		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**----**
Credits: 1	**Practical Exam:**	**50 Marks**
	Total:	**50 Marks**

Course Objective:

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 python 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. **Develop** the small application using OOP.	6	Design
6. **Describe** the basic python programming.	1	Remember

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

Operating System Recommended: 64-bit Open source Linux or its derivative
Programming tools recommended: - Open Source C++ Programming tool like G++/GCC.
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, 4 Assignments from group B, 2 from group C, Group D compulsory.

Suggested list of Assignments
Group-A

1. 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				

2. 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.

3. 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).

4. 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

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++ /Python 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++ /Python 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. Write a Python 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

12. Write a Python 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.

13. To accept from user the number of Fibonacci numbers to be generated and print the Fibonacci series.

Group D

14. To Develop a Mini project using OOP concept.

Home

CO217: Mini Project/Choice Based Subject		
Teaching Scheme	**Examination Scheme**	
Lectures: 4 Hrs. / Week	**Term Work:**	**50 Marks**
Credits: 2	**Oral Exam:**	**50 Marks**
	Total:	**100 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: Python Programming

Bucket 2: Web Development using HTML & Java Script

Bucket 3: Core Java Programming

Bucket 4: Computer Graphics and Animation

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
Python Programming

Course Objectives:

1. To learn basic principles of Python programming language
2. To understand the concepts of variables and loops
3. To understand the concept of Functions
4. To represent Lists, Tuples and Dictionaries
5. To acquainted with application development in Python

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

Course Outcomes	Blooms Taxonomy	
	Level	**Descriptor**
1.**Describe** basic principles of Python programming language	1	Remember
2. **Illustrate** use of variables and loops	2	Understand
3. **Apply** the Functions in Python Programming	3	Apply
4. **Examine** Lists, Tuples and Dictionaries	4	Analyse
5. **Create** an application using Python Programming	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	-	-	1	2	-	2	-	1	-	1	1	2	-	-	2
CO2	2	1	1	2	-	2	-	3	3	-	1	2	1	2	2
CO3	2	1	1	1	-	2	-	1	3	-	1	3	1	-	3
CO4	2	1	1	1	-	2	-	3	3	-	1	3	1	-	2
CO5	3	3	3	3	3	2	-	3	3	3	1	3	2	2	3

COURSE CONTENTS			
I	**GETTING STARTED WITH PYTHON**	**No. of Hours**	**COs**
	Installation and configuration, Concept of interpreter, Indent in python	2	1
II	**VARIABLES LOOPS AND STATEMENTS**	**No. of Hours**	**COs**

	Variables, While Loops, For Loops, If Statements, If Else Statements, If Elif Else Statements	4	2
III	**FUNCTIONS**	**No. of Hours**	**COs**
	Functions and variables, Functions ,Function Parameters ,Global and Local Variables.	4	3
IV	**INTERMEDIATE PYTHON**	**No. of Hours**	**COs**
	Input and Statistics, Import Syntax, Making Modules, Error Handling - Try and Except ,Lists vs. Tuples and List Manipulation, Dictionaries	5	4
V	**WORKING WITH FILES AND CLASSES**	**No. of Hours**	**COs**
	Writing to a File, Appending to a File ,Reading from a File, Classes	3	5

Suggested List of Laboratory Assignments on Python Programming

1. Python Program for factorial of a number
2. Program to print ASCII Value of a character
3. Python program to check if a string is palindrome or not
4. Python program to check whether the string is Symmetrical or Palindrome
5. Write a python function to find factorial of a number
6. Write a program using try-except to avoid unexpected termination of program
7. Python Program to Find the Size (Resolution) of a Image

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.

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

Bucket-2
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

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

Course Outcomes	Blooms 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. **Design** and develop static websites	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	1	-		-		-	3	-	-	-	-	3	-	-	--
CO2	1	-		-		-	3	-	-	-	-	3	-	-	--
CO3	1	-		-		-	3	-	-	-	-	3	-	-	---
CO4	1	-		-		-	3	-	-	-	-	3	-	-	--

COURSE CONTENTS			
I	**INTRODUCTION**	**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 **Essential HTML Tags** - Linking Pages Together - Adding Images - Creating Lists and Tables - Testing and Validation	4	1,4
II	**CSS**	**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	5	2,4
III	**JAVASCRIPT BASICS WITH CODING STANDARD**S	**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
IV	**JAVA SCRIPT 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 Intro, Java script Assignments	5	3,4

Suggested List of Laboratory Assignments on Web Development using HTML & Java Script

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

Suggested Mini Project on Web Development using HTML & Java Script

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:

Reference Books (R):

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

Bucket-3
Core Java Programming

Course Objectives:

1. To learn the fundamental concept of Java Programming.
2. To study the Inheritance and Package.
3. To learn the Exception Handling and Multi-threading.
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. **Understand** the use of Java Programming concepts for application development.	2	Understand
2. **Understand** how to apply the re-usability concept in development of application.	2	Understand
3. **Design** and develop the Multi-threaded application.	3	Apply
4. **Design** and develop the application using database connectivity.	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	1	2	1	-	1	1	3	3	1	3	1	2	2
CO2	2	1	1	2	1	-	1	1	3	3	1	3	1	2	2
CO3	2	2	2	2	2	-	1	1	3	3	1	3	1	2	2
CO4	2	2	2	2	2	-	1	1	3	3	1	3	2	2	2

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 Cycle of Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the Runnable interface.	4	3
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			

1. Develop the application using the basic concepts of java programming.
2. Develop the application using the various types of inheritance and polymorphism in java programming.
3. Develop the application in java programming using the concept of interface.
4. Implement the program in java to demonstrate create and of use of package concept in java.
5. Develop the application to demonstrate the exception handling mechanism in java programming.
6. Develop the Multithreaded application in java programming using extending Thread class.
7. Develop the Multithreaded application in java programming using implementing the runnable interface.
8. Develop the GUI application using the concept of applet in java programming.
9. 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

Bucket-4
Computer Graphics and Animation

Course Objectives:

1. To acquire fundamental knowledge of Computer Graphics.
2. To learn various algorithms for generating and rendering graphical figures and learn mathematics behind the graphical transformations.
3. To learn various algorithms for polygon filling and curve generation.
4. To acquire fundamental knowledge of Computer Animation

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

Course Outcomes	Blooms Taxonomy	
	Level	**Descriptor**
1. **Design** basic objects in computer graphics using mathematical properties of the object.	6	Create
2. **Apply** various transformations on 2D objects.	3	Apply
3. **Develop** non regular geometric shapes using curves and fractals and create animation.	6	Create
4. **Develop** the graphical simulation using computer graphics and animation concepts.	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	1	1	2		-	-	-	-	-	-		3	1	--
CO2	2	1	2	-		-	-	-	-	-	-		3	1	--
CO3	2	1	2	-		-	-	-	-	-	2		3	1	---
CO4	2	1	2	2		-	-	-	-	-	2		3	1	2

COURSE CONTENTS			
I	**GRAPHICS PRIMITIVES AND SCAN CONVERSION**	**No. of Hours**	**COs**
	Concepts, applications of computer graphics, pixel, resolution, aspect ratio, Scan conversions, lines, line segments, vectors, pixels and frame buffers, qualities of good line drawing algorithms, line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham, Bresenham Circle drawing algorithm (OpenGL)	4	1

II	POLYGONS	No. of Hours	COs
	Introduction to polygon, types: convex, concave and complex. Representation of polygon, Inside test, polygon filling algorithms – flood fill, seed fill, scan line fill and filling with patterns.	3	2

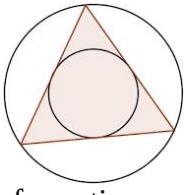
III	TRANSFORMATIONS	No. of Hours	COs
	2-D transformations: introduction, matrices, Translation, scaling, rotation, homogeneous coordinates and matrix representation, translation, coordinate transformation, rotation about an arbitrary point, inverse and shear transformation. (Blender)	4	2

IV	HIDDEN SURFACES , CURVES AND FRACTALS	No. of Hours	COs
	Hidden Surfaces Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter), Area subdivision (Warnock) Curves: Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve, Fractals: Introduction, Classification, Applications, Fractal generation: snowflake, Triadic curve, Hilbert curve.	3	3

V	ANIMATION	No. of Hours	COs
	Segment: Introduction, Segment table and operation on segment, Animation: Introduction, Principles of animation, Design of animation sequences (Blender)	3	3,4

Suggested List of Laboratory Assignments on Computer Graphics and Animation

1. Write C++ program to draw line using Bresenham‘s algorithm.
2. Write C++ program to draw circle using Bresenham‘s algorithm in OpenGL.
3. Write C++ program to draw inscribed and Circumscribed circles in the triangle as shownas an example below. (Use any Circle drawing and Line drawing algorithms)



4. Write C++ program to draw a polygon and fill it withdesired color using Seed fill algorithm.
5. Write program to draw 2D object in Blender and perform following basic transformations,

a) Scaling
b) Translation
c) Rotation

6. Write C++ program to draw waves using any curve generation technique
Suggested Mini Project on Computer Graphics and Animation
Implement a mini project in computer graphics and animation for scenes in Blender like a. Train Signal Simulation b. Traffic Signal Simulation c. Tic Tac Toe Game d. Satellite Launch e. Clock f. Tower of Hanoi g. Aquarium
Books:
Reference Books (R):
R1. D. Rogers, J. Adams, ―Mathematical Elements for Computer Graphics, 2nd Edition, Tata McGrawHill Publication, 2002, ISBN 0 – 07 – 048677 – 8. R2. Suzanne weixel, "Graphics and Animation Basic", Thomson Publisher, ISBN-10:0619055340 ISBN-13:978-0619055349 R3. Shirley, P. & Marschner, S. (2009). Fundamentals of Computer Graphics. CRC Press (4th ed.). University of Cambridge need to purchase, Stanford University
Text Books(T):
T1. S. Harrington, ―Computer Graphics, 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6 , NIT Hamirpr T2. D. Rogers, ―Procedural Elements for Computer Graphics, 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4., IIT Kanpur T3. J. Foley, V. Dam, S. Feiner, J. Hughes, ―Computer Graphics Principles and Practice, 3rd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9. University of Cambridge need to purchase , IIT Bombay, Stanford University, IIT Kanpur T4. Donald D. Hearn, M. Pauline Baker, Computer Graphics C Version, 2nd Edition, Pearson.

Home

MC218: Innovation - Project based – Science and Technology, Social, Design & Innovation		
Teaching Scheme	**Examination Scheme**	
Practical : 2Hrs. / 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

2020 Pattern

Curriculum

(T Y B. Tech. Sem-V & VI with effect from Academic Year 2022-2023)

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 2020 w.e.f. from A.Y 2022-23 as per the guidelines. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by

(Dr.D.B.Kshirsagar)
BoS Chairman

Approved by

Dean Academics

Director
Sanjivani College of Engineering,
Kopargaon

Director

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute)

Department of Computer Engineering

COURSE STRUCTURE- 2020 PATTERN

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

SEMESTER V

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			
			L (hrs)	T (hrs)	P (hrs)	Credits	CIA	ISE	ESE	TW	OR	PR	Grand Total
PCC	CO301	Design and Analysis of Algorithms	4	-	-	4	20	30	50	-	-	-	100
PCC	CO302	Computer Network	3	-	-	3	20	30	50	-	-	-	100
PCC	CO303	Database Management System	3	-	-	3	20	30	50	-	-	-	100
PCC	CO304	Theory of Computation	4	-	-	4	20	30	50	-	-	-	100
PEC	CO305	Professional Elective - I	3	-	-	3	20	30	50	-	-	-	100
LC	CO306	Computer Network Laboratory	-	-	2	1	-	-	-	-	-	50	50
LC	CO307	Database Management System Laboratory	-	-	2	1	-	-	-	-	-	50	50
LC	CO308	Professional Elective - I Laboratory	-	-	2	1	-	-	-	-	50	-	50
PROJ	CO309	Mini Project Based on Skill based Credit Course		-	2	1	-	-		50	-	-	50
MLC	MC310	Mandatory Learning Course-V	1	-	-	NC	-	-	-	-	-	-	**Pass/ Fail**
Total			18	-	08	21	100	150	250	50	50	100	**700**

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

Code	Professional Elective-1
CO305 A	Digital Image Processing (DIP)
CO305 B	Software Engineering and Design(SED)
CO305 C	Data Mining and Warehousing (DMW)

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute)

Department of Computer Engineering

COURSE STRUCTURE- 2020 PATTERN

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

SEMESTER VI

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			Grand Total
			L (hrs)	T (hrs)	P (hrs)	Credits	CIA	ISE	ESE	TW	OR	PR	
PCC	CO311	Internet of Things	4	-	-	4	20	30	50	-	-	-	100
PCC	CO312	System Programming and Operating System	3	-	-	3	20	30	50	-	-	-	100
PCC	CO313	Web Technology	3	-	-	3	20	30	50	-	-	-	100
PEC	CO314	Professional Elective - II	3	-	-	3	20	30	50	-	-	-	100
HSMC	HS315	Corporate Readiness	2	-		2	50	-	-	-	-	-	50
PROJ	PR316	IPR and EDP	2	-	-	2	20	-	30	-	-		50
LC	CO317	Internet of Things Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	CO318	System Programming and Operating System Laboratory	-	-	2	1	-	-	-	-	-	50	50
LC	CO319	Web Technology Laboratory	-	-	2	1				-	50	-	50
PROJ	CO320	Creational Activity	-	-	2	1	-	-	-	50	-	-	50
MLC	MC321	Mandatory Learning Course-VI	1	-	-	NC	-	-	-	-	-	-	**Pass/ Fail**
Total			18	-	08	21	150	120	230	50	100	50	**700**

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

Code	Professional Elective-II
CO314 A	Software Testing and Quality Assurance
CO314 B	Cloud Computing
CO314 C	Soft Computing

SEMESTER V

CO301: Design and Analysis of Algorithms			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	**4**	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Data Structures-I, Data Structures-II, Discrete Mathematics

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Course Objectives:

1. To study and perform analysis of algorithms
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 algorithm and distribute algorithms

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Students will be able to design and analyse algorithms	4	Analyse
2. Students will be able solve problems using greedy strategy	3	Apply
3.Students will be able to solve problems using dynamic programming strategy	3	Apply
4. Students will be able to solve problems using backtracking and branch-n-bound strategies	3	Apply
5.Students will be able to apply computational complexity theory	3	Apply
6. Students will be able to develop parallel algorithms and distribute algorithm.	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	1	2	1	1	2	2	1	2	3	3	3
CO2	3	3	3	3	1	2	1	1	2	2	1	2	3	3	3
CO3	3	3	3	3	1	2	1	1	2	2	1	2	3	3	3
CO4	3	3	3	3	1	2	1	1	2	2	1	2	3	3	3
CO5	2	3	3	3	1	2	2	1	2	2	1	2	3	3	3
CO6	2	3	3	2	2	2	2	1	2	2	1	2	3	3	3

COURSE CONTENTS

Unit I	**Problem Solving and Basics of Algorithmic Analysis**	**No. of Hours**	**Cos**
	Problem solving principles: Classification of problem, problem solving strategies, What are algorithms, classificationof time complexities (linear, logarithmic etc) ,Divide and Conquer strategy. Asymptotic notations, Best case, worst case,average case analysis, lower bound and upper bound, amortized analysis. Recurrences: Formulation and solving recurrence equations using Master Theorem.	8	CO1
Unit II	**Greedy Strategy**	**No. of Hours**	**Cos**
	Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms-Job scheduling and activity selection problems	8	CO2
Unit III	**Dynamic Programming**	**No. of Hours**	**Cos**
	Principle, control abstraction, time analysis of control abstraction, binomial coefficients, OBST, 0/1 knapsack, Chain Matrix Matrix Multiplication.	8	CO3
Unit IV	**Backtracking and Branch -and-Bound**	**No. of Hours**	**Cos**

	Backtracking: Principle, control abstraction, time analysis of control abstraction, 8-queen problem, graph coloring problem, sum of subsets problem. Branch-and-Bound: Principle, control abstraction, time analysis of control abstraction, strategies: FIFO, LIFO and LC approaches. TSP, knapsack problem.	8	CO4
Unit V	**Complexity Theory**	**No. of Hours**	**Cos**
	Polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P class, NP class &NP complete problems- vertex cover and 3-SAT and NP-Hard Problems: Hamiltonian cycle problem, Clique problem	8	CO5
Unit VI	**Parallel Algorithms**	**No. of Hours**	**Cos**
	Sequential and parallel computing, RAM & PRAM models, Amdahl's Law, Brent's theorem, parallel algorithm analysis and optimal parallel algorithms. Distributed Algorithms, Embedded Algorithms	8	CO6
Books:			

Text Books(T):

T1. Horowitz and Sahani, Fundamentals of Computer Algorithms, 2nd edition, University Press, ISBN:97 881 73716126,817371 61262

T2.Gills Brassard and Paul Bartly, Fundamentals of Algorithmic, PHI New Delhi.

T3.The Design and Analysis of Computer Algorithms, Aho,Hopcroft,Ullman.

Reference Books(R):

R1. Algorithms and Parallel Computing, Fayez Gebali, Willy, ISBN 978-0-470-90210-3

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

CO302: Computer Network			
Teaching Scheme		**Examination Scheme**	
Lectures: 3 Hrs. / Week		**Continuous Assessment:**	**20 Marks**
Credits: 3		**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 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	2	1	-	1	-	1	1	3	3	3
CO2	1	2	2	-	-	-	-	-	-	-	-	1	3	3	3
CO3	1	1	1	1	-	-	-	-	-	-	-	1	3	3	3
CO4	1	3	1	-	1	-	-	-	-	-	-	1	3	3	3
CO5	1	2	2	1	1	-	-	-	-	-	-	1	3	3	3
CO6	2	3	3	1	2	2	-	-	2	-	1	2	3	3	3

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, Design issues for Layers, Network Devices: Bridge, Switch, Router and Access Point, Smart NIC.	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 andWait, Sliding Window Protocol.	7 Hrs.	2
Unit-III	**Medium Access Control Layer**	No.of Hours	COs
	Channel allocation: Static and Dynamic, Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards and Frame Formats, 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, Frame formats, CSMA/CA.	7 Hrs.	3
Unit-IV	**Internet Layer**	No.of Hours	COs
	Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP, Routing Protocols: Distance Vector, Link State, Path Vector, Routing in Internet: RIP, OSPF, BGP, Congestion control and QoS, MPLS, Routing in MANET : AODV, DSR.	7 Hrs.	4
Unit-V	**Transport Layer**	No.of Hours	COs
	Services, Berkley Sockets, Addressing, Connection establishment, Connection release, Flow control andbuffering, Multiplexing, TCP Congestion Control, Quality of Service (QoS), Differentiated services, Protocols: TCP and UDP.	7 Hrs.	5
Unit-VI	**Application Layer**	No.of Hours	COs

	Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP). Case study: Network Performance: Throughput, Latency, Packet loss, Retransmission.	7 Hrs.	6
Books:			

Textbooks:

T1. Andrew S. Tenenbaum, "Computer Networks", PHI, ISBN 81-203-2175-8.

T2. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw- Hill, Publications, ISBN: 0 – 07 – 058408 – 7.

Reference Books:

R1. Kurose, Ross "Computer Networking a Top Down Approach Featuring the Internet",Pearson, ISBN-10: 0132856204.

R2. Matthew S. G, "802.11 Wireless Networks", O'Reilly publications, ISBN: 81-7656-992-5

R3. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols" Prentice Hall, ISBN-10: 8131706885; ISBN-13: 978-8131706886.

R4. Holger Karl and Andreas Willing, "Protocols and Architectures for Wireless Sensor Networks", Wiley India , ISBN: 9788126533695.

R5. Eldad Perahia, Robert Stacey, "Next Generation Wireless LANs", Cambridge, ISBN-10:1107016762; ISBN-13: 978-1107016767.

R6. 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.

CO303: Database Management System			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	**3**	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 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	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	-	1	1	2	3	2	3	3	3	3
CO2	3	3	2	3	3	2	3	3	2	3	2	3	3	3	3
CO3	3	3	2	3	1	-	2	1	2	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	3	2	3	2	3	3	3	3
CO5	3	3	3	3	1	-	3	3	2	3	2	3	3	3	3
CO6	3	3	3	3	3	2	2	3	-	3	2	3	3	3	3

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.	07 Hrs.	CO1
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, DatabaseModification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored Procedures & Functions, Cursors, Triggers, Assertions, roles and privileges , Embedded SQL, Dynamic SQL.	07 Hrs.	CO2
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 Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF	08 Hrs.	CO3
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.	08 Hrs.	CO4
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 DistributedDatabases, Distributed Database Design, Distributed Data Storage, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database. Database Security: Authentication,	07 Hrs.	CO5

	Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.		
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, DistributedDatabase 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 socialmedia using neo4J. Introduction to Big Data.	08 Hrs.	CO6

Books:

Text Books:

T1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw HillPublishers, 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’ReillyPublications, ISBN: 978-1-449-34468-9.

CO304: Theory of Computation			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4 Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	4	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 Marks**
		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 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 languages	3	Apply
6. **Demonstrate** the understanding of key terms, such as algorithm, computability, decidability, and complexity through problem solving.	2	Understand

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

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	-	-	1	3	3	1	1	1	1	1
CO2	2	3	2	3	2	-	-	1	3	3	1	1	1	1	1
CO3	2	3	2	3	2	-	-	1	3	3	1	1	1	1	1
CO4	3	3	2	3	2	-	-	1	3	3	1	1	1	1	1
CO5	3	3	2	2	-	-	-	1	3	3	1	1	1	1	1
CO6	3	3	1	2	-	-	-	1	2	2	1	1	1	-	1

COURSE CONTENTS

Unit I	**FORMAL LANGUAGE THEORY AND FINITE AUTOMATA**	**No. of Hours**	**Cos**
	Basic Mathematical Objects: Sets, Logic, Functions, Relations Introduction to Formal language, Alphabets and languages, Finite representation of language, Finite Automata (FA): An InformalPicture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language, Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA, FA withoutput: Moore and Mealy machines -Definition, models, inter-conversion. Application of FA: Text Search. Case Study: FSM for Traffic Signal Controller, Vending Machine	7	1
Unit II	**REGULAR EXPRESSIONS (RE) AND LANGUAGES**	**No. of Hours**	**Cos**
	Operators of RE, Building RE, Precedence of operators, Algebraic laws for RE, Conversions: NFA to DFA, RE to DFA, DFA to RE, State/loop elimination, Arden‘s theorem, Properties of Regular Languages: Pumping Lemma for Regular languages, Closure and Decision properties, Applications of RE: Regular Expressions in UNIX, Lexical analysis, Finding patterns in text Case Study : RE in Text Search and Replace	7	2
Unit III	**CONTEXT FREE GRAMMARS (CFG) AND LANGUAGES**	**No. of Hours**	**Cos**

	Introduction, Regular Grammar, Context Free Grammar- Definition, Derivations, Language of a grammar, sentential forms, Parse trees- inference, derivations, parse trees, Ambiguity in grammar and Languages- ambiguous Grammar, Simplification of CFG, Normal Forms- Chomsky normal form, Greibach normal form, Closure properties of CFL, Decision properties of CFL's, Chomsky Hierarchy, Application of CFG: Parsers, The YACC Parser-Generator, Markup languages, XML and Document Type Definitions. Case Study: CFG for Parenthesis Match, Palindrome Strings	7	3
Unit IV	**PUSHDOWN AUTOMATA (PDA) & LINEAR BOUNDED AUTOMATA (LBA)**	**No. of Hours**	**Cos**
	Definition of the PDA, Languages of a PDA, Equivalence of Acceptance by Final State & Empty stack, Equivalence of PDA's and CFG's, Deterministic PDA, PDA and Context Free Language, Definition of Linear Bounded Automata, Language of LBA, LBA and Context Sensitive Language.	7	4
Unit V	**TURING MACHINES (TM)**	**No. of Hours**	**Cos**
	Problems that computers cannot solve, Turing Machine: Notation for the TM, Instantaneous description for TM, Transition diagrams for TM, The Language of Turing Machine, TM and Halting, Programming techniques for TM's, Extensions to the basic TM, Turing Machines and Computers, Church-Turing Thesis, Universal Turing Machines.	7	5
Unit VI	**UNDECIDABILITY & INTRACTABLE PROBLEMS**	**No. of Hours**	**Cos**
	A Language that is not recursively enumerable, an un-decidable problem that is RE, Post's Correspondence Problem, The Classes P and NP, An NP-Complete Problem, A Restricted Satisfiability Problem: Normal Forms for Boolean Expressions, Converting Expressions to CNF, The Problem of Independent Sets, The Node-Cover Problem	7	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. H.L. Lewis, Christos H. Papadimitriou, "Elements of the Theory of Computation", Prentice Hall, ISBN-10: 0132624788; ISBN-13: 978-0132624787

Reference Books(R):

R1.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

R2.Sanjeev Arora and Boaz Barak, "Computational Complexity: A Modern Approach", Cambridge University Pre ss, ISBN:0521424267 9780521424264

R3.Daniel Cohen, “Introduction to Computer Theory”, Wiley & Sons, ISBN 97881265133454.
R4.J. Carroll & D Long, “Theory of Finite Automata”, Prentice Hall, ISBN 0-13-913708-4
R5.Kavi Mahesh, “Theory of Computation: A Problem-Solving Approach”, Wiley India, ISBN10 8126533110.
R6.Michael Sipser, “Introduction to the Theory of Computation”, Cengage Learning, ISBN-13: 9781133187813
R7.Vivek Kulkarni, “Theory of Computation”, Oxford University Press, ISBN 0-19-808458

Co305 A: Digital Image Processing			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	4	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 Marks**
		Total:	**100 Marks**

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Prerequisite Course:

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Course Objectives:

1. To learn fundamentals of Image and Speech 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 learn different applications in areas of Image Processing.

Course Outcomes:

After completion of the course, students are able to -

COs	Course Outcomes	Bloom's Taxonomy	
		BLevel	**Descriptor**
CO1	Understand basics of Image Processing.	2	Understand
CO2	Understand and apply image enhancement andrestoration techniques.	3	Understand
CO3	Describe and use image compression techniques.	3	Apply
CO4	Describe and apply image segmentation techniques.	3	Apply
CO5	Understand and apply different edge & object detection techniques.	3	Understand
CO6	Develop applications in Image processing and machine learning	4	Evaluate

Course Contents

Unit-I	**Introduction to Image Processing**	**No. of Hrs**	**COs**
	What is Digital Image processing, Fundamental steps in Digital Image processing, Components of an Image Processing System, Imagesampling and Quantization: Basic concept in Sampling and Quantization, Representing Digital Images, Spatial and Gray Level resolution. Basic relationships between pixels.	7 Hrs.	1
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.	2
Unit-III	**Image Compression**	**No. of Hrs**	**COs**
	Image Compression: Introduction, Coding Redundancy, Inter-pixel redundancy, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, Run length coding. Image compression model - Lossy Compression methods, Lossless compression methods.	7 Hrs.	3
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, Grow Cut region growing, line detection, Edge detection, Edge linking, Region based segmentation-Region growing, split and merge technique, local processing, regional processing, Hough transform,.	7 Hrs.	4
Unit-V	**Edge and Line Detection**	**No. of Hrs**	**COs**
	Introduction, Edge detection, Derivative (difference) operators,Morphologic edge detection, Watershed segmentation, Pattern fitting approach, Edge linking and Edge following, Edge element extraction by thresholding, Edge detector performance, Line detection, Corner detection..	7 Hrs.	5
Unit-VI	**Image Processing Applications**	**No. of Hrs**	**COs**
	Application of image enhancement and analysis, Object detection and recognition,Voice response systems, Speaker recognition systems, Speech recognition systems	7 Hrs.	6

Books:

Text Books:

1.Rafel Gonzallez and R. Woods Digital Image Processing, Second edition.
Bhabatosh *Chanda a*nd Dwijesh Dutta Majumder *Digital Image Processing And Analysis*

Reference Books:

1.Milan Sonka Vaclav Hlavac Roger Boyle,Image Processing, Analysis, and Machine Vision, Second Edition, Thomson Publication

CO305 B: Software Engineering and Design			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	**3**	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 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 analysing s/w requirements.
3. To apply project planning and management to software project development
4. To apply design principles to software project development.
5. To understand and apply Object Oriented concept for designing OO based model/application.
6. To choose and use modern design tools for software project development .

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Decide process model for developing a software project	2	Understand
2. Analyze the problem statement (SRS) and choose proper designtechnique for designing web- based/ desktop application	4	Analyze
3. Apply Project Planning and Management to s/w project development	3	Apply
4. Design and analyze an application using UML modeling as fundamental tool	4	Analyze
5. Apply Object Oriented design for s/w project development	3	Apply
6. Decide and apply appropriate modern tool for designing and modeling	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	2	2	-	-	-	1	1	1	1	1	1	3	3	3	2
CO2	-	2	2	-	-	-	1	-	1	1	-	3	3	3	2
CO3	-	-	1	-	2	-	1	1	1	1	3	3	3	3	2
CO4	-	-	2	1	3	-	1	1	1	1	-	3	3	3	2
CO5	-	1	2	-	-	-	1	1	1	1	1	3	3	3	2
CO6	-	-	-	1	3	1	1	1	1	1	1	3	3	3	2

COURSE CONTENTS

Unit I	**Introduction to Software Engineering**	**No. of Hours**	**Cos**
	Nature of Software,Software engineering,The Software Process,Software Myths,A Generic Process Model,Prescriptive Process Models:The Waterfall Model,Incremental Process Models,Evolutionary Process Models,Concurrent Models,Specialized Process Models,The formal Methods Models,The Unified Process ,Personal ,Agility Principles,Extreme Programming,(XP),SCRUM,Introduction to Clean Room Software Engineering. Case Studies: An information system (mental health-care system), wilderness weather system	6	CO1
Unit II	**Requirements Engineering and Analysis**	**No. of Hours**	**Cos**
	Requirements Engineering:User and System requirements, functional and non-functional requirements, A spiral view of requirements engineering process, Software requirements specifications (SRS): SRS document, The structure of SRS, Ways of writing SRS, Structured and Tabular SRS for insulin pump, Requirements Elicitation and Analysis:Process, requirements validation, requirements management. Case study:Mental health care patient management system (MHC-PMS)	6	CO2
Unit III	**Project Planning and Management**	**No. of Hours**	**Cos**

	The Management Spectrum Software Scope, Problem Decomposition, Process Decomposition Process and project metrics, Size-Oriented Metrics, Function-Oriented Metrics Software Process Reconciling LOC and FP Metrics,Object-Oriented Metrics ,Integrating Metrics within the Software Project Estimation,Decomposition , Process-Based Estimation,Estimation with Use Cases Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Model ,Agile estimation Model, Project scheduling: Basic Concepts Defining a Task Set for the Software Project ,Scheduling : Tracking the Schedule, Earned Value Analysis, Risk Management,Project plan.	6	CO3
Unit IV	**Introduction to Software Design**	**No. of Hours**	**Cos**
	Introduction to software design, design methods- procedural / structural and object oriented, Requirement Vs Analysis Vs Architecture Vs Design Vs Development 4+1 Architecture, case study of transferring requirement to design, UP, COMET use case based software life cycle, Introduction to UML -Basic building blocks, Reusability, Use case modeling, use case template	6	CO4
Unit V	**Static Modeling**	**No. of Hours**	**Cos**
	Analysis Vs Design, Class diagram- Analysis - Object & classes, finding analysis & design classes, refining analysis relationships, Inheritance & polymorphism, Object diagram, Component diagram- Interfaces & components, deployment diagram, package diagram.	6	CO5
Unit VI	**Dynamic Modeling**	**No. of Hours**	**Cos**
	Interaction & Interaction overview diagram, sequence diagram, Timing diagram, Communication diagram, Advanced state machine diagram, activity diagram	6	CO6

Books:

Text Books(T):

T1. Roger S Pressman "Software Engineering : A Practitioner's Approach " 7th Edition Mcgraw-Hill ISBN:0073375977

T2. Ian Sommerville " Software Engineering" 9th edition Pearson Education SBN-13: 978-0-13-703515-1, ISBN-10: 0-13-703515-2 , pdf downloadable.

T3. Jim Arlow, Ila Neustadt, "UML 2 and the unified process –practical object-oriented analysis and design" Addison Wesley, Second edition, ISBN 978-0201770605

Reference Books(R)

R1. Pankaj Jalote " An Integrated Approach to Software Engineering" 3rd Edition Narosa Publication ISBN: 81-7319-702-4 pdf down loadable.

R2. Rajib Mall " Fundamentals of Software Engineering" 3rd edition PHI
R3. Gardy Booch, James Rambaugh, Ivar Jacobson, "The unified modeling language user guide" , Pearson Education, Second edition, 2008, ISBN 0-321-24562-8

CO305C: Data Mining			
Teaching Scheme	**Examination Scheme**		
Lectures:	**3 hrs/week**	**Continuous Assessment:**	**20 Marks**
		In-Sem Exam:	**30 Marks**
Credits:	**3**	**End-Sem Exam:**	**50 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	1	1	1	2	2	1	3	2	3
CO2	3	2	2	3	2	2	1	1	1	2	2	1	3	2	3
CO3	2	2	3	2	2	2	1	1	1	2	2	1	1	3	2

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

Course Contents

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 and decimal scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data Discretization: Binning, Histogram Analysis.	6 Hrs.	CO2
Unit-III	**Data Warehouse**	No.of Hours	COs
	Data Warehouse, Operational Database Systems and Data Warehouses(OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model, Concept Hierarchies, Data Warehouse Architecture, The Process of Data Warehouse Design, A three-tier data warehousing architecture,Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP.	6 Hrs.	CO3
Unit-IV	**Cluster Analysis: Measuring Similarity & Dissimilarity**	No.of Hours	COs

	Measuring Data Similarity and Dissimilarity, Proximity Measures for Nominal Attributes and Binary Attributes, interval scaled; Dissimilarity of Numeric Data: 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	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 UniversityPress, ISBN:9781316614808.			
Reference Books: R1. Vipin Kumar, "Introduction to Data Mining", Pearson, ISBN-13: 978-0321321367ISBN-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 FrancisGroup, ISBN9781482234893
R6. Carlo Vercellis, “Business Intelligence - Data Mining and Optimization for Decision Making”,Wiley Publications, ISBN: 9780470753866

CO306: Computer Network Laboratory		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work: 50 Marks**	
Credits: 1	**Total:**	**50 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	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1	2	2	3	-	2	2	1	-	1	-	1	1	3	3	3
CO2	1	1	3	-	1	-	-	-	-	-	-	-	3	3	3
CO3	1	2	1	-	1	-	-	-	-	-	-	-	3	3	3
CO4	2	2	2	-	1	-	-	-	-	-	-	1	3	3	3
CO5	1	1	1	1	1	-	-	-	-	-	-	1	3	3	3
CO6	1	3	3	1	3	2	-	-	-	-	-	2	3	3	3

List of Assignments

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.
3. Write a program to demonstrate subnetting and find the subnet masks.
4. Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window protocol.
5. Write a program using TCP socket for wired network for following:
   a. Say Hello to Each other b. File transfer c. Calculator (Arithmetic)
6. Write a program using UDP socket for wired network for following:
   a. Say Hello to Each other b. File transfer c. Calculator (Arithmetic)
7. Install and configure DHCP server.
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 packet Tracer.

CO307: Database Management System Laboratory			
Teaching Scheme		**Examination Scheme**	
Practical :	**2 Hrs. / Week**	**Term Work:**	
Credits:	**1**	**Practical Exam:**	**50 Marks**
		Total:	**50 Marks**

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Prerequisite Course: (if any) 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	PO 7	PO 8	PO 9	PO 1 0	PO 1 1	PO 1 2	PS O1	PS O2	PSO 3
CO1	3	3	-	3	3	-	1	1	2	3	2	3	3	3	3
CO 2	3	3	2	3	3	-	3	3	2	3	2	3	3	3	3
CO 3	3	3	2	3	1	-	2	1	2	3	2	3	3	3	3
CO 4	3	3	3	3	2	-	2	3	2	3	2	3	3	3	3
CO 5	3	3	3	3	1	-	3	3	2	3	2	3	3	3	3
CO 6	3	3	3	3	3	-	3	3	-	3	2	3	3	3	3

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 DevelopSQL 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, alltypes 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 thenfine 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. 5per 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 abovestatement.**
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 datashould be skipped. **Frame the separate problem statement for writing PL/SQL block to implement alltypes of Cursors inline with above statement. The problem statement should clearly statethe requirements.**
5	PL/SQL Stored Procedure and Stored Function. Write a Stored Procedure namely proc_Grade for the categorization of student. If marksscored 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 firstclass, 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 therecords 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 withabove 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) andimport 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 ratingsof 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 conceptscovered in Part C, students in group are expected to design and develop databaseapplication 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
13	Using the database concepts covered in Part-A & Part-B & connectivity conceptscovered in Part C, students in group are expected to design and develop databaseapplication 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

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/

CO308 B: Software Engineering and Design Lab			
Teaching Scheme		**Examination Scheme**	
Practical:	**2 Hrs. / Week**	**Oral:**	**50 Marks**
Credits:	1	**Total:**	**50 Marks**

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Prerequisite Course: Computer Fundamentals and Programming

==========

Course Objectives:

1. To learn and understand the principles of software engineering
2. To be acquainted with methods of capturing,specifying,visualizing and analysing s/w requirements.
3. To apply project planning and management to software project development
4. To apply design principles to software project development.
5. To understand and apply Object Oriented concept for designing OO based model/application.
6. To choose and use modern design tools for software project development .

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

Course Outcomes	**Bloom's Taxonomy**	
	Level	**Descriptor**
1. Decide process model for developing a software project	2	Understand
2. Analyze the problem statement (SRS) and choose proper design technique for designing web- based/ desktop application	4	Analyse
3. Apply Project Planning and Management to s/w project development	3	Apply
4. Design and analyze an application using UML modeling as fundamental tool	4	Analyse
5. Apply Object Oriented design for s/w project development	3	Apply
6. Decide and apply appropriate modern tool for designing and modeling	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
CO2	2	2	-	-	-	-	-	-	-	-	-	2	3	3	2
CO3	2	2	2	-	-	-	-	-	-	-	-	1	3	3	2
CO4	2	2	2	-	-	-	-	-	-	-	-	2	3	3	2
CO5	2	2	2	-	-	-	-	-	-	-	-	1	3	3	2
CO6	2	-	1	-	1	-	-	-	-	-	-	2	3	3	2

Suggested List of Assignments

Lab Instructor should ask students to perform following assignments by considering different applications such as Banking,Library Management system,Hospital Management System etc.

1.For the system under consideration perform detailed requirements analysis.

2. Identify different use cases and draw the use case diagram for the system to be developed using UML tool.

3.Identify different classes for the system to be implemented and draw the class diagram with different relationships using UML tool.

4.Draw the activity diagram by identifying different operations in the system.

5.Draw the state diagram with different states.Also show the events and transitions.

6.Identify objects,actors and draw the sequence diagram for the system.

7. Draw the Deployment diagram for the system with different hardware devices.

CO308 C: DATA MINING 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	1	1	1	2	2	1	3	2	3
CO2	3	2	2	3	2	2	1	1	1	2	2	1	3	2	3
CO3	2	2	3	2	2	2	1	1	1	2	2	1	1	3	2
CO4	2	2	2	3	2	2	1	1	1	2	2	1	3	2	3
CO5	3	2	3	3	3	3	1	1	1	2	2	1	2	2	3
CO6	2	3	3	3	3	2	1	1	1	2	2	1	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

CO309 :Mini Project Based on Skill based Credit Course			
Teaching Scheme		**Examination Scheme**	
Practical	**2 Hrs. / Week**	**TW**	**50 Marks**
Credits:	**1**	**Total:**	**50 Marks**

COURSE INTRODUCTION

The mini project is designed to help students develop practical ability and knowledge about practical tools/techniques in order to solve real life problems related to the industry, academic institutions and computer science research. The course Mini Project is one that involves practical work for understanding and solving problems in the field of computing.

Any computer science project usually consists of the following: analysis, design, coding/implementation and testing of some information system or subsystem, such as, a piece of software.

The subsystem does not have to be a computer program; a design document might be the appropriate output from a design study. The design and development of hardware system/subsystems would also be an appropriate project; however, in this course we expect a software system or subsystem. This course will also develop your investigative, research and report writing skills and will provide an opportunity for you to investigate a chosen topic in considerable depth. Mini Project provides the opportunity for students todemonstrate the application of their programming and research skills, and to apply their knowledge tocomplex computing problems.

The Mini Project is not only a part of the coursework, but also a mechanism to demonstrate your abilities and specialization. It provides the opportunity for you to demonstrate originality, teamwork, inspiration, planning and organization in a software project, and to put into practice some of the techniques you have been taught throughout the previous courses. The Mini Project is important for a number of reasons. It provides students with:

• Opportunity to specialize in specific areas of computer science;

• Future employers will most likely ask you about your project at interview;

• Opportunity to demonstrate a wide range of skills and knowledge learned, and

• encourages integration of knowledge gained in the previous course units.

The project report is an extremely important aspect of the project. It serves to show what you have achieved and should demonstrate that:

You understand the wider context of computing by relating your choice of the

Project, and the approach you take, to existing products or research.

• You can apply the theoretical and practical techniques taught in the course to the problem, you are addressing and that you understand their relevance to the wider world of computing.

• You are capable of objectively criticizing your own work and making constructive suggestions for improvements or further work based on your experiences so far.

• You can explain your thinking and working processes clearly and concisely to others through your project report.

Common Instructions to Students:

1. Students should remain in contact with the concerned Guide for deciding scope, sharing of learning materials etc. for the completion of mini projects.
2. Students will complete their Mini-project report and submit a soft copy as per suggested format, after discussion within the group so that it will represent a group work.

Suggested format for the Report of Mini-Project

Mini-project report may be of 25 to 40 page write up including Title page, certificate, acknowledgement, Contents, Introduction, Objectives, methodology, Literature review, actual contribution including extended work, photos of actual work done, tables, observations, Graphs, figures, good photos from literature for better explanation, Letter of interaction with outside industry /institute/ individuals, paper details in journal or participation certificate in conference, seminar, paper, email correspondence, Appendix if any, list of references in standard format (alphabetically) as per standard journal paper.

All write up will be in Microsoft Word, page set A4 size, Text font 12 Times in Roman, Main heading may be 14 or 16 font size, maintain uniformity, No page border, and include page numbers. Additional files after all corrections can be made in pdf format with proper file name.

Suggested format for Mini-project

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 theguidance 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.

MC 310: 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

CO311: Internet Of Things (IOT)			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4 Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	**4**	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Digital Electronics, Computer Network

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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 introduce learners to a set of advanced topics in embedded IoT and lead them to understand research in networks.
3. To develop a comprehensive approach towards building small low cost embedded IoT applications.
4. To learn to implement secure infrastructure for 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 and the needs of embedded system components for the Internet of Things.	2	Understand
2) Explain what is IoT, its enabling technologies for developing systems with its emergence along with security challenges.	2	Understand
3) Apply knowledge of IoT application design methodology for designing and implementing IoT applications.	3	Apply
4) Classify IoT protocols for making IoT devices communication in real time applications.	4	Analyse

5) Design an IoT application to work with cloud computing architecture.	3	Apply
6) Survey IoT applications based on the knowledge of security measures	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	1	2	-	-	-	-	-	-	-	-	-
CO2	2	1	-	1	1	-	-	3	-	-	-	-	-	-	1
CO3	3	3	3	2	1	2	-	-	3	3	2	1	1	3	1
CO4	1	3	1	1	1	2	-	-	-	-	-	-	1	-	-
CO5	2	3	3	2	1	2	2	-	-	-	1	2	1	-	1
CO6	2	1	2	2	1	3	-	-	-	2	-	1	1	-	1

COURSE CONTENTS

Unit I	**Introduction to IOT**	**No. of Hours**	**Cos**
	Embedded Systems: Introduction, Definition, Characteristics of Embedded System, Real time systems, Real time tasks, Processor basics: General Processors in Computer Vs Embedded Processors, Microcontrollers, Microcontroller Properties, Components of Microcontrollers, System-On-Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.	6	CO1
Unit II	**Internet of Things: Concepts**	**No. of Hours**	**Cos**
	IoT: Definition and characteristics of IoT, Internet of Things: Vision, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks, Physical design of IoT: Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog / Digital Conversion, Logical design of IoT: IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT	6	CO2
Unit III	**IoT Platforms Design Methodology**	**No. of Hours**	**Cos**

	Basics of IoT Networking, Networking Components, Internet Structure, Connectivity Technologies, IoT communication models and IoT Communication APIs, Sensor Networks, IoT DesignMethodology, Four pillars of IoT (M2M, SCADA, WSN, DCM) # Case Studies: Home Automation using IoT communication models and IoT Communication APIs.	6	CO3
Unit IV	**IoT Protocols**	**No. of Hours**	**Cos**
	Protocol Standardization for IoT, M2M and WSN Protocols, SCADA and RFID Protocols, Protocols – IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, IP based protocols: 6LoWPAN and RPL, ZigBee Smart Energy 2.0, ETSI TC M2M, Canbus, LoRa. # Case Studies: LoRa based Smart Irrigation System	6	CO4
Unit V	**IoT: Cloud Platforms for IoT**	**No. of Hours**	**Cos**
	Software Defined Networking, Introduction to Cloud Storage Models, Communication API, WAMP: AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework: Django Architecture and application development with Django, Amazon Web Services for IoT, SkyNet IoT Messaging Platform, RESTful Web Service, GRPC, SOAP. #Case Studies: Smart parking, Forest Fire Detection	6	CO5
Unit VI	**IoT Security**	**No. of Hours**	**Cos**
	IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, non-repudiation and availability, Security model for IoT, Challenges in designing IOT applications, lightweight cryptography #Case Studies: Home Intrusion Detection	6	CO6

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: KeyApplications and Protocols, 2nd Edition,Wiley Publication,ISBN: 978-1-119-99435-0

Reference Books(R):

R1 Dawoud Shenouda Dawoud, Peter Dawoud,Microcontroller and Smart Home Networks, ISBN: 9788770221566, e-ISBN: 9788770221559.

R2 Charles Crowell,IoT - Internet of Things for Beginners: An Easy-to-Understand Introduction to IoT,ISBN-13 : 979-8613100194

R3 David Hanes,Gonzalo Salgueiro,Robert Barton,Jerome Henry -IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things,Cisco Press,ISBN-13: 978-1-58714-456-1 ISBN-10: 1-58714-456-5

R4 David Etter, IoT Security: Practical guide book,amazon kindle,Page numbers source ISBN : 1540335011.

R5 Brian Russell, Drew Van Duren, Practical Internet of Things Security - SecondEdition,Packt Publishing , ISBN: 9781788625821

e-Books:

https://www.iotforall.com/ebooks/an-introduction-to-iot
https://www.qorvo.com/design-hub/ebooks/internet-of-things-for-dummies

MOOC/ Video Lectures available at:

- https://nptel.ac.in/courses/106/105/106105166/
- https://www.udemy.com/course/a-complete-course-on-an-iot-system-design-and-development/
- https://www.coursera.org/learn/iot

https://nptel.ac.in/courses/108/108/108108098/

CO312: System Programming and Operating System			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	**3**	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 Marks**
		Total:	**100 Marks**

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

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Course Objectives:

1. To learn and understand basics of system programming
2. To obtain knowledge of data structures used in design of system software.
3. To learn format of object modules and the loader functions such as linking, relocation, and loading
4. To be familiar with structures and functions of Operating Systems and process management.
5. To learn and understand memory management of operating system.
6. To get acquainted with I/O and File management in operating system

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Identify suitable data structures and design two pass assembler	3	Apply
2. Use suitable data structures and design two pass macro processor and loader	3	Apply
3. Use tools like LEX and YACC to build different phases of compiler.	3	Apply
4. Implement and Analyze the performance of process scheduling algorithms	4	Analyze
5. Demonstrate memory organization and memory management policies	3	Apply
6. Understand I/O, File Management and disk scheduling 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	2	2	-	-	1	3	3	1	1	2	2	2
CO2	2	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO3	3	3	2	2	3	-	-	1	3	3	1	1	2	2	2
CO4	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO5	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO6	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2

COURSE CONTENTS

Unit I	**Introduction and Assemblers**	**No. of Hours**	**COs**
	Introduction: Introduction to Systems Programming, Need of Systems Programming, Software Hierarchy, Types of software: system software and application software, Machine Structure, Machine language and Assembly Language. **Components of System Software:** Assembler, Macro processor, Compiler, Interpreter, Linker, Loader, Debugger, Operating System. **Assemblers:** General design procedure, design of two pass assembler. **Case Study: Study of Debugging tools like GDB**	6	CO1
Unit II	**Macro Processor, Linkers and Loaders**	**No. of Hours**	**COs**
	Macro Processor: Macro instructions, Features of macro facility, Design of two-pass macro processor. **Loaders:** Loader schemes: Compile and go, General Loader Scheme, Absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, overlay structure. Design of an absolute loader, Design of direct linking loader. **Linkers:** Relocation and linking concepts, Design of linker, self relocating programs, Static and dynamic link libraries, **Case Study: GNU M4 Macro Processor**	6	CO2
Unit III	**Compilers and Interpreters**	**No. of Hours**	**COs**
	Role of lexical analysis -parsing & Token, patterns and Lexemes & Lexical Errors, regular definitions for the language constructs & strings, sequences, Comments & Transition diagram for recognition of tokens, reserved words and identifiers, examples **Introduction to Compilers and Interpreters:** General Model of Complier, Program interpretation, Comparison of compiler and Interpreter, Use of Interpreter and components of Interpreter. **Case Study: LEX and YACC specification and features.**	6	CO3

Unit IV	Operating System	No. of Hours	COs
	Operating Systems: Introduction to different types of operating Systems, System Components, OS services, System structure- Layered Approach. **Process Management:** Process Concept- Process states, Process control block, Threads, **Process Scheduling:** Types of process schedulers, Types of scheduling: Preemptive, Non preemptive. Scheduling algorithms: FCFS, SJF, RR, Priority, **Deadlocks:** Methods of handling deadlocks, Deadlock prevention, avoidance and detection, Recovery from deadlocks. **Case Study: Process Management in Windows/Linux/Android**	6	CO4
Unit V	**Memory Management**	**No. of Hours**	**COs**
	Introduction: Memory Management concepts, Memory Management requirements. **Memory management:** Contiguous and non-contiguous, Swapping, Paging,Structure of the Page Table, Segmentation. **Virtual Memory:** Background, Demand paging, Page replacement scheme- FIFO, LRU, Optimal, Thrashing **80386 Programming Model** **Case Study: Memory Management in Windows/Linux/Android**	6	CO5
Unit VI	**I/O and File Management**	**No. of Hours**	**COs**
	I/O Management: I/O Devices, Organization of I/O function, I/O Buffering, Disk Scheduling- Disk Scheduling policies like FIFO, LIFO, STTF, SCAN, C-SCAN. **File Management:** File Concept, Access methods, Directory andDisk Structure, Protection, File System Structure, File System implementation, Directory Implementation, Allocation methods, Free Space management. **Case study: UNIX File system, Operating System Virtualization**	6	CO6

Books:

Text Books(T):

1. John Donovan, “System Programming”, McGraw Hill, ISBN 978-0--07-460482-3.
2. Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 – 4

Silberschatz, Galvin, Gagne, "Operating System Principles", 9th Edition, Wiley, ISBN978-1-118-06333-0

Reference Books(R):

1. Alfred V.Aho,Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, “Compilers-Principles,Techniques and Tools”, Pearson,ISBN:978-81-317-2101-8
2. 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

e-Books :

1. https://www.elsevier.com/books/systems-programming/anthony/978-0-12-800729-7
2. https://www.kobo.com/us/en/ebook/linux-system-programming-1
3. https://www.ebooks.com/en-us/subjects/computers-operating-systems-ebooks/279/

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

MOOCs Courses Links:

1. https://www.udacity.com/course/introduction-to-operating-systems--ud923
2. nptel video lecture link: https://nptel.ac.in/courses/106/105/106105214/
3. https://www.edx.org/course/computer-hardware-and-operating-systems
4. https://onlinecourses.nptel.ac.in/noc19_cs50/preview

https://www.udemy.com/course/system-programming/

CO313: Web Technology			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	**3**	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 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 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. **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 to **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	2	3	3	2	3	2	1	3	3	3	1	3	2	3	3
CO2	2	3	3	2	3	2	1	3	3	3	1	3	3	3	3
CO3	2	3	3	2	3	2	1	3	3	3	1	3	3	3	3
CO4	2	3	3	2	3	2	1	3	3	3	1	3	3	3	3
CO5	3	3	3	2	3	2	1	3	3	3	1	3	3	3	3
CO6	3	3	3	2	3	2	1	3	3	3	1	3	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 DirectivesControllers, Filters, Forms, Modules, Ajax in AngularJS, Routing, Introduction to SPA, Creating HTML Templates, Configuring Route Provider.	7	CO3 CO4
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 directorystructure, 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 servletand 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:

Sr. No.	Authors	Title	Edition	Year	Publication
1	Laura Lemay	Mastering HTML, CSS & JavaScript	First	2016	BPB Publication
2	Juha Hinkula	Full Stack Development with Spring Boot and React	3rd	2013	Paperback

3	Ken Williamson	Learning AngularJS: A Guide to AngularJS Development	1st	2015	O'Reilly Media, Inc.
4	Ivan Bayross	Java Server Programming	2nd	2008	Shroff Publishers

References Books:

Sr. No.	Authors	Title	Edition	Year	Publication
1	Herbert Schildt	Java The complete Reference	9th	2014	McGraw Hill Education
2	Greg L. Turnquist	Learning Spring Boot 2.0	2nd	2017	Packt Publishing
3	KOGENT Learning Solutions Inc.	Web Technologies HTML, Javascript, PHP, Java, JSP, XML and Ajax	1st	2014	Dreamtech Press

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	PSO3
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	-	-	-	-

Course Contents

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 · Registration procedure of Copyrights · Infringement (piracy) of Copyrights and Remedies · Copyrights over software and hardware	4 Hrs.	4
Unit 5	**Entrepreneurship: Introduction**	**No.of Hours**	**COs**
	5.1**Concept and Definitions**: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development,A	4	5

	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.		
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 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**	4	
	Text Books: • Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI, New Delhi • The Indian Patent act 1970. • The copyright act 1957		

- Manual of patent office practice and procedure of Govt. of India.
- Manual of Designs Practice and Procedure of Govt. India
- Manual of Trademarks Practice and Procedure of Govt. India
- Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India
- Intellectual Property Rights- A Primer, R. Anita Rao & Bhanoji, Rao, Eastern BookCo.
- The Dynamics of Entrepreneurial Development & Management by Desai, Vasant, HimalayaPublishing House, Delhi.
- Managing Small Business by Longenecker, Moore, Petty and Palich, Cengage Learning,India Edition.
- Cases in Entrepreneurship by Morse and Mitchell, Sage South Asia Edition.
- Entrepreneurship – Indian Cases on Change Agents by K Ramchandran, TMGH.

Reference Books:

1. Handbook of Indian Patent Law and Practice,
2. Entrepreneurship: 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.

CO314A: Software Testing and Quality Assurance (STQA)			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	**3**	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Software Engineering & Design

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Course Objectives:

1. To 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 analyse 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	PSO3
CO1	2	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO2	2	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO3	3	3	2	2	3	-	-	1	3	3	1	1	2	2	2
CO4	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO5	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO6	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2

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, Test Plan, Introduction Testing Strategies	Hrs.6	CO1
Unit-II	**Black Box Testing**	No. of Hours	
	Introduction, 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 of Black- Box testing.	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 of White-Box testing.	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.	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:	Hrs.6	CO5
Unit-VI	**Automation Testing**	No. of Hours	
	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,	Hrs.8	CO6

	2.Junit or JMeter 3. Basic Mobile Testing Too: opium		

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

CO314B: Cloud Computing (Professional Elective-II)			
Teaching Scheme		**Examination Scheme**	
Lectures: 3 Hrs. / Week		**Continuous Assessment:**	**20 Marks**
Credits: 3		**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Computer Network, Operating System

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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 uses 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 fundamentals and roots of cloud computing	2	Understand
2. **Install and create** virtualization environments that forms the basisfor cloud	3	Apply
3. **Apply** security to cloud applications and data.	3	Apply
4. Study and **Analyse** different cloud file systems. Compare available cloud file systems	4	Analyse
5. **Use** cloud platforms like AWS and Microsoft Azure.	3	Apply
6. Understand the future of Cloud Computing and **create** Docker.	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	PSO2	PSO3
CO1	3	-	-	-	-	-	-	1	3	3	1	1	-	-	1
CO2	3	3	1	2	3	2	3	1	3	3	1	1	1	1	1
CO3	3	3	1	2	3	-	-	1	3	3	1	1	1	1	1
CO4	3	3	1	2	3	2	1	1	3	3	1	1	1	1	1
CO5	2	3	1	2	3	2	3	1	3	3	1	1	1	1	1
CO6	2	2	1	-	2	-	-	1	3	3	1	1	1	-	-

COURSE CONTENTS

Unit I	**INTRODUCTION TO CLOUD COMPUTING**	**No. of Hours**	**COs**
	Cloud Computing Basics, History of Cloud Computing, Importance of Cloud Computing in the Current Era, Characteristics of Cloud Computing, What Cloud Computing Really Is? Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing, Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Model, Cloud Service Models: SaaS, PaaS, IaaS,	6	CO1
Unit II	**VIRTUALIZATION**	**No. of Hours**	**COs**
	Definition of Virtualization, Adopting Virtualization Types of Virtualization, Examples, Virtual Machines Programming Languages, Server Virtualization, OS Virtualization, Storage Virtualization, Network Virtualization, Virtualization Architecture and Software, The Virtualization Architecture, Virtual Clustering Web services, AJAX and mashups: Web services: SOAP and REST, SOAP versus REST , AJAX: asynchronous 'rich' interfaces , Mashups: user interface services	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, 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.	**6**	**CO3**
Unit IV	**DATA STORAGE AND CLOUD COMPUTING**	**No. of Hours**	**COs**
	Introduction to Enterprise Data Storage: Data Storage Management, File Systems, Cloud Data Stores, Using Grids for Data Storage, What is Cloud Storage? :, Overview of Cloud Storage, Data Management for Cloud Storage, Cloud Data Management Interface (CDMI) , Cloud Storage Requirements **Cloud Storage from LANs to WANs:** Introduction, Cloud Characteristic, Distributed Data Storage, Applications Utilizing Cloud Storage **Data in the cloud** : Relational databases, 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: Understanding Amazon Web Services , Amazon Web Service Components and Services , Working with the ElasticCompute 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 :** 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	7	CO4
Unit VI	**FUTURE OF CLOUD COMPUTING**	**No. of Hours**	**COs**

	Future Trends, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud , Energy Aware Cloud Computing , JungleComputing, **Case Study :** Hospital Lowers IT Costs andImproves Clinician Productivity with Virtual Desktops **Docker at a Glance:** Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.	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. Barrie Sosinsky, "Cloud Computing Bible" , Wiley Publications, ISBN: 978-0-470-90356-8.T3. Gautam Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications"Cambridge University Press , ISBN 978-0-521-13735-5

T4. Karl Matthias and Sean P. Kane, "Docker: Up and Running", O'Reilly , 978-1-49191757-2

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.

CO314 C: Soft Computing (Professional Elective-II)			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3Hrs. / Week**	**Continuous Assessment:**	**20 Marks**
Credits:	**3**	**In-Sem Exam:**	**30 Marks**
		End-Sem Exam:	**50 Marks**
		Total:	**100 Marks**

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Prerequisite Course: (if any) : Mathematical background, Proficiency with algorithms, Programming Skills, Critical thinking and problem solving skill

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Course Objectives:

1. To know the basics behind the Design and development of intelligent systems in the framework of soft computing.
2. To acquire knowledge of Artificial Neural Networks Fuzzy sets, Fuzzy Logic, Evolutionary computing and swarm intelligence.
3. To explore the applications of soft computing.
4. To understand the need of optimization.

Course Outcomes (COs):

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

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand and explore the soft computing methodologies, such as ANN.	2	Understand
CO2	Understand and apply ANNs methodologies	3	Apply
CO3	Design and development of certain scientific and commercial application using ANNs	6	Create
CO4	Understand and analyze certain scientific and commercial application using Fuzzy logic	4	Analyze
CO5	Understand and explore the soft computing methodologies such as Genetic algorithms	3	Understand
CO6	Understand and Develop the soft computing application	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	-	2	3	-	-	1	-	-	-	3	1	1	2
CO2	3	3	-	2	3	-	-	1	-	-	-	3	1	1	2
CO3	3	3	2	3	3	-	-	1	2	2	2	3	2	3	3
CO4	3	3	2	3	3	-	-	1	2	2	2	3	1	1	2
CO5	3	2	-	2	3	-	-	1	-	-	-	3	1	1	2
CO6	3	3	2	3	3	2	2	1	2	2	2	3	2	3	3

Course Contents

Unit-I	**Introduction to Soft Computing**	No.of Hours	COs
	Introduction, soft computing vs. hard computing,various types of soft computing techniques, and applications of soft computing. Basic tools of soft computing – Fuzzy logic, neural network, evolutionary computing. Introduction to Hybrid Soft computing Techniques, Applications of Soft computing,	8Hrs.	CO1

Unit-II	**Artificial Neural Networks : An Introduction**	No.of Hours	COs
	Fundamental Concepts, Evolution of Neural Network, Basic Model of Artificial Neural Network, Important terminologies of ANNs, Mc-Culloch – Pitts Neuron, Hebb Network	8Hrs.	CO2

Unit-III	**Artificial Neural Networks : Learning Rule & Types ofANNs Network**	No.of Hours	COs
	Supervised Learning Networks, Associative Memory Networks, Unsupervised Learning Networks, Back Propagation Networks, Back Propagation Learning, Special Networks, ANNs Applications	8Hrs.	CO3

Unit-IV	**Fuzzy Systems**	No.of Hours	COs
	Introduction to fuzzy logic, classical sets and Fuzzy sets , Classical Relations and Fuzzy relations, membership functions, Fuzzy arithmetic and fuzzy measures, Fuzzy Rule Base and approximate	8Hrs.	CO4

	Reasoning, Fuzzy Decision Making, Fuzzy Logic Control Systems. Defuzzification,		
Unit-V	**Genetic Algorithm**	No.of Hours	Cos
	Introduction, Biological Background, Traditional Optimization and Search Techniques, Genetic Algorithm and Search Space, Simple GA, Operations in Genetic Algorithm- Encoding, Selection,Crossover, Mutation, Stopping condition for Genetic Flow, Constraints in Genetic Algorithm, Problem Solving using GA, Classification of Genetic Algorithm, Holland Classifier Systems, Genetic Programming, Advantages and Limitations of GA, Applications of GA	8Hrs.	CO5
Unit-VI	**Applications of Soft computing and Hybrid Soft Computing Techniques**	No.of Hours	Cos
	Introduction, A Fusion Approach of Multi spectral Images with SAR (Synthetic Aperture Radar), Optimization of Traveling Salesman Problem using Genetic Algorithm Approach, Soft Computing Based Hybrid Fuzzy Controllers, Soft Computing Based Rocket Engine Control. Nero-Fuzzy Hybrid Systems, Genetic Nero-Hybrid Systems.	8Hrs.	CO6

Books:

Text Books:

1. S.N. Sivanandam- "Principles of Soft Computing", Wiley India- ISBN- 9788126527410
2. S. Rajsekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic
3. Algorithm: Synthesis and Applications" , Prentice Hall of India, ISBN: 0451211243
4. J S R Jang, CT Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing" , PHI PVT LTD,ISBN 0-13-261066-3.
5. De Jong , "Evolutionary Computation: A Unified Approach", Cambridge (Massachusetts):MIT Press. ISBN: 0-262-04194-4. 2006
6. Maurice Clerc, "Particle Swarm Optimization", ISTE, Print ISBN:9781905209040 |Online ISBN:9780470612163 |DOI:10.1002/9780470612163

Reference Books

1. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", 2nd Edition-Wiley India- ISBN: 978-0-470-51250-0

2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems" Oxford University Press, ISBN 10: 0195671546

3. Siman Haykin, "Neural Networks", Prentice Hall of India, ISBN: 0-7923-9475-5

4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" , Wiley India, ISBN: 978-0-470-74376-8.

5. Eiben and Smith, "Introduction to Evolutionary Computation", Springer, ISBN-10:3642072852

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 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
Use IoT embedded platforms for low cost IoT system implementations	3	Apply
Describe various IoT devices, embedded platforms, programming environments for IoT systems	2	Understand
Demonstrate the small system for sensor-based application.	3	Apply
Solve the problems related to the primitive needs using IoT.	3	Apply
Demonstrate IoT application for distributed environment.	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	2	1	-	-	-	-	3	-	1	2	2	1
CO2	2	1	3	2	3	-	-	-	-	3	-	1	3	3	1

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

Suggested List of Assignment

[Students have to complete at list 8 assignment towards the successful completion of Term Work, where all the implementation and design assignments are compulsory]

Group A [All assignments are compulsory**]**

1. Study of sensors and actuators used for IOT and create a report on it.
2. Identify different boards like Raspberry-Pi, Beagle board, Arduino and other microcontrollers.
3. Study of different operating systems for Raspberry-Pi /Beaglebone / Arduino. Understanding the process of installing the OS on Raspberry-Pi / Beaglebone / Arduino.
4. Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO and its use in programs.
5. Survey of different commercial and open-source clouds, create a report on it.

Group B [All assignments are compulsory**]**

6. Implementation of temperature control using Arduino Uno as master and ESP8266 sensor as slave and upload the data on think speak.
7. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor. Write an application to detect obstacles and notify users using LEDs.
8. Control different appliances through Node MCU / different boards using locally hosted websites.

Group C [Any one**]**

9. Implementation of "Home Atomization" using Raspberry-Pi.
10. Design any one IOT based application.

CO318: System Programming and Operating System Lab			
Teaching Scheme		**Examination Scheme**	
Lectures:	**2 Hrs. / Week**	**PR Exam:**	**50 Marks**
Credits:	**1**	**TW:**	**Marks**
		Continuous Assessment:	
		Total:	**50 Marks**

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

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Course Objectives:

1. To understand the design of two pass assembler.
2. To learn the design of two pass macro-processor.
3. To get acquainted with tools like LEX & YACC.
4. To be familiar with Preemptive and Non-Preemptive Scheduling Schemes.
5. To acquire knowledge of UNIX system calls
6. To learn and understand noncontiguous memory allocation technique like paging.

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Design and Implement Two Pass Assembler	3	Apply
2. Design and Implement Two Pass Macro-processor	3	Apply
3. Handle tools like LEX & YACC	3	Apply
4. Analyze and Implement Preemptive and Non-Preemptive process scheduling schemes	4	Analyze
5. Implement UNIX system calls	3	Apply
6. Demonstrate and Implement different page replacement policies	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	2	2	-	-	1	3	3	1	1	2	2	2
CO2	2	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO3	3	3	2	2	3	-	-	1	3	3	1	1	2	2	2
CO4	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO5	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2
CO6	3	3	2	2	2	-	-	1	3	3	1	1	2	2	2

Guidelines for Student Journal

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

1. Design suitable data structures and implement pass-I of a two-pass assembler for apseudo-machine using object-oriented feature. Implementation should consist of a few instructions from each category and few assembler directives.
2. Implement Pass-II of two pass assembler for a pseudo-machine using object-oriented features.The output of assignment-1 (intermediate file and symbol table) should be input for this assignment.
3. Design suitable data structures and implement pass-I of a two-pass macro-processor using OOP features.
4. Write a program for pass-II of a two-pass macro-processor. The output of assignment-3 (MNT, MDT and file without any macro definitions) should be input for this assignment.
5. Write a program using Lex specifications to implement lexical analysis phase of compiler to generate tokens of subset of ‘C’ program.
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 following CPU scheduling algorithms: FCFS, SJF (Non Preemptive), Priority (Non-Preemptive) and Round Robin (Preemptive)

9. Implement UNIX system calls like ps, fork, join, exec family, and wait for process management (use shell script/ Java/ C programming).

10. Write a Program to implement page replacement simulation using following algorithms
    1. FIFO 2. LRU and 3. Optimal

Books:

Text Books(T):

1. John Donovan, “System Programming”, McGraw Hill, ISBN 978-0--07-460482-3.
2. Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 – 4
3. Silberschatz, Galvin, Gagne, "Operating System Principles", 9th Edition, Wiley, ISBN 978-1-118-06333-0

Reference Books(R):

1. Alfred V.Aho,Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, “Compilers-Principles,Techniques and Tools”, Pearson,ISBN:978-81-317-2101-8
2. John R. Levine, Tony Mason, Doug Brown, “Lex and Yacc”, O’Reilly & Associates, Inc, ISBN:1-56592-000-7

CO319: Web Technology Lab			
Teaching Scheme		**Examination Scheme**	
Practical:	**2 Hrs. / Week**	**Oral 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.	3	**Apply**
2. **Apply** knowledge of the client side technologies for web development.	3	**Apply**
3**. Understand** architecture of AngularJS and to **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):

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

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 and adopt the process of project management.	2	Understand
CO2	**Identify and develop an application using suitable software and hardware.**	4	Analyze
CO3	**Apply** different testing methods and tools.	3	Apply
CO4	**Apply** their knowledge to participate in 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**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO3**
CO1	2	2	2	1	2	2	1	1	3	2	1	2	2	2	2
CO2	3	3	3	3	3	2	1	1	3	2	1	2	2	2	2
CO3	3	3	3	3	3	2	1	1	3	2	1	2	2	2	2

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

Subject Description:

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

Guidelines

I] Compulsory Activities

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

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

Bucket 1: Certification

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

Bucket 2: Publication

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

OR

Presentation and Publication in National or International conference.

Bucket 3: Achievement

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

Bucket 4: Product Development and Projects

End product development and Patent

OR

Winner in State or National project competition.

OR

Project Presented at National Level competition.

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

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

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

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

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

The specific objectives, however, are as follows.

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

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

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

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

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

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

B. Tech. Computer Engineering

2020 Pattern

Curriculum

(B. Tech. Sem-VII & VIII 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 Final Year Computer Engineering Program Curriculum Structure and Syllabus for semester VII & VIII of Pattern 2020 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

Dr. A.B. Pawar
Dean Academics

Director
Sanjivani College of Engineering
Kopargaon

Director

SRES's Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to SPPU Pune)

COURSE STRUCTURE- 2020 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING

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

SRES's Sanjivani College of Engineering, Kopargaon

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COURSE STRUCTURE- 2020 PATTERN

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

SEMESTER VII

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme						
			L (hrs)	T (hrs)	P (hrs)	Credits	Theory			Practical			Grand Total
							CIA	ISE	ESE	TW	OR	PR	
PCC	CO401	High Performance Computing	3	-	-	3	20	30	50	-	-	-	100
PCC	CO402	Machine Learning	4	-	-	4	20	30	50	-	-	-	100
PCC	CO403	Cryptography and Network Security	3	-	-	3	20	30	50	-	-	-	100
PEC	CO404	Professional Elective – III	3	-	-	3	20	30	50	-	-	-	100
PEC	CO405	Professional Elective – IV	3	-	-	3	20	30	50	-	-	-	100
LC	CO406	High Performance Computing Laboratory	-	-	2	1	-	-	-	50	-		50
LC	CO407	Machine Learning Laboratory	-	-	2	1	-	-	-		-	50	50
LC	CO408	Cryptography and Network Security Laboratory	-	-	2	1	-	-	-		50	-	50
PROJ	CO409	Project Stage- I		-	6	3		-	-	100	50	-	150
MLC	MC410	Mandatory Learning Course-VII	1	-	-	NC	-	-	-	-	-	-	**PASS/ FAIL**
Total			17	-	12	22	100	150	250	150	100	50	**800**

Mandatory Learning Course-VII: Financially Smart

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

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COURSE STRUCTURE- 2020 PATTERN

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

SEMESTER VIII

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			
			L (hrs)	T(hrs)	P (hrs)	Credits	CIA	ISE	ESE	TW	OR	P R	Grand Total
PCC	CO411	Open Elective -I	3	-	-	3	25	-	75	-	-	-	100
PCC	CO412	Open Elective -II	3	-	-	3	25	-	75	-	-	-	100
PCC	CO413	Open Elective –III	2	-	-	2	25	-	75	-	-	-	100
PROJ	CO414	Professional Internship			12	6				100	50		150
PROJ	CO415	Project Stage- II	-	-	4	2	-	-	-	-	50	-	50
Total			8	-	16	16	75	-	225	100	100	-	**500**

Open Elective-I
CO411 A Ethical Hacking
CO411 B Introduction to Game Theory and Mechanism Design
CO411 C Design and Implementation of Human-Computer Interfaces
CO411 D Learning Analytics Tools

Open Elective-II
CO412 A Parameterized Algorithm
CO412 B Deep Learning for Computer Vision
CO412 C Introduction to Industry 4.0 and Industrial IOT

Open Elective-III
CO413 A Innovation, Business Models and Entrepreneurship
CO413 B Knowledge Management
CO413 C Services Marketing: Integration People, Technology, Strategy

SEMESTER VII

CO401: High Performance Computing	
Teaching Scheme	**Evaluation Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA): 20 Marks**
Credits: 3	**In-Sem Exam (ISE): 30 Marks**
	End-Sem Exam (ESE): 50 Marks
	Total: 100 Marks

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

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Course Objectives:

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

Course Outcomes (COs):

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

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

	frameworks.		

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

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

Course Contents

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

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

	CUDA- C. Apache Hadoop, Apache Spark, Apache Flink, OpenCL,		

Books:

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason sanders, Edward Kandrot, “CUDA by Example”, Addison-Wesley, ISBN-13: 978-0-13-138768-3.

Reference Books:

1. Kai Hwang, ”Scalable Parallel Computing”, McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, “CUDA Programming: A Developer's Guide to Parallel Computing with GPUs”, Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
3. David Culler Jaswinder Pal Singh, ”Parallel Computer Architecture: A Hardware/Software Approach”, Morgan Kaufmann,1999, ISBN 978-1-55860-343-1
4. Rod Stephens, “ Essential Algorithms”, Wiley, ISBN: *ISBN*: 978-1-118-61210-1.

E-Resources:-

1. https://nptel.ac.in/courses/106102163

CO402: Machine Learning	
Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs. / Week	**Continuous Internal Assessment (CIA): 20 Marks**
	In-Sem Exam (ISE): 30 Marks
Credits: 4	**End-Sem Exam (ESE): 50 Marks**
	Total: 100 Marks

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

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Course Objectives:

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

Course Outcomes (COs):

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

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

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

(PSOs):

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

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

Course Contents

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

	Robust regression with random sample consensus, Polynomial regression, Isotonic regression, **Logistic regression**-Linear classification, Logistic regression, Implementation and Optimizations, Stochastic gradient descendent algorithms, Finding the optimal hyper-parameters through grid search, Classification metric, ROC Curve.		
Unit-IV	**BAYESIAN AND SVM TECHNIQUES**	No.of Hours	COs
	Bayes Theorom, Naïve Bayes Classifiers, Naïve Bayes in Scikit-learn- Bernoulli Naïve Bayes,Multinomial Naïve Bayes, and Gaussian Naïve Bayes. Support Vector Machine(SVM)- Linear Support Vector Machines, Scikit- learn implementation Linear Classification, Kernel based classification, Non- linear Examples. Controlled Support Vector Machines, Support Vector Regression.	7 Hrs.	CO 4
Unit-V	**CLASSIFICATION AND ENSEMBLE LEARNING**	No.of Hours	COs
	Decision Trees- Impurity measures, Feature Importance. Decision Tree Classification with Scikitlearn, Ensemble Learning-Random Forest, AdaBoost, Gradient Tree Boosting, Voting Classifier. Introduction to Meta Classifier: Concepts of Weak and eager learner, Ensemble methods, Bagging, Boosting, Random Forests.K-NN Algorithms	7 Hrs.	CO 5
Unit-VI	**CLUSTERING TECHNIQUES**		
	Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index. Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering- Dendrograms, Agglomerative clustering in Scikit- learn, Connectivity Constraints	7 Hrs	CO 6
Books:			
Text Books:			

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

Reference Books:

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

e-Resources:

1. https://machinelearningbook.com/

MOOC/ Video Lectures available at:

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

CO403: Cryptography and Network Security	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA): 20 Marks**
	In-Sem Exam(ISE): 30 Marks
Credits: 3	**End-Sem Exam(ESE): 50 Marks**
	Total: 100 Marks

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

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Course Objectives:

1. To offer an understanding of principle concepts, central topics and basic approaches in cryptography and network security.
2. To know the basics of symmetric key cryptography.
3. To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.
4. To apply algorithmic strategies for authentication in cryptography and network security.
5. To develop problem solving abilities using Cyber Security.
6. To enhance awareness about network security solutions against computer-attacks.

Course Outcomes (COs):

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

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Recognize concept of Security needed in Communication of data through computers and networks.	2	Understand
CO2	Understand various Encryption mechanisms for secure transmission of data and management of key required for encryption.	2	Understand
CO3	Understand Encryption mechanisms in Public Key cryptography and implement various encryption techniques.	3	Apply
CO4	Understand authentication requirements and implement various authentication mechanisms	3	Apply

CO5	Apply security tools in various environments for network security.	3	Apply
CO6	Apply appropriate network security solutions against computer-attacks.	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	2	1	3	3	-	2	1	-	-
CO2	3	3	2	2	2	3	3	3	3	3	2	3	2	3	3
CO3	3	3	2	2	2	3	3	3	3	3	2	3	2	3	3
CO4	3	3	1	-	3	3	3	3	3	3	2	3	2	3	3
CO5	3	3	2	3	3	2	3	3	3	3	2	3	1	-	2
CO6	3	3	2	3	3	3	3	3	3	3	2	3	1	-	2

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

Course Contents

Unit-I	**Introduction**	**No. of Hours**	**COs**
	Introduction to Cryptography, Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model. Overview of Network Security, Importance and Challenges of Network Security, Goals and Objectives of Network Security, Basic Terminologies in Network Security. Introduction to Network Protocols, TCP/IP Protocol Suite, Network Architecture and Models (OSI, TCP/IP)	07 Hrs.	CO1
Unit-II	**Symmetric Ciphers**	**No. of Hours**	**COs**
	Math Background: Modular Arithmetic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem Substitution &Transposition Techniques, Block Ciphers (DES, AES) : Feistal Cipher Structure, Simplifies DES, DES, Double and Triple DES, Block Cipher	07 Hrs.	CO2

	design Principles, AES, Modes of Operation		
Unit-III	**Public Key Cryptography**	**No. of Hours**	**COs**
	Principles Of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie- Hellman Key Exchange, Elgamal Algorithm, Elliptic Curve Cryptography, X.509 certificate. Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.	07 Hrs.	CO3
Unit-IV	**Authentication**	**No.of Hours**	**COs**
	Key Management: Key Distribution Techniques, Kerberos, Hash and MAC Algorithms: Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures,	07 Hrs.	CO4
Unit-V	**Network Threats and Vulnerabilities**	**No.of Hours**	**COs**
	Types of Network Threats, Common Network Vulnerabilities, Malware and Virus Attacks, Network Intrusions and Unauthorized Access, DoS and DDoS, Pharming attack, Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting, Ransomware, SQL- injection, Sniffing. Introduction to Ethical Hacking, Anonymity, Information Gathering, Scanning Networks and Tools, Vulnerability Analysis.	07 Hrs.	CO5
Unit-VI	**Security in Networks**	**No.of Hours**	**COs**
	Security in Networks: Firewalls and Intrusion Detection/Prevention Systems (IDS/IPS), Virtual Private Networks (VPNs), Network Access Control (NAC), Secure Sockets Layer/Transport Layer Security (SSL/TLS), Network Security Appliances. Email Security – PGP, S/MIME.	07 Hrs.	CO6
Books:			

Text Books:

1. William Stallings; “Cryptography and Network Security-Principles and Practices” 6th Edition , Pearson Education, 2014, ISBN13:9780133354690.
2. Bernard Menezes, “Network Security and Cryptography”, 1st Edition, Cengage Learning, 2010, ISBN 81-315-1349-1.
3. Raef Meeuwisse, “Cybersecurity for Beginners”, 2nd Edition, Cyber Simplicity, 2017, ISBN-9781911452157.

Reference Books:

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

E-Resources:

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

CO404A: Natural Language Processing			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3 Hrs. / Week**	**Continuous Internal Assessment (CIA):**	**20 Marks**
Credits:	**3**	**In-Sem Exam(ISE):**	**30 Marks**
		End-Sem (ESE):	**50 Marks**
		Total:	**100 Marks**

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

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Course Objectives:

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

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

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

Mapping of COs with POs/PSOs

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

COURSE CONTENTS

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

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

	and their solutions, then build a chatbot using a Reformer model.		

Books:

Text Books:

1. Christopher D.Manning and Hinrich Schutze,, "Foundations of Statistical Natural Language Processing" , MIT Press, 1999
2. Introduction to Natural Language Processing By Jacob Eisenstein
3. Foundation of Statistical Natural Language Processing - Christopher D Manning and Hinrich Schütze.
4. James Allen, "Natural Language Understanding", Pearson Publication, ISBN: 978-81-317-0895- 8 2nd Edition
5. Daniel Jurafsky, James H. Martin, "Speech and Language Processing", Second Edition, Prentice Hall, 2008.
6. Jacob Eisenstein, "An Introduction to Information Retrieval", Cambridge University Press

Reference Books:

1. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems by Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana (Published on June 17, 2020)
2. Nitin Indurkhya and Fred J. Damerau**, "**Handbook of Natural Language Processing", 2nd ed. CRC press
3. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit Paperback – 7 July 2009.

E-Resources:

1. https://www.coursera.org/specializations/natural-language-processing
2. https://onlinecourses.nptel.ac.in/noc23_cs45/preview

CO404 B : DevOps and Cloud	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA): 20 Marks**
	In-Sem Exam(ISE): 30 Marks
Credits: 3	**End-Sem (ESE): 50 Marks**
	Total: 100 Marks

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

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Course Objectives:

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

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

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

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

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

COURSE CONTENTS

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

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

CO404 C: Data Analytics		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA): 20 Marks**	
Credits: 3	**In-Sem Exam (ISE): 30 Marks**	
	End-Sem Exam (ESE): 50 Marks	
	Total: 100 Marks	

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

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Course Objectives:

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

Course Outcomes (COs):

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

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

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

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

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

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

Course Contents

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

	Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream Filtering Streams, Counting Distinct Elements in a Stream Real time Analytics Platform(RTAP) applications .	7 Hrs.	CO 4
Unit-V	**Data Analytics Applications**	No.of Hours	COs
	Application in Industries: Retail, E-commerce, Finance, Sports, Others - healthcare, education, telecom etc. Application in business functions: Marketing Sales, Supply chain management, HR, Others - Finance, IT, Manufacturing and Strategy.	7 Hrs.	CO 5
Unit-VI	**Big Data Visualization**		
	Introduction to Data visualization, Challenges to Big data visualization, Analytics for unstructured data- Use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem- Pig, HIVE, HBase, Mahout, NoSQL. An Analytics Project-Communicating, operationalizing, creating final deliverables.	7 Hrs	CO 6

Books:

Text Books:

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN0-07-120413-X
2. Ashutosh Nandeshwar , "Tableau Data Visualization Codebook", Packt Publishing, ISBN 978-1-84968-978-6
3. Alberto Cordoba, ―Understanding the Predictive Analytics Lifecycle‖, Wiley, 2014
4. Eric Siegel, Thomas H. Davenport, ―Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die‖, Wiley, 2013.

Reference Books:

1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.

2. Mark Gardner, “Beginning R: The Statistical Programming Language”, Wrox Publication, ISBN: 978-1-118-16430-3
3. LuísTorgo, “Data Mining with R, Learning with Case Studies”, CRC Press, Talay and Francis Group, ISBN9781482234893
4. Carlo Vercellis, “Business Intelligence - Data Mining and Optimization for Decision Making”, Wiley Publications, ISBN: 9780470753866.

E-Resources:

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

CO405A: Deep Learning & Soft Computing	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment(CIA): 20 Marks**
	In-Sem Exam(ISE) : 30 Marks
Credits: 3	**End-Sem Exam(ESE): 50 Marks**
	Total: 100 Marks

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

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Course Objectives:

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

Course Outcomes (COs):

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

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

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

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

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

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

Course Contents

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

	level Optimization, Applications of GA in Machine Learning.		
Unit-V	**Convolutional Neural Networks(CNN)**	No.of Hours	COs
	Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation.	07 Hrs.	CO5
Unit-VI	**Recurrent Neural Networks(RNN)**	No.of Hours	COs
	Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs-Recurrent Neural Network Language Models-Word-Level RNNs	07 Hrs.	CO6

Books:

Text Books:

1. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
3. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

Reference Books:

1. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
3. Deep learning, Rajiv Chopra,Khanna book Publishing Co. New Delhi

e-Resources:

2. https://cse.iitkgp.ac.in/~dsamanta/courses/sca/index.html
3. http://www.musaliarcollege.com/e-Books/CSE/introduction-to-soft-computing%20(1).pdf
4. http://www.deeplearningbook.org/
5. http://deeplearning.net/tutorial/deeplearning.pdf
6. http://www.dkriesel.com/en/science/neural_networks

MOOC/ Video Lectures available at:

3. https://nptel.ac.in/courses/106/105/106105173/
4. https://nptel.ac.in/courses/117/105/117105084/
5. https://nptel.ac.in/courses/127/105/127105006

CO405B: Advanced Databases	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA):20 Marks**
Credits: 3	**In-Sem Exam(ISE): 30 Marks**
	End-Sem Exam(ESE) : 60 Marks
	Total: 100 Marks

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Prerequisite Course: (if any) Database Management System Concepts

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Course 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): https://in.coursera.org/learn/Advanceddatabase

CO405C: Blockchain Technology	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs. / Week	**Continuous Internal Assessment (CIA):20 Marks**
Credits: 3	**In-Sem Exam(ISE): 30 Marks**
	End-Sem Exam(ESE) : 50 Marks
	Total: 100 Marks

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

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Course Objectives:

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

Course Outcomes (COs):

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

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

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

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

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

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

Course Contents

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

	Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks	06 Hrs.	CO5
Unit-VI	**Blockchain Use Cases**	No.of Hours	COs
	Block chain in Financial Service, Supply Chain Management and Government Services	06 Hrs.	CO6

Books:

Text Books:

1. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing. Date: March 2018, ISBN: 9781788839044.
2. Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press.

Reference Books:

1. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

2. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.

3. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design And Use Cases"[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/

4. Melanie Swan ,"Blockchain : Blueprint for a New Economy" O'Reilly.

E-Resources:

1. https://nptel.ac.in/courses/106/105/106105184/

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

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

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Course Objectives:

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

Course Outcomes (COs):

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

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

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

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

Tools for High Performance Computing Laboratory

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

Programming Languages: PYTHON/Java/OpenMP/MPI

Programming tools recommended Anaconda or Miniconda Frameworks/ Apache Hadoop

Online Tools: MPI libraries

Guidelines for Student Journal

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

Guidelines for Assessment

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

List of High Performance Computing Laboratory Assignments (Any Eight)

1. **Parallel sorting Algorithms**- for Bubble Sort and Merger Sort, based on existing sequential algorithms, design and implement parallel algorithm utilizing all resources available.
2. **Vector and Matrix Operations**- Design parallel algorithm to
    a) Add two large vectors
    b) Multiply Vector and Matrix
    c) Multiply two N × N arrays using n2 processors.

3. Parallel Implementation of the K Nearest Neighbors Classifier using python/openmp.

4. Study of Cluster building steps - MPI Cluster setup and overview of different routines.

a. Different steps to build a MPI cluster over LAN.

b. Master-Slave concept and different MPI routines.

5. Parallel implementation of all pair shortest path algorithm using openmp/MPI
6. Program to implement point-to-point communication using MPI routines.

a. Parallelizing Trapezoidal Rule using MPI_Send and MPI_Reveive.

7. Program to implement collective communication using MPI routines.

a. Gather, Scatter and Broadcast operations.

b. Matrix-Vector multiplication execution.

8. Program to implement Merge sort/ Graph Computation algorithm using MPI routines.

a. Steps in parallelizing Merge Sort/ Matrix Partitioning.

9. Program to execute matrix multiplication using CUDA.

a. Basic CUDA host, device and memory constructs.

b. Thread- warp, block, grid usage.

10. Program to implement Map-Reduce parallelism for Warehouse -Scale Computer.

a. Parallelism using Map-Reduce programming model.

b. Example of word count process with key-value pair.

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

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

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

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Course Objectives:

1.To understand the need for machine learning for various problem solving

2.To understand nature of the problem and apply machine learning algorithm.

3. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning

4.To understand the latest trends in machine learning

5.To design appropriate machine learning algorithms for problem solving.

Course Outcomes (COs):

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

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

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

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

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

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

Tools for Machine Learning Laboratory Practice

Operating System recommended: - 64-bit Open source Linux or its derivative
Programming Languages: PYTHON/R
Programmingtools recommended:Anaconda or Miniconda Frameworks
Online Tools:Google Colab

Guidelines for Student Journal

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

Guidelines for Assessment

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

List of Machine Learning Laboratory Assignments

1. **Assignment on Linear Regression:**

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

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

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

(Dataset Downloads Link):
https://drive.google.com/file/d/12BY34aCbYLoLjy3gDUMrZEBUf7l5FZsd/view?usp=share_link

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

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

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

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

(Dataset Downloads Link):
https://drive.google.com/file/d/12BY34aCbYLoLjy3gDUMrZEBUf7l5FZsd/view?usp=share_link

5**. Implement SVM Classification Technique on any dataset.**
(For ex: IRIS Dataset.) (Dataset Downloads Link):https://drive.google.com/file/d/12BY34aCbYLoLjy3gDUMrZEBUf7l5FZsd/view?usp=share_link

6. **Assignment on K-Means Clustering**:

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

1] Which cluster does P6 belongs to?

2] What is the population of cluster around m2?
3] What is updated value of m1 and m2?

7. Implement **Gradient Boost Classifier Model** on Income Evaluation Data set.
(Dataset Downloads Link) https://drive.google.com/file/d/1zI-X3zdiuM9u74zQyKIShvAUtPJQ7jUK/view?usp=sharing

Machine Learning Lab Books:
Text Books:
1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, a. ISBN10: 1785889621, ISBN-13: 978-1785889622 2. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, a. 2013. 3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach", O"REILLY, a. SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.
Reference Books:
1. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004. 2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009. 3. Ethem Alpaydin, " Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0262-01243-0 4. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, Edition 2012, ISBN-10: 1107422221; ISBN-13: 9781107422223 5. Tom Mitchell "Machine Learning" McGraw Hill Publication, ISBN : 0070428077 9780070428072 6. Nikhil Buduma, "Fundamentals of Deep Learning", O"REILLY publication, second edition 2017, ISBN: 149192561
e-Resources:
7. https://machinelearningbook.com/
MOOC/ Video Lectures available at:
6. https://onlinecourses.nptel.ac.in/noc22_cs97/preview **7.** https://nptel.ac.in/courses/106106139

CO408: Cryptography and Network Security Laboratory		
Teaching Scheme	**Examination Scheme**	
Lectures: 2 Hrs. / Week	**OR Exam:**	**50 Marks**
Credits: 1	**Total:**	**50 Marks**

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

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Course Objectives:

1. To offer an understanding of principle concepts, central topics and basic approaches in cryptography and network security.
2. To know the basics of symmetric key cryptography.
3. To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.
4. To apply algorithmic strategies for authentication in cryptography and network security.
5. To develop problem solving abilities using Cyber Security.
6. To enhance awareness about network security solutions against computer-attacks.

Course Outcomes (COs):

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

CO No.	**Statement of Course Outcome**	**Bloom's Taxonomy**	
		Level	**Descriptor**
CO1	Recognize concept of Security needed in Communication of data through computers and networks.	2	Understand
CO2	Understand various Encryption mechanisms for secure transmission of data and management of key required for encryption.	2	Understand
CO3	Understand Encryption mechanisms in Public Key cryptography and implement various encryption techniques.	3	Apply
CO4	Understand authentication requirements and implement various authentication mechanisms	3	Apply
CO5	Apply security tools in various environments for network security.	3	Apply
CO6	Apply appropriate network security solutions against computer-attacks.	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	2	1	3	3	-	2	1	-	-
CO2	3	3	2	2	2	3	3	3	3	3	2	3	2	3	3
CO3	3	3	2	2	2	3	3	3	3	3	2	3	2	3	3
CO4	3	3	1	-	3	3	3	3	3	3	2	3	2	3	3
CO5	3	3	2	3	3	2	3	3	3	3	2	3	1	-	2
CO6	3	3	2	3	3	3	3	3	3	3	2	3	1	-	2

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

Tools for Cyber Security Laboratory

Operating System recommended - 64-bit Open source Linux or its derivative
Programming Languages: PYTHON/Java
Programming tools recommended Anaconda or Miniconda Frameworks.
Online Tools: -

Guidelines for Student Journal

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

Guidelines for Assessment

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

List of Cyber Security Laboratory Assignments (Any Eight)

1. W.A.P. to implement Caeser Cipher.
2. W.A.P. to implement Playfair Cipher with key ldrp.
3. W.A.P. to implement polyalphabetic Cipher.
4. W.A.P. to implement Hill Cipher. (Use any matrix but find the inverse yourself).
5. W.A.P. to implement Rail fence technique
6. W.A.P. to implement Simple Columnar Transposition technique
7. W.A.P. to implement Advanced Columnar Transposition technique.
8. Write a program for Simplified DES implementation
9. Write a program for Simplified AES implementation.

10. Implementation of Diffe-Hellman key exchange algorithms.

11. W.A.P. to implement Simple RSA Algorithm with small numbers.

List of Mini Projects: (Any one)

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

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

Course Objectives:

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

Course Outcomes (COs):

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

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

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

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

CO2	3	3	2	3	-	-	2	-	-	-	3	2	3	3	2
CO3	-	-	-	-	3	-	-	3	3	-	3	1	3	3	2
CO4	-	-	-	-	3	2	2	2	3	3	2	3	3	3	2

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

- The student shall complete the partial work of the Project which will consist of problem statement, literature review, SRS, Model and Design.
- The student is expected to complete the project at least up to the design phase.
- As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic.
- The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.
- The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.
- Follow guidelines and formats as mentioned in Project Workbook recommended by the Department Board of Studies.

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

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

1. COURSE OBJECTIVE-

The course will enable the student do the following:

A. Become aware of the importance of financial planning.

B. Work toward setting life goals to achieve financial and personal success.

C. Accomplish the following, in line with the purpose of this University:

1. Contribute to the education of the whole person.
2. Place their faith in Jesus Christ at the center of his or her life.
3. Encourage the synthesis and integration of the common bond of knowledge provided by the university into a unified whole.
4. Sharpen the communication, computation, and critical analysis skills of each student.
5. Develop appreciation for differing cultures.
6. Increase the student's recognition of God's order, diversity, and creativity and their consequences in the social and historical sciences.
7. Demonstrate that knowledge and experience are related, not separated.
8. Reveal God's purpose and glory as evident in this course of study.
9. Develop basic skills, acquire basic knowledge, and formulate a world vision.
10. Advocate the examination of this field of knowledge in the context of its influence upon and its

being influenced by others.

D. Prepare a student for an active role in the general area of business administration (in line with the purpose of the business administration program).

E. Prepare the student in the following areas (in line with the departmental objectives):

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

2. COURSE OBJECTIVES

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

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

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

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

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

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

D. Answer the following questions about credit:

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

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

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

SEMESTER VIII

CO411 E : Privacy and Security in Online Social Media	
Teaching Scheme	**Evaluation Scheme**
Lectures: 12 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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

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Course Contents

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

CO411 F : Advanced Computer Networks	
Teaching Scheme	**Evaluation Scheme**
Lectures: 12 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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

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Course Contents

Week No	Content
Week 1	High Performance Switching and Routing: Introduction, performance considerations, IP address lookup.
Week 2	Algorithms for IP address lookup and optimization, hardware implementation of address lookup.
Week 3	Packet Classification: Need for packet classification and methods for packet classification.
Week 4	Differentiated Service, Quality of Service, Traffic Polishing, Traffic Shaping.
Week 5	Network Softwarization – Introduction.
Week 6	Software Defined Networking (SDN) - Deep Dive (Northbound and Southbound interface) , Working with Mininet + Lab Exercises with Mininet
Week 7	Network Function Virtualization (NFV) - Architecture and Concepts
Week 8	Programmable Networks - Introduction to P4, SmartNICS and P4 switches. + Lab Exercise with Mininet and BMV2 switches.
Week 9	Data Center Networking (DCN) – Introduction
Week 10	DCN - Deep Dive (Network topologies, Container Network Interfaces)
Week 11	Content Distribution on the Internet, Architectures for Information Centric Networking
Week 12	Content Naming, Routing and Caching, Security in Named Data Networking.
Books:-	
1. High Performance Switches and Routers, H. Jonathan Chao, Bin Liu, 2007, John Wiley & Sons, Inc. ISBN-10: 0-470-05367-4 2. Information-Centric Networks: A New Paradigm for the Internet (Focus Series in	

Networks and Telecommunications), Gabriel M. de Brito, Pedro B. Velloso, Igor M. Moraes, Wiley-ISTE; 1st edition, 2013, ISBN: 9781848214491

3. Information-Centric Networking (ICN): Content Centric Networking (CCNx) and Named Data Networking (NDN) Terminology, B. Wissingh, C. Wood, A. Afanasyev, L. Zhang, D. Oran and C. Tschudin, RFC 8793, June 2020

4. Software-Defined Networks: A Systems Approach, Peterson, Cascone, O'Connor, Vachuska, and Davie, Online Free Reference Book available at https://sdn.systemsapproach.org/index.html

5. Cloud Networking: Understanding Cloud-based Data Centre Networks, Gary Lee (Author), Morgan Kaufmann (Publisher), 2014,ISBN-139780128007280

E-Resources:

https://onlinecourses.nptel.ac.in/noc24_cs11/preview

CO411 G : Getting Started with Competitive Programming	
Teaching Scheme	**Evaluation Scheme**
Lectures: 12 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Data Structures and Algorithms, Familiarity with a programming language (ideally C++ or Python)

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Course Contents

Week No	Content
Week 1	Sorting and Searching Algorithms.
Week 2	Greedy Algorithms – I.
Week 3	Greedy Algorithms – II.
Week 4	Week 4: Disjoint Set Union with Path Compression.
Week 5	Minimum Spanning Tree.
Week 6	Shortest Paths: Dijkstra and Beyond.
Week 7	Network Flows – I.
Week 8	Network Flows - II, Divide and Conquer
Week 9	Dynamic programming – I.
Week 10	Dynamic programming – II.
Week 11	Dynamic programming – III.
Week 12	Dynamic programming – IV.

Books:-

1. Algorithms by Jeff Erickson (freely available online)
2. Algorithms Illuminated by Tim Roughgarden
3. Algorithm Design by Jon Kleinberg and Éva Tardos
4. Introduction to Algorithms by Cormen, Leiserson, Rivest, Stein
5. Competitive Programming 4: The Lower Bound of Programming Contests in the 2020s by Steven Halim and Felix Halim
6. Guide to Competitive Programming: Learning and Improving Algorithms Through

Contests Antti Laaksonen
E-Resources:
https://onlinecourses.nptel.ac.in/noc24_cs29/preview

CO411 H : Business Intelligence & Analytics	
Teaching Scheme	**Evaluation Scheme**
Lectures: 12 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) A core course on Business statistics desirable

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Course Contents

Week No	Content
Week 1	Introduction to Business Intelligence & Analytics (BIA), drivers of BIA, types of analytics: descriptive to prescriptive, vocabulary of business analytics, course plan and resources. Books to refer : Text 1: Han et al. (2023) Chapter 1, Introduction
Week 2	Technical architecture of BIA, case analysis of AT&T Long distance, fundamentals of data management, OnLine Transaction Processing (OLTP), design process of databases Books to refer : Text 1: Han et al. (2023) Chapter 4, Data Warehouse and Online Analytical Processing (pp. 85-108).
Week 3	Relational databases, normalisation, SQL queries, ShopSense case of management questions, data warehousing, OnLine Analytical Processing (OLAP), data cube Books to refer : Tutorial: SQL tutorial on MySQL (https://www.mysqltutorial.org)
Week 4	Descriptive analytics, and visualization, customer analytics, survival analysis, customer lifetime value, case study Books to refer : a. Knowing When to Worry: Using Survival Analysis to Understand Customers: https://learning.oreilly.com/library/view/data-mining - techniques/9780470650936/9780470650936c 10.xhtml#c10_level1_1 b. Customer Lifetime Value (CLV): A Critical Metric for Building Strong Customer

	Relationships, https://www.gartner.com/en/digital-markets/insights/what-is-customer-lifetime-value
Week 5	Data mining process, introduction to statistical learning, data pre-processing, data quality, overview of data mining techniques, case study using regression analysis Books to refer : a. Text 2: James et al. (2013) Chapter 1, Statistical learning, ISL b. Text 2: James et al. (2013) Chapter 2, Linear regression, ISL
Week 6	Introduction to classification, classification techniques, scoring models, classifier performance, ROC and PR curves Books to refer : Text 1: Han et al. (2023) Chapter 6, Classification: Basic concepts and methods
Week 7	Introduction to decision trees, tree induction, measures of purity, tree algorithms, pruning, ensemble methods Books to refer : Text 2: James et al. (2013) Chapter 8, Tree- based models
Week 8	Tree implementation in Python: problem of targeted mailing Books to refer : a. https://scikit-learn.org/stable/modules/model_evaluation.html#roc-metrics b. https://scikit-learn.org/stable/visualizations.html
Week 9	Cluster analysis, measures of distance, clustering algorithms, K-means and other techniques, cluster quality Books to refer : Text 2: James et al. (2013) Chapter 10, Unsupervised learning (pp. 385-400)
Week 10	A store segmentation case study using clustering, implementation in Python, profiling clusters, cluster interpretation and actionable insights, RFM sub-segmentation for customer loyalty Books to refer : What Is Recency, Frequency, Monetary Value (RFM) in

	Marketing?: https://www.investopedia.com/terms/r/rfm-recency-frequency-monetary-value.asp
Week 11	Machine learning, Artificial Neural Networks (ANN), topology and training algorithms, back propagation, financial time series modelling using ANN, implementation in Python Books to refer : Kaastra & Boyd (1996) Designing a neural network for forecasting financial and economic time series, JNC: https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=bcbb8ca9d6a6ce6017710ebf6143da76b6edf98b
Week 12	Text mining, process, key concepts, sentiment scoring, text mining using R-the case of a movie discussion forum, summary Books to refer : Silge and Robinson, Text Mining with R, A Tidy Approach: O'reilly: www.tidytextmining.com/index.html
Books:-	
1. Text 1: Han, J., Pei, J. & Tong H. (2023). Data Mining Concepts and Techniques, 4th ed, New Delhi: Elsevier. 2. Text 2 : James, G., Witten, D., Hastie, T. and Tibshirani,R. (2013) An Introduction to Statistical Learning with Applications in R, Springer: NY	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_cs65/preview	

CO412 D : Affective Computing	
Teaching Scheme	**Evaluation Scheme**
Lectures: 12 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) 1.Programming, 2.Artificial Intelligence, 3.Machine Learning

Desirable Prerequisites: 4.Human-Computer Interaction, 5.Deep Learning

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Course Contents

Week No	Content
Week 1	Fundamentals of Affective Computing.
Week 2	Emotion Theory and Emotional Design
Week 3	Experimental Design: Affect Elicitation; Research and Development Tools
Week 4	Emotions in Facial Expressions
Week 5	Emotions in Voice
Week 6	Emotions in Text
Week 7	Emotions in Physiological Signals
Week 8	Multimodal Emotion Recognition
Week 9	Emotional Empathy in Agents/Machines/Robots
Week 10	Online and Adaptive Recognition of Emotions: Challenges and Opportunities
Week 11	Case Study: Updated from Time to Time
Week 12	Ethical Issues: Ethical, legal and Social Implications of Affective Computing
Books:-	
1. Affective Computing. MIT Press 2. The Oxford Handbook of Affective Computing. Oxford University Press 3. The Encyclopedia of Human-Computer Interaction, 2nd Ed. 4. Interaction Design: Beyond Human-Computer Interaction. 2019. (5th Edition) by Jenny Preece, Helen Sharp, Yvonne Rogers (Wiley)	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_cs12/preview	

CO412 E : Blockchain and its Applications	
Teaching Scheme	**Evaluation Scheme**
Lectures: 12 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Computer Networks; Operating Systems; Cryptography and Network Security.

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Course Contents

Week No	Content
Week 1	Introduction to Blockchain Technology and its Importance
Week 2	Basic Crypto Primitives I – Cryptographic Hash
Week 3	Basic Crypto Primitives II – Digital Signature
Week 4	Evolution of the Blockchain Technology
Week 5	Elements of a Blockchain
Week 6	Blockchain Consensus I – Permissionless Models
Week 7	Blockchain Consensus II – Permissioned Models
Week 8	Smart Contract Hands On I – Ethereum Smart Contracts (Permissionless Model)
Week 9	Smart Contract Hand On II – Hyperledger Fabric (Permissioned Model)
Week 10	Decentralized Identity Management
Week 11	Blockchain Interoperability
Week 12	Blockchain Applications

Books:-

1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020, ISBN: 9781839213199, book website: https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199
2. Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials
3. Ethereum Development Resources - https://ethereum.org/en/developers
4. Online materials and case studies

E-Resources: https://onlinecourses.nptel.ac.in/noc24_cs15/preview

CO412 F : Introduction to Industry 4.0 and Industrial IOT	
Teaching Scheme	**Evaluation Scheme**
Lectures: 12 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Basic knowledge of computer and internet

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Course Contents

Week No	Content
Week 1	Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II.
Week 2	Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.
Week 3	Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis.
Week 4	Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.
Week 5	IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.
Week 6	Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.
Week 7	Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.
Week 8	Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.
Week 9	Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.
Week 10	Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly

	Line, Food Industry.
Week 11	Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.
Week 12	Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies : Case study - I : Milk Processing and Packaging Industries Case study - II: Manufacturing Industries - Part I Case study - III : Manufacturing Industries - Part II Case study - IV : Student Projects - Part I Case study - V : Student Projects - Part II Case study - VI : Virtual Reality Lab Case study - VII : Steel Technology Lab.

Books:-

1. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.
   Availability:https://www.amazon.in/Introduction-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1
2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
   Availability:https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3
3. Research Papers.

E-Resources:

https://onlinecourses.nptel.ac.in/noc24_cs34/preview

CO412 G : Object Oriented System Development Using UML, Java And Patterns	
Teaching Scheme	**Evaluation Scheme**
Lectures: 12 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Programming Using Java, Software Engineering.

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Course Contents

Week No	Content
Week 1	Introduction.
Week 2	Life Cycle Models for OO Development.
Week 3	Use Case Diagram.
Week 4	Class Diagram I.
Week 5	Class Diagram II.
Week 6	Sequence Diagram.
Week 7	State chart diagram.
Week 8	Design process.
Week 9	Introduction to design patterns.
Week 10	GRASP patterns.
Week 11	GoF pattern I.
Week 12	GoF Pattern II
Books:-	
1. Robert Martin, UML for Java Programmers, Pearson, Ali Bahrami, Object-oriented System Development, TMH, 1999	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_cs40/preview	

CO413 D : Project Management	
Teaching Scheme	**Evaluation Scheme**
Lectures: 8 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 2	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any)

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Course Contents

Week No	Content
Week 1	Part-I Project Initiation Lecture 1 - Introduction to project management - I Lecture 2 - Introduction to project management -II Lecture 3 - Agile project management Lecture 4 - Project strategy and selection overview Lecture 5 - Project selection models.
Week 2	Part-I Project Initiation Lecture 6 - Project manager Lecture 7 - Attributes of Effective Project Manager Lecture 8 - Managing for stakeholders Lecture 9 - Resolving Conflicts Lecture 10 - Negotiation
Week 3	Part-I Project Initiation Lecture 11 - Project in the organization structure Lecture 12- Human factors and the project team Part-II Project Planning Lecture 13 - Traditional project activity planning Lecture 14 - Agile project planning, Project charter Lecture 15 - Coordination through integration management.
Week 4	Part-II Project Planning Lecture 16 - Project feasibility analysis, Lecture 17 - Estimating project budgets Lecture 18 - Project risk management

	Lecture 19 - Quantitative risk assessment methodologies Lecture 20 - Critical path method (CPM).
Week 5	Part-II Project Planning Lecture 21 - Programme evaluation and review technique (PERT) Lecture 22 - Risk analysis with simulation for scheduling Lecture 23 - Gantt Chart, Scheduling with scrum Lecture 24 - Crashing a project Lecture 25 - Resource loading.
Week 6	Part-II Project Planning Lecture 26 - Resource levelling, Case study on Statue of Unity Lecture 27 - Goldratt's critical chain Part-III Project Execution Lecture 28 - Planning-monitoring-controlling cycle Lecture 29 - Earned value analysis Lecture 30 - Agile tools for tracking project.
Week 7	Part-III Project Execution Lecture 31 - Three types of project-controlling Lecture 32 - Control of change scope and scope creep Lecture 33 - Project audit, Lecture 34 - Essentials of an audit/evaluation Lecture 35 - When to close a project.
Week 8	Part-III Project Execution Lecture 36 - Benefits realisation, Case study on the success of Chandrayan-3 Part-IV IT for Project Management Lecture 37 - Software for project management Lecture 38 - Demo on project management software Lecture 39 - Simulations software for project management Lecture 40 - Course Summary.
Books:-	
1. Project Management (A Strategic Managerial Approach) by Meredith	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_mg01/preview	

CO413 E : Ethics In Engineering Practice	
Teaching Scheme	**Evaluation Scheme**
Lectures: 8 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 2	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Basic understanding of business management.

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Course Contents

Week No	Content
Week 1	Introduction to Ethical Reasoning and Engineer Ethics.
Week 2	Professional Practice in Engineering.
Week 3	Ethics as Design - Doing Justice to Moral Problems.
Week 4	Central Professional Responsibilities of Engineers.
Week 5	Computers, Software, and Digital Information.
Week 6	Rights and Responsibilities Regarding Intellectual Property.
Week 7	Workplace Rights and Responsibilities.
Week 8	Responsibility for the Environment.

Books:-

1. Ethics in Engineering practice and Research (2nd Edition) by Caroline Whitbeck Cambridge
2. Ethics in Engineering MW Martin and R Schinzinger MC Graw Hill
3. Engineering Ethics and Environment P a Vesilind and AS Gunn Cambridge

E-Resources:

https://onlinecourses.nptel.ac.in/noc24_mg17/preview

CO413 F : Supply Chain Analytics	
Teaching Scheme	**Evaluation Scheme**
Lectures: 8 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 2	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Basic knowledge of Operations management will be desirable**.**

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Course Contents

Week No	Content
Week 1	Context of today's supply chains (SC) analytics Understanding and defining the supply chain analytics (SCA) Revisions of Basic Lessons of Supply Chain Management Why is Analytics Important in a supply chain? Relating Operations Management with Supply chain concepts with SC Analytics The importance of supply chain analytics in the flows involving material, money, information and ownership.
Week 2	Supply chain analytics Key issues in supply chain analytics What involves in supply chain analytics Concept of Descriptive Analytics in a Supply Chain Discussion on a Few Supply Chains Analytics applications in India (students participation is expected) Decision Domains in in supply chain analytics.
Week 3	Foundation of Business Analytics (BA) E2: Introduction to Modelling, Approaches for Optimization and Simulation, Modelling software, Supply Chain (SC) Decisions that requires mathematical or interpretative modelling Understanding of Data and its role in Analytics Analytics of a Transportation problem in a Supply Chain Managerial implication of results of analytics.
Week 4	A CASE STUDY OF SUPPLY CHAIN ANALYTICS.
Week 5	Foundation of PRESCRIPTIVE ANALYTICS IN NETWORK PLANNING IN A SUPPLY CHAIN

	Network Planning in a Supply Chain Importance of Network Planning Design of Logistics Network using Heuristics/optimization (Exercise 3.4 Levi (2008)) Concept of 3PL/4PL in a Supply Chain Case Study: GATI.
Week 6	Foundation of Modeling Coordination Decisions in SUPPLY CHAIN MANAGEMENT.
Week 7	Foundation of PERFORMACE MANAGEMENT IN SUPPLY CHAIN MANAGEMENT.
Week 8	IT ENABLEMENT OF SUPPLY CHAINS Role of ICT in Supply chains.
Books:-	
1. Supply chain management by Sunil Chopra, and Peter Meindl, Pearson 2. Jeremy F. Shapiro. Modeling the Supply Chain. Duxbury Thomson Learning 3. D. Simchi-Levi, P. Kaminsky, E. Simchi-Levi, and Ravi Shankar, Designing and Managing the Supply Chain concepts, Strategies and Case studies, Third Edition, Tata McGraw Hill, New Delhi, 2008. 4. Rahul Saxena • Anand Srinivasan, Business Analytics	
E-Resources:	
https://onlinecourses.nptel.ac.in/noc24_mg58/preview	

CO413 G : Business Forecasting	
Teaching Scheme	**Evaluation Scheme**
Lectures: 8 Week	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 2	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: (if any) Basic Probability and Statistics**.**

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Course Contents

Week No	Content
Week 1	Lecture 1: Introduction to Business forecasting Lecture 2: Data Driven Decision Making and Essentials of Predictive Analytics Lecture 3: Types of Forecasting: Qualitative Approaches and Quantitative Approaches.
Week 2	Lecture 4: Components of a Time Series and Measures of Forecast Accuracy Lecture 5: Moving Average Methods: Simple, Weighted, and Exponential Moving Average.
Week 3	Lecture 6: Exponential Smoothing Lecture 7: Trend Projections and Holt Model.
Week 4	Lecture 8: Regression Analysis Lecture 9: Measure of Goodness and Standard Error.
Week 5	Lecture 10: Seasonality, Seasonal Index, and Quarterly Average Method Lecture 11: Seasonality and Trend: Holt Winter Method Lecture 12: Decomposition Method.
Week 6	Lecture 13: ACF and PACF Lecture 14: ARIMA.
Week 7	Lecture 15: Introduction to Machine Learning Lecture 16: Logistic Regression Lecture 17: Human Judgement in Time Series Analysis.
Week 8	Lecture 18: Monte Carlo Simulation and Risk Analytics Lecture 19: Predictive Analytics using @Risk software/Python.
Books:-	
1. Business Forecasting: John E Hanke and Dean Wichern, Pearson, 9th Edition	

2. Business Analytics, (PART 4: Regressions Analysis and Time Series Forecasting), Albright and Winston, Cengage Learning, 5th Edition, 2015
3. Essentials of Business Analytics- Descriptive, Predictive and Prescriptive Analytics, (Chapter 1,4,5,6 and 11), Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, Cengage Learning, 2nd Edition, 2016
4. Forecasting Methods and Applications, Makridakis et al., 3rd Edition, 2017, Willey.
5. An introduction to Management Science, Chapter 15, Anderson and Williams, Cengage Learning, 13th Edition, 2015
6. Quantitative Analysis for Management, Render and Stair, Chapter 5, Pearson, 10th Edition.

E-Resources:

https://onlinecourses.nptel.ac.in/noc24_mg66/preview

CO414 : Professional Internship	
Teaching Scheme	**Evaluation Scheme**
Lectures: - 12 Hrs./Week	**Term Work (TW): 100 Marks**
Tutorials: - Hrs./ week	**Oral Exam (OR): 50 Marks**
Credits: 6	**Total : 150 Marks**

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Prerequisite Course: (if any) -

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Course Objectives:

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry/on project experience provides much more professional experience as value addition to classroom teaching.

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the workingenvironment of industry organizations.

Course Outcomes (COs):

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

COs	Course outcomes	Bloom's Taxonomy	
		Level	Descriptor
CO1	To **demonstrate** professional competence through industry internship.	3	Demonstrate
CO2	To **apply** knowledge gained through internships to complete academic activities in aprofessional manner.	3	Apply
CO3	To choose appropriate technology and tools to **solve** given problem.	3	Solve
CO4	To demonstrate abilities of a responsible professional and use ethical practices in day today life.	3	Demonstrate
CO5	**Creating** network and social circle, and developing relationships with industry people.	6	Create
CO6	To **analyze** various career opportunities and decide carrier goals.	4	Analze

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

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

Guidelines:

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Final Year Engineering curriculum.

- Student should complete 250 hours internship either in offline/online mode.
- Those students registering for other companies (except AWS, data science, fuel) have to provide company details (Name, CIN no, corporate Id no) and industry person contact details.
- All students need to submit weekly progress report signed by concerned industry person and college mentor.
- In weekly report student have mention no of hours they worked on each day.
- Each student will have one Internal guide (college mentor).
- Student should contact his/her guide from college on weekly basis to communicate the progress.

- Student must keep any proof regarding internship registration (email, joining letter).
- Student should have internship plan or schedule.

- Student should compulsorily follow the rules and regulations as laid by industry..
- Coursera/NPTEL courses will not consider as internship.
- Student have to submit internship report at the end of the semester along with internship certificate.
- Students have to submit 8 weekly progress reports to their respective college mentor. Each weekly report consist of 10 marks. (80 marks for weekly assessment report) and 20 marks for Internship Report (total 100 marks for term work)
- Internship oral (50 marks) will be conducted at the time of 8th semester final exams.
- All students must complete an internship by the end of their 8th semester. Failing to complete the internship, Students will be responsible for any academic losses.
- College faculty will confirm the authenticity of the internship. Students are required to work on an industrial project.

Duration:

Internship is to be completed after semester 6^{th} and before commencement of semester 8^{th} of at least 250 hours and it is to be assessed and evaluated in semester 8^{th}.

Internship work Identification:

Student can select internship from following buckets

1. AWS Certification
2. Data Science course with project work
3. Fuel Training
4. Geeks for Geeks
5. SDI Bhubaneswar
6. SAP
7. Company Internship.

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovationor entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves

ready for the industry[1].

Students must register at Internshala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the VI th semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their VIth semester examination and before academic schedule of semester VII.

Student can take internship work in the form of the following but not limited to:

1. Working for consultancy/ research project,
2. Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
3. Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
4. Development of new product/ Business Plan/ registration of start-up,
5. Industry / Government Organization Internship,
6. Internship through Internshala,
7. In-house product development, intercollegiate, inter department research internship underresearch lab/group, micro/small/medium enterprise/online internship,
8. Research internship under professors, IISC, IIT's, Research organizations,
9. NGOs or Social Internships, rural internship,
10. Participate in open source development.

Internship Diary/ Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall

compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Evaluation through Seminar Presentation/Viva-Voce at the Department-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

1. Depth of knowledge and skills
2. Communication & Presentation Skills
3. Team Work
4. Creativity
5. Planning & Organizational skills
6. Adaptability
7. Analytical Skills
8. Attitude & Behavior at work
6. Societal Understanding
7. Ethics
8. Regularity and punctuality
9. Attendance record
10. Diary/Work book
11. Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate whathe has observed and learnt in the training period.

Internship Diary/workbook may be evaluated on the basis of the following criteria:

1. Proper and timely documented entries
2. Adequacy & quality of information recorded
3. Data recorded
4. Thought process and recording techniques used
5. Organization of the information

The report shall be presented covering following recommended fields but limited to,

1. Title/Cover Page

2. Internship completion certificate
3. Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
4. Index/Table of Contents
5. Introduction
6. Title/Problem statement/objectives
7. Motivation/Scope and rationale of the study
8. Methodological details
9. Results / Analysis /inferences and conclusion
10. Suggestions / Recommendations for improvement to industry, if any
11. Attendance Record
12. Acknowledgement
13. List of reference (Library books, magazines and other sources)

Feedback from internship supervisor (External and Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership…..

CO415: Project Stage - II	
Teaching Scheme	**Evaluation Scheme**
PR Hours: 4 Hrs. / Week	**Oral Exam (OR): 50 Marks**
Credits: 2	**Total: 50 Marks**

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Course Objectives:

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

Course Outcomes (COs):

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

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

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

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

CO2	3	3	2	3	-	-	2	-	-	-	3	2	3	3	2
CO3	-	-	-	-	3	-	-	3	3	-	3	1	3	3	2
CO4	-	-	-	-	3	2	2	2	3	3	2	3	3	3	2

The Students shall complete the remaining project work including the

- Performance discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems,
- Comparative analysis and validation of results and conclusions.
- The students need to do the research paper publications/ patent filing & Publication/ Participation in reputed conferences as per the minimum requirement specified by the Dept. In addition, Participation in the Project Contests is mandatory for the students. If the Project Work is Entrepreneurship related and if found worthy for this domain then Department needs to encourage such students for completing the formalities to do so.
- The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is duly certified by the concerned guide and Head of the Department/Institute.
- Follow guidelines and formats as mentioned / recommended by the Department Board of Studies.
- Final expected outcome must be exhibited in any condition by the quality of the student projects at the end of the academic year in terms of quality of implementation, research component fulfilment, Entrepreneurship (if possible).