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

2019 Pattern

Curriculum

(SY B. Tech. Sem-III & IV with effect from Academic Year 2020-2021)

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 2019 w.e.f. from A.Y 2020-21 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

COURSE STRUCTURE- 2019 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				
PROJ	CO201	First Year Internship	-	-	-	2	-	-	-	50	-	-	**50**
BSC	BS202	Vector Calculus and Differential Equation	3	1	-	4	30	50	20	-	-	-	**100**
PCC	CO203	Data Structures I	4	-	-	4	30	50	20	-	-	-	**100**
PCC	CO204	Digital Electronics and Data Communication	3	-	-	3	30	50	20	-	-	-	**100**
PCC	CO205	Computer Organization and Architecture	3	-	-	3	30	50	20	-	-	-	**100**
HSMC	HS206	Universal Human Values and Ethics	3	-	-	3	30	50	20	-	-	-	**100**
LC	CO207	Data Structures Laboratory-I	-	-	2	1	-	-	-	-	50	25	**75**
LC	CO208	Digital Electronics Laboratory	-	-	2	1	-	-	-	-	50	25	**75**
LC	CO209	Computer Organization Laboratory	-	-	2	1	-	-	-	50	-	25	**75**
MC	MC210	Mandatory Course – III	2	-	-	No	-	-	-	-	-	-	-
		Total	18	1	6	**22**	150	250	100	100	100	75	**775**

MC210	**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				
PCC	CO211	Discrete Mathematics	3	1	-	4	30	50	20	-	-	-	**100**
PCC	CO212	Object Oriented Programming	3	-	-	3	30	50	20	-	-	-	**100**
PCC	CO213	Operating System and Administration	4	-	-	4	30	50	20	-	-	-	**100**
PCC	CO214	Data Structures-II	4	-	-	4	30	50	20	-	-	-	**100**
PROJ	CO215	Seminar	1	-	2	2	-	-	-	25	-	25	**50**
LC	CO216	Data Structure Laboratory -II	-	-	2	1	-	-	-	-	50	25	**75**
LC	CO217	Operating System and Administration Laboratory	-	-	2	1	-	-	-	-	50	25	**75**
LC	CO218	Object Oriented Programming Laboratory	-	-	2	1	-	-	-	-	50	25	**75**
PROJ	CO219	Mini Project / Choice Based Subject	-	-	4	2	-	-	-	-	-	50	**50**
MC	MC220	Mandatory Course – IV	2	-	-	NC	-	-	-	-	-	-	-
		Total	17	1	12	**22**	120	200	80	25	150	150	**725**

MC220	**Mandatory Course - IV**	**Innovation - Project based – Sc., Tech, Social, Design & Innovation**

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: First Year Internship	
Teaching Scheme	**Examination Scheme**
Lectures: - Hrs./Week	**Oral Exam: 50 Marks**
Tutorials: - Hrs./ week	**Total : 50 Marks**
Credits: 2	

GUIDELINES FOR INTERNSHIP

There are three different options available for the students to earn internship credit.

1. **Online Course:** Students shall register for an online course on Programming in C of 8 weeks duration offered via SWAYAM/NPTEL. Credits shall be awarded only on successful completion of the course under the authorized mentor and passing the examination of the said course.
2. **RedHat Certification:** Students shall register for level 1 RedHat certification course in RedHat Academy Centre of the department. Students shall attend all the classes of the course as the schedule given by the RedHat Academy. Credits shall be awarded to the students on passing the examination conducted by RedHat.
3. **Internship at Centre for IoT Consultancy:** Students shall register for internship of 4 week duration at the Centre for IoT Consultancy in the department of Information Technology. Students will have to attend the training programme as per the schedule given by the Centre for IoT Consultancy.

   The contents for the IoT training are as follows: Introduction to Internet of Things, study and identification of different Sensors, study and identification of different electronics components including breadboard. Introduction to Arduino device, writing programs using Arduino IDE, interfacing of input and output devices with Arduino, WiFi module, Use of IoT mobile Apps.

   Students shall be given hands on practice during training and shall have to design and develop following projects.

   1. Automatic street/corridor/passage/stair case light controller.
   2. Room temperature indicator with relay switch.
   3. Object detector using ultrasonic sensor.
   4. Door lock using RFID.
   5. Water tank level indicator with relay.
   6. Heartbeat indicator.

   Students shall be awarded internship credits only on successful implementation and submission of any 4 projects mentioned above at the Centre for IoT Consultancy.

BS202: Vector Calculus and Differential Equation		
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‴ 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

CO203: 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 strategies.
2. To be acquainted with linear data structure, its constraints and advantages.
3. To understand the representation and memory requirements of various linear data structures.
4. To operate on data stored in linear data structures.
5. To be familiar with the applications of data structures.
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.	2	Understand
2. **Summarize** different types of data structures, and its usage.	1	Remember
3**. Use** appropriate data structure for solving problems and programming.	3	Apply
4. **Operate** on data stored in different linear data structures.	3	Apply
5. **Analyze** the problem to select appropriate algorithm and data structure.	4	Analyze
6. **Apply** appropriate searching and sorting techniques 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	3	2	2	-	-	-	-	-	-	-	2	3	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	1	2	-	-	1	-	1	-	-	2	3	2	-
CO4	2	3	2	2	-	-	1	-	2	1	-	-	3	2	-
CO5	1	3	2	-	-	-	2	-	2	-	-	2	3	2	-
CO6	2	3	2	-	-	-	-	-	1	-	-	2	3	2	-

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	1,2
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	2,3,4
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	2,3,4,5
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 Applications of Stack– Well form-ness of Parenthesis	8	2,3,4,5
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	2,3,4,5
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

CO204: 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	-	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	3	1	3	1	-	-	-	-	-	-	-	-	3	3	-
CO3	3	1	3	1	-	-	-	-	-	-	-	-	3	3	-
CO4	1	1	1	1	-	-	-	-	-	-	-	-	1	1	-
CO5	1	1	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

CO205: 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	-
CO2	3	1	2	-	-	-	-	-	-	-	-	1	3	1	-
CO3	1	-	1	-	-	-	1	-	-	-	-	1	1	1	-
CO4	1	-	1	-	-	-	1	-	-	-	-	1	1	1	-
CO5	1	-	1	-	-	-	-	-	-	-	-	1	1	2	-
CO6	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

HS206: 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**

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

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	6	4

	life and profession		
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

CO207: Data Structures Laboratory-I		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**25 Marks**
Credits: 1	**Practical Exam:**	**50 Marks**
	Total:	**75 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	2	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	1	2	-	-	2	-	1	-	-	2	3	2	-
CO3	2	3	2	2	-	-	2	-	2	-	-	-	3	2	-
CO4	1	3	2	-	-	-	2	-	1	-	-	2	3	2	-
CO5	2	3	2	-	-	-	-	-	1	-	-	2	3	2	-

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

CO208: Digital Electronics Laboratory	
Teaching Scheme	**Examination Scheme**
Practical : 2 Hrs. / Week	**Term Work: 25 Marks**
Credits: 1	**Practical Exam: 50 Marks**
	Total: 75 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	-	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	3	1	3	1	-	-	-	-	-	-	-	-	3	3	-
CO3	2	-	1	-	-	-	-	-	-	-	-	-	1	1	-
CO4	3	1	3	1	-	-	-	-	-	-	-	-	3	3	-
CO5	1	1	1	1	-	-	-	-	-	-	-	-	1	1	-

Suggested List of Assignments

Group A (Any 4)

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

RPM sensor output = 0 only when speed < 4800 rpm

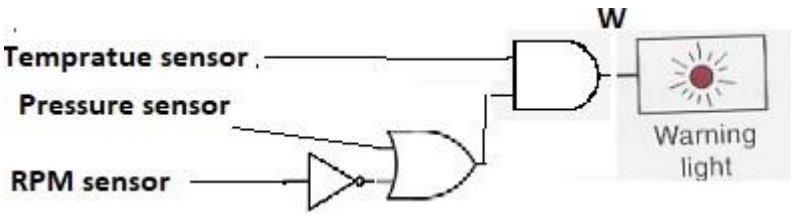
P sensor output = 0 only when pressure <220 psi

T sensor output = 0 only when temperature $<200^0$F

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

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

(b) Implement the circuit using NAND gate.



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

a. Its after 5 o‟clock and all machines are shut down.

b. Its Friday, the production run for day is complete and all machine are shut down.

Design logic circuit that will control the horn.

9. Design multiplier circuit that takes two bit binary number x1x0 and y1y0 as a input and produces binary output z3z2z1z0 that is equal to arithmetic product of the input numbers.

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

and HIGH when level is too high. Also temperature sensor output C and D are low when temperature is satisfactory and HIGH when temperature is too low. Design logic circuit that will detect whenever level in tank A or tank B is too high at the same time that the temperature in either tank C or tank D is too low.

Group B (Any 4)

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

Group C (Mandatory)

16. Study various Transmission media of Data communication.

Home

CO209: Computer Organization Laboratory		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**25 Marks**
Credits: 1	**Oral Exam:**	**50 Marks**
	Total:	**75 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	-
CO2	2	1	1	-	-	-	-	-	-	-	-	-	2	1	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	3	1	-
CO4	3	1	2	-	-	-	-	-	-	-	-	-	1	1	-
CO5	2	1	2	-	-	-	-	-	-	-	-	-	1	-	-
CO6	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 210 : 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

CO211: 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. **Analyze** the problem to select appropriate set theory operation.	4	Analyze
2. **Apply** relation and function to find out the mapping between the objects.	3	Apply
3. **Relate** the graph theory concepts to solve real word problems.	4	Analyze
4. **Apply** the appropriate algorithm for construction of tree.	3	Create
5. **Summarize** different type‟s algebraic system and its usage.	1	Remember
6. **Understand** significance of number theory.	2	Understand

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

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

COURSE CONTENTS

Unit I	**SET THEORY AND LOGIC**	**No. of Hours**	**COs**
	Significance of Discrete Mathematics in Computer Engineering, Sets– Need of Sets, Representation of Sets, Set Operations, Venn diagram, cardinality of set, principle of inclusion and exclusion, Types of Sets –Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets. Introduction to bounded and unbounded sets and multiset, power set, Subset, Universal Set, Empty Set, Power Set. Propositional Logic-logic, Propositional Equivalences, Application of Propositional logic-translating English Sentences, Proof by Mathematical Induction.	8	1
Unit II	**RELATION AND FUNCTIONS**	**No. of Hours**	**COs**
	Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings, partitions, Hasse Diagram, Lattices, Chains and Anti-Chains, Transitive Closure and Warshall,,s Algorithm, n-Ary Relations and their Applications. Functions- Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Functions, The Pigeonhole Principle.	8	2
Unit III	**GRAPH THEORY**	**No. of Hours**	**COs**
	Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and	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: 0132078457, 9780132078450.

R2. N. Biggs,"Discrete Mathematics", 3rd Edition, Oxford University Press, ISBN 0 –19850717 –

8.
R3. Dr. K. D. Joshi, “Foundations of Discrete Mathematics”, New Age International Limited, Publishers, January 1996, ISBN: 8122408265, 9788122408263.
R4. Seymour Lipsehutz and Marc Lars Lipson “Discrete Mathematics”, 3rd Special,Indian Edition, ISBN-13: 978-0-07-060174-1
R5. DeoNarsingh, “Graph theory with applications to Engineering & Computer Science”, Prentice Hall of India Pvt. Ltd., 2000.

Home

CO212: 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	2	-	2	1	-	-	-	-	-	-	2	-	2	-	2
CO2	2	-	2	1	-	-	-	-	-	-	2	-	2	-	2
CO3	2	-	2	1	-	-	-	-	-	-	2	-	2	-	2
CO4	2	-	2	1	-	-	-	-	-	-	2	-	3	-	2
CO5	2	-	2	1	-	-	-	-	-	-	2	-	2	-	2
CO6	2	-	2	1	-	-	-	-	-	-	2	-	2	-	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

CO213: 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 the interactive installation and network installation of Linux OS
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. **Create** disk partitioning and Install the Linux operating system like Fedora, Ubuntu.	6	Create
2. **Acquire** the Basic knowledge of Unix/Linux operating system and its administrative features.	2	Understand
3. **Write** Basic shell script commands and Admin commands	6	Create
4. **Acquire** the Knowledge of files and storage systems	2	Understand
5. **Control** the processes and its execution.	4	Analyze
6. **Add** and **Manage** the users in Linux OS	6	Create

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

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

COURSE CONTENTS

Unit I	INTRODUCTION TO OPERATING SYSTEM	No. of Hours	COs
	General Overview: History of Unix, System Structure User perspective, Operating system Services Assumptions about Hardware, Basic Concepts of Operating Systems, Kernel, shell and file system structure, Basic Concepts of Linux, Basic Commands of Linux, Advanced Linux Commands, Installation of Linux, Interactive Installation,	8	2

Unit II	INTRODUCTION TO THE KERNEL AND BUFFER CACHE	No. of Hours	COs
	Architecture of Unix operating system, Introduction to the system concepts, Kernel data structure, System Administration. Buffer Cache, Buffer Headers, Structure of Buffer Pool, Reading and Writing disk block. **Case Study- Booting and Shut Down, Scripting and Shell** Bootstrapping,Booting PCs, GRUB,Booting with single user mode,Rebooting and Shutting down.,Shell Basics, bash scriptingPythonScripting, Scripting Best Practices,Working with Startup Scripts	8	2

Unit III	THE STRUCTURE OF PROCESS, PROCESS CONTROL AND PROCESS SCHEDULING	No. of Hours	COs
	Process state and transitions, Layout of the system memory, Context of the process, saving the context of the process, Manipulation the process address space, Sleep, Process creation, Signal, Process termination, Awaiting	8	4

	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

CO214: 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	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	2	2	-	-	-	-	-	-	3	3	3	-
CO5	3	3	3	3	2	-	-	-	-	-	-	3	3	3	-
CO6	2	3	1	-	-	-	-	-	-	-	-	3	3	3	-

COURSE CONTENTS

Unit I	**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

CO215: Seminar		
Teaching Scheme	**Examination Scheme**	
Lectures: 1 Hrs. / Week	**Term Work:**	**25 Marks**
Practical : 2 Hrs. / Week	**Oral:**	**25 Marks**
Credits: 2	**Total:**	**50 Marks**

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Prerequisite:

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Course Objectives:

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

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

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

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

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

Guidelines:

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

Recommended Format of the Seminar Report:

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

List of Assignments

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

Reference Books:

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

Home

CO216: Data Structure Lab II		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**25 Marks**
Credits: 1	**Practical Exam:**	**50 Marks**
	Total:	**75 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	3	-	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	2	2	-	-	-	-	-	-	3	3	3	-
CO5	3	3	3	3	2	-	-	-	-	-	-	3	3	3	-
CO6	2	3	1	-	-	-	-	-	-	-	-	3	3	3	-

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

CO217: Operating System and Administration Lab		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**25 Marks**
Credits: 1	**Practical Exam:**	**50 Marks**
	Total:	**75 Marks**

Course Objectives

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

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

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

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

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

Suggested List of Assignments

Group A (Implement any four assignments)

1. Implementation of Create/ rename/ delete a file using Unix/Linux commands. Adding users and access rights

2. Write a function to display the list of devices connected to your system including the physical names and its instance number. Write a function using mount and unmounts command to mount device and un-mount it.

3. Implement the commands for creation and deletion of directory. Write a program to change current working directory and display the node details for each file in the new directory.

4. Process related commands list the processes for the current shell, Display information about processes, Display the global priority of a process, and change the priority of a process with default arguments.

5. Use Operating system Commands to obtain the following results

1. To print the name of operating system
2. To print the login name
3. To print the host name

Group B (Implement any four assignments)

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

7. Write program to find number of CPU cores and CPU Manufacturer

8. Study assignment on Installation of Linux, Interactive Installation.

9. Write a shell script that determines the period for which a specified user is working on the system.

10. Write a shell script that accepts a file name, starting and ending line numbers as arguments and

displays all the lines between the given line numbers.

Group C (Implement any four assignments)

11. Write a C/C++ script to display all logged in users

12. C/C++ Program to Parent creating the child process by use of fork.

13. Java Program to identify the available memory in the system

14. Write Java script to display all logged in users. Count the number of logged-in users. Write a program to create a foreground and background process for the selected user and display its status.

15. Python Program to add two matrices.

16. Python Program to Illustrate Different Set Operations

17. Python Program to Generate a Random Number

Home

CO218: Object Oriented Programming Laboratory		
Teaching Scheme	**Examination Scheme**	
Practical : 2 Hrs. / Week	**Term Work:**	**25 Marks**
Credits: 1	**Practical Exam:**	**50 Marks**
	Total:	**75 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	2	-	-	-	-	-	-	2	-	3	-	2
CO2	3	-	2	2	-	-	-	-	-	-	2	-	3	-	2
CO3	3	-	2	2	-	-	-	-	-	-	2	-	2	-	2
CO4	3	-	2	2	-	-	-	-	-	-	2	-	3	-	2

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

Operating System Recommended: 64-bit Open source Linux or its derivative
Programming tools recommended: - Open Source C++ Programming tool like G++/GCC.
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

CO219: Mini Project/Choice Based Subject		
Teaching Scheme	**Examination Scheme**	
Lectures: 4 Hrs. / Week	**Term Work:**	**50 Marks**
Credits: 2		
	Total:	**50 Marks**

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Prerequisite: Basics of Programming

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

Bucket 1: 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:

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

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 STANDARDS	No. of Hours	COs
	JS How To, JS Where To, JS Statements,JS Comments, JS Variables, JS Operators, JS Comparisons, JS If...Else, JS Switch, JS Popup Boxes, JS Functions, JS For Loop, JS While , Loop, JS Break Loops, JS For...In,JS Events, JS Try...Catch, JS Throw, JS Special Text, JS Guidelines	4	3,4

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.	6	Create
4. **Design** and develop the application using database connectivity.	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	-	3	-	2	-	-	-	2	2	2	2	-	2	3
CO2	2	-	3	-	2	-	-	-	2	2	2	2	-	2	3
CO3	2	-	3	-	2	-	-	-	2	2	2	2	-	2	3
CO4	2	-	3	-	2	-	-	-	2	2	2	2	-	2	3

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

	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		

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

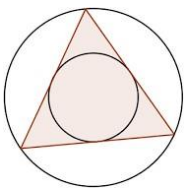
COURSE CONTENTS

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	4	1

	algorithm (OpenGL)		
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 shown as an example below. (Use any Circle drawing and Line drawing algorithms)



4. Write C++ program to draw a polygon and fill it with desired 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

MC220: Innovation - Project based – Science and Technology, Social, Design & Innovation		
Teaching Scheme	**Examination Scheme**	
Practical : 2Hrs. / Week	**Term Work:**	**50 Marks**
Credits: No Credit		
	Total:	**50 Marks**

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

2019 Pattern

Curriculum

(T Y B. Tech. Sem-V & VI 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 Third Year Computer Engineering Program Curriculum Structure and Syllabus for semester V & VI of Pattern 2019 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

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Science
PC	Professional Core	CA	Continuous Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MC	Mandatory Course

SRES's Sanjivani College of Engineering Kopargaon

COURSE STRUCTURE- 2019 PATTERN

THIRD YEAR B. TECH: COMPUTER ENGINEERING

SEMESTER V

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme-Marks						
							Theory						
			L (hrs)	T (hrs)	P (hrs)	Credits	ISE	ESE	CIA	OR	PR	TW	Total
PRJ	CO301	**Second Year Internship**	-	-	-	2				50	-	-	50
PCC	CO302	Design and Analysis of Algorithms	4	-	-	4	30	50	20	-	-	-	100
PCC	CO303	Computer Network	3	-	-	3	30	50	20	-	-	-	100
PCC	CO304	Theory of Computation	3	-	-	3	30	50	20	-	-	-	100
PCC	CO305	Data Base Management System	3	-	-	3	30	50	20	-	-	-	100
PEC	CO306	Professional Elective - I	3	-	-	3	30	50	20	-	-	-	100
PC	CO307	Design and Analysis of Algorithms Laboratory	-	-	2	1	-	-	-			25	25
PC	CO308	Computer Network Laboratory	-	-	2	1	-	-	-	25	-	-	25
PC	CO309	Database Management System Laboratory	-	-	2	1	-	-	-	-	50		50
PRJ	CO310	Skill based Credit Course	1	-		1	-	-	50	-	-		50
MC	MC311	Mandatory Course-V	1	-	-	Non Credit	-	-	-	-	-	-	-
Total			18	-	06	22	150	250	150	75	50	25	**700**

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

Code	Professional Elective-1
CO306 A	Web Technology (WT)
CO306 B	Software Engineering and Design(SED)
CO306 C	Microcontroller and Robotics (MR)

COURSE STRUCTURE- 2019 PATTERN

THIRD YEAR B. TECH: COMPUTER ENGINEERING

SEMESTER VI

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme-Marks						
							Theory						
			L (hrs)	T (hrs)	P (hrs)	Credits	ISE	ESE	CIA	OR	PR	TW	Total
PCC	CO312	Internet Of Things	3	-	-	3	30	50	20	-	-	-	100
PCC	CO313	System Programming and Operating System	3	-	-	3	30	50	20	-	-	-	100
PEC	CO314	Professional Elective-2	3	-	-	3	30	50	20	-	-	-	100
OE	CO315	Open Elective-1	4	-	-	4	30	50	20	-	-	-	100
PRJ	CO316	IPR and EDP	2	-	-	2	15	25	10	-	-		50
PRJ	CO317	IPR and EDP Lab	-	-	2	1	-	-	-	-	-	50	50
HSMC	HS318	Corporate Readiness	1	-	2	2	-	-	-	-	-	50	50
PC	CO318	Internet of Things Laboratory	-	-	2	1	-	-	-	75	-	-	75
PC	CO319	System Programming and Operating System Laboratory	-	-	2	1	-	-	-		75	-	75
MC	MC321	Mandatory Course-VI	1	-	-	Non Credit	-	-	-	-	-	-	-
Total			17	-	08	20	135	225	90	75	75	100	**700**

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

Code	Professional Elective-II
CO314 A	Software Testing and Quality Assurance (STQA)
CO314 B	Advanced Database Management System (ADBMS)
CO314 C	Wireless Sensor Network (WSN)

Code	Open Elective-1
CO315 A	IOT Basics

SEMESTER V

CO302: Design and Analysis of Algorithms			
Teaching Scheme		**Examination Scheme**	
Lectures:	**4Hrs. / 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: 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	2	3	2	3	-	1	2	1	-	-	-	1	3		-

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

COURSE CONTENTS

Unit I	**Problem Solving and Basics of Algorithmic Analysis**	**No. of Hours**	**Cos**
	Problem solving principles: Classification of problem, problem solving strategies, What are algorithms, classification of 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

CO303: Computer Network			
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: 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.	4	Analysis
6. **Develop** different network applications.	5	Evaluate

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				1		2		1	1	2	1	1
CO2		3	1										1	1	1
CO3													2		
CO4		3	1		1							1	3	1	1
CO5	1	3	3									1	3		1
CO6	2	3	3	2	2	2	1	1	2		1	2	3	2	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 and Wait, Sliding Window Protocol.	7 Hrs.	2

Unit-III	Medium Access Control Layer	No.of Hours	COs
	Channel allocation: Static and Dynamic, Multiple Access Protocols: 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 and buffering, 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, Re-transmission.	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.

R7. Approach Featuring the Internet”, 10th Edition, Wiley; ISBN13: 978-1-118-96126-1.

CO304: Theory of Computation			
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: 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. **Analyse** and design Finite Automata for regular languages	4	Analyse
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. **Analyse** and design Pushdown Automata for context free language	4	Analyse
5. **Analyse** and design Turing Machines for unrestricted languages	4	Analyse
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):

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

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

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 Informal Picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language, Deterministic and Nondeterministic FA (DFA and NFA), epsilon- NFA, FA with output: 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: Database Management System			
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: (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	1	--	--	2	--	--	--	--	--	2	3	2	3	2	1
CO2	2	--	--	2	--	--	--	--	--	2	2	2	2	2	--
CO3	1	--	--		--	--	--	--	--	3	2	2	2	3	--

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

Course Contents

Unit-I	**Introduction to DBMS**	**No.of Hours**	**COs**
	Introduction to Database Management Systems, File system verses database system, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database users, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.	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, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored Procedures & Functions, Cursors, Triggers, Assertions, roles and privileges , Embedded SQL, Dynamic SQL.	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 Distributed Databases, Distributed Database Design, Distributed Data Storage, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database. Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	07 Hrs.	CO5
Unit-VI	**NoSQL Database**	**No.of Hours**	**COs**
	Introduction to NoSQL Database, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Distributed Database Model, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL Data Models, MongoDB- Introduction, CRUD operation, aggregation, indexing, sharding, Case Study-unstructured data from social media. Introduction to Big Data.	08 Hrs.	CO6
Books:			
Text Books:			
T1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition T2**.** Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4			
Reference Books:			
R1. C J Date, "An Introduction to Database Systems", Addison-Wesley, ISBN: 0201144719 R2**.** S.K.Singh, "Database Systems : Concepts, Design and Application", Pearson, Education, ISBN 978-81-317-6092-5 R3. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN-10: 0321826620, ISBN-13: 978-0321826626. R4. Kristina Chodorow, Michael Dirolf, "MongoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468-9.			

CO306: Web Technology			
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: Basic knowledge of Programming and Computer Systems

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Course Objectives:

1. To learn the concepts of World Wide Web and internet.
2. To learn the web application development process and elements of web page.
3. To understand current client side and server side web technologies.
4. To learn current client side and server side frameworks.
5. To understand MVC architecture .
6. To learn XML , AJAX concept and its usage.

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. **Understand** Internet and World Wide Web.	2	**Understand**
2. **Understand** the process of web development and various elements of web pages.	2	**Understand**
3**. Apply** client side and server side technologies to implement web application.	3	**Apply**
4. **Apply** client side and server side frameworks to enhance the web application functionality.	3	**Apply**
5. **Apply** MVC architecture to implement complex web application.	3	**Apply**
6. **Apply** XML and Ajax Concepts to implement web 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	-	-	3	-	-	-	1	-	-	-	-	-	1	1	-
CO2	-	-	3	-	-	-	1	-	-	-	-	-	2	2	-
CO3	-	-	3	-	-	-	2	-	-	3	-	3	3	1	2
CO4	-	-	3	-	-	-	2	-	-	3	-	-	3	3	2
CO5	-	-	3	-	-	-	2	-	-	2	-	1	3	3	2

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

COURSE CONTENTS

Unit I	**Introduction to Web Technologies**	**No. of Hours**	**Cos**
	Internet, WWW, Webpage, Website, Types of Web Applications, Web Application Architecture, Web Servers, Roles and responsibilities of Web Developer, Challenges in Web App Development. **HTML:** Structure of Web Page, Text Formatting tags, Image, tables, links, frames, forms and HTML 5.	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. **AJAX:** Introduction, Working of AJAX, AJAX processing steps, coding AJAX script.	7	CO2 CO3 CO6
Unit III	**Client Side Technologies and JS Library**	**No. of Hours**	**Cos**
	Java Script: JS in an HTML (Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS. **DOM:** DOM levels, DOM Objects and their properties and methods, Manipulating DOM **JQuery:** Introduction to JQuery, Loading JQuery, Selecting elements, changing styles, creating elements, appending elements, removing elements, handling events. Bootstrap framework.	7	CO3 CO4
Unit IV	**Server side Technologies**	**No. of Hours**	**Cos**
	Introduction to CGI **Servlet:** lntroduction, life cycle of servlet, servlet directory structure, servlet example, form handling, cookies and session tracking. **JSP :** life cycle, JSP tags, built in objects, Directives, File uploading and page redirecting. Database connectivity using servlet and JSP	8	CO3 CO4

Unit V	Server side Technologies and Framework	No. of Hours	Cos
	PHP : Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, using PostgreSQL/MySQL with PHP. Introduction to **Laravel framework**	8	CO3 CO4 CO6
Unit VI	**MVC and CMS**	**No.of Hours**	**Cos**
	MVC **AngularJS:** Overview, directives, expression, controllers, filters, tables, modules, forms, includes, views, scopes, services, dependency injection, custom directives, Internationalization, **Java Struts:** Overview, architecture, configuration, sample code. Web Hosting example. **CMS:** Joomla/wordpress	6	CO4 CO5
Books:			
Text Books(T):			
T1. Achyut Godbole & AtulKahate, "WebTechnologies: TCP/IP to Internet Application Architectures",McGraw Hill Education publications T2. Robin Nixon," Learning PHP, Mysql and Javascript with JQuery, CSS & HTML5", 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			

CO306: Micro Controller and Robotics			
Teaching Scheme		**Examination Scheme**	
Lectures:	**03 Hrs. / Week**	**In-Sem Exam:**	**30 Marks**
Credits:	**03**	**End-Sem Exam:**	**50 Marks**
		Continuous Internal Assessment:	**20 Marks**
		Total:	**100 Marks**

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Prerequisite Course: Data Structure, Microprocessor Systems

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Course Objectives:

1. To understand architecture and features of typical Microcontroller
2. To understand the need of microcontrollers in real life applications.
3. To learn interfacing of real world peripheral devices
4. To study various hardware and software tools for developing embedded applications
5. To acquaint with the fundamentals of mobile robotics
6. To solve real world problems with the help of robotics

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

Course Outcomes	Bloom's Taxonomy	
	Level	Descriptor
1. 1.**Understand** the importance of microcontroller in designing embedded application.	2	**Understand**
2. 2.**Apply** knowledge to write program for embedded applications	3	**Apply**
3**. 3.Understand** the interfacing to real world devices.	2	**Understand**
4. 4.**Design** and develop embedded processor based applications	3	**Apply**
5. 5**.Explore** the fundamentals of Robotics	2	**Understand**
6. 6.**Apply** knowledge to develop real-world problems solutions with robotics.	4	**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	2	2	1	-	-	-	-	-	-	3	2	1
CO2	3	3	3	2	3	1	-	-	-	-	-	-	2	2	2
CO3	3	2	3	2	3	2	-	-	2	-	1	2	3	3	2

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

COURSE CONTENTS

Unit-I	**INTRODUCTION TO MICROCONTROLLER**	**No.of Hours**	**COs**
	Introduction, MCS51 Microcontroller: internal architecture, pin description, addressing modes. Difference between microcontroller and microprocessor, criteria for choosing a microcontroller	08 Hrs.	CO1
Unit-II	**PROGRAMMING MICROCONTROLLER**	**No.of Hours**	**COs**
	Instruction set-arithmetic, logical, data transfer, branching and Flag manipulation Instructions. 8051 assembly language programming- Timers, Interrupts, I/O ports, Interfacing I/O Devices, Serial Communication, Introduction to C programming in 8051,introduction to RTOS.	08 Hrs.	CO2
Unit-III	**PERIPHERAL INTERFACING**	**No.of Hours**	**COs**
	Real world interfacing- Analog to Digital converter, Digital to Analog converter, Mechanical switches, LEDs, seven segment display, keypads, LCDs, DC motor, stepper motor, PWM, External Memory Interface.	08 Hrs.	CO3
Unit-IV	**EMBEDDED PROCESSOR**	**No.of Hours**	**COs**
	Embedded Systems: Application Domain and Characteristic of Embedded System, Real time systems and Real time scheduling, Processor basics and System-On-Chip, Case Study: ARM, Arduino, Raspberry PI	08 Hrs.	CO1 CO4
Unit-V	**ROBOTICS**	**No.of Hours**	**COs**
	Robotics: Fundamentals, path Planning for Point Robot, Mobile Robot Hardware, Non Visual Sensors : Contact Sensors, Inertial Sensors, Infrared Sensors, Sonar, Radar, laser Rangefinders, . Robot System Control: Horizontal and Vertical Decomposition	08 Hrs.	CO5
Unit-VI	**ROBOTS IN PRACTICE**	**No.of Hours**	**COs**

	Robot Pose Maintenance and Localization: Simple Landmark Measurement, Servo Control, Robots in Practice: Delivery Robots, Intelligent Vehicles, Mining Automation, Space Robotics, Autonomous Aircrafts, Agriculture, Forestry, Domestic Robots.	08 Hrs.	CO6

Books:

Text Books:

T1. Muhammed Ali Mazidi, "The 8051 Microcontroller and Embedded systems", Prentice Hall, 2007

T2. John B. Peatman, "Design with PIC microcontroller", McGraw Hill International Ltd., 1997

T3. Michael Jenkin, Gregory, "Computational Principles of Mobile Robotics", Cambridge University Press, 2010, ISBN : 978-0-52-187157-0

Reference Books:

R1. Scott Mackenzie, Raphael C. W. Phan, "The 8051 Microcontroller", Prentice Hall, 2007

R2. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

R3. B.P. Singh, Advanced Microprocessors and Microcontrollers, NewAge International Publishers, 8122422853

CO306: Software Engineering and Design			
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: 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 managemen to software project developmentl
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	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):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	1	1	1	1	1	1	3	2	2	-
CO2	-	2	2	-	-	-	1	-	1	1	-	3	2	2	-
CO3	-	-	1	-	2	-	1	1	1	1	3	3	2	3	2
CO4	-	-	2	1	3	-	1	1	1	1	-	3	2	2	2
CO5	-	1	2	-	-	-	1	1	1	1	1	3	2	2	2
CO6	-	-	-	1	3	1	1	1	1	1	1	3	2	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.	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	6	CO3
	Concepts Defining a Task Set for the Software Project , Scheduling : Tracking the Schedule, Earned Value Analysis, Risk Management,Project plan.		
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

CO307: Design and Analysis of Algorithms Lab			
Teaching Scheme		**Examination Scheme**	
Practical:	**2 Hrs. / Week**	**Term Work:**	**25 Marks**
Credits:	1	**Total:**	25 Marks

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

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Course Objectives:Liberation Serif;Times New Roman

1. To develop problem solving abilities using mathematical modelling
2. To apply algorithmic strategies and testing while solving problems
3. To develop time and space efficient algorithms
4. To design algorithmic assignments using backtracking and branch-n-bound strategies
5. To develop parallel algorithms
6. To develop String Matching 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 to Demonstrate efficient design, analysis and testing of algorithmic assignments	4	Analyse
2. Students will be to Debug and Demonstrate the Testing of functioning using Software Engineering for OO Programming	2	Understand
3**.** Students will be to develop efficient Algorithms	4	Analyse
4. Students will be to Apply Backtracking and Branch-n-Bound strategy	3	Apply
5. Students will be able to use Parallel Environments	2	Understand
6. Students will be to develop String Matching algorithms	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	1	3	2	2	1	1	2	-	-	-	1	3	2	-
CO2	1	1	3	-	2	1	1	2	-	-	-	2	1	1	-
CO3	1	1	1	2	-	1	1	2	-	-	-	1	3	2	2

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

Suggested List of Assignments

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.

Perform any 8 Experiments

1. Using Divide and Conquer Strategies, design a function for Binary Search using C Also compute it's time complexity.
2. Using Divide and Conquer Strategies design a class for Concurrent Quick Sort using C++.Also Compute it's time complexity.
3. 8-Queen matrix is stored having first queen placed, use backtracking to place remaining queens to generate the final 8-queen matrix using python.
4. Concurrent Implementation of travelling salesman problem Given a Graph G=(V, E), where V is a set of cities, E=set of edges assigned with different costs. Salesman starts from the source city and wants to visit the destination city. Find out the shortest possible distance.
5. Implementation of 0-1 knapsack problem using branch and bound approach. Consider the number of objects N, Weights as w1. w2..... wn, profits as p1, p2. ...pn and Knapsack or bag capacity as m. Find an optimal solution.
6. Implementation of Optimal Merge Pattern Problem For a set of sorted files of different lengths, merge all the files into a single sorted file in minimum time.
7. Implementation of Sum of Subsets Problem using Backtracking.Given a set S of n objects with weight (w1, w2. ..wn) and a value M. Find subsets of elements of S whose total weight equals to M.
8. Implementation of Parallel Merge sort. Given list of N elements is divided into sublists and then they are merged by comparing elements with adjacent lists to get a final sorted output.
9. Write a Program to implement the Rabin-Karp String Matching algorithm.
10. Write a Program to implement KMP String Matching algorithm.

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

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

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Course Objectives:

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

Course Outcomes (COs) :

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

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

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

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

Course Contents

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.

CO309: 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	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	2	--	--	--	--	--	2	3	2	3	2	1
CO2	2	--	--	2	--	--	--	--	--	2	2	2	2	2	--
CO3	1	--	--		--	--	--	--	--	3	2	2	2	3	--
CO4	2	--	--	2	--	--	--	--	--	3	2	2	1	2	--
CO5	2	--	--	2	--	--	--	--	--	3	2	2	2	3	--
CO6	2	--	--	2	--	--	--	--	--	3	2	3	2	2	1

Course Contents

Sr. No.	Title of Assignment
	Group A- Database Programming Languages – SQL, PL/SQL
1	Study of Open Source Relational Databases: MySQL/Oracle and Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence
2	Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator, all types of Join, Sub-Query and View.
3	Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory. Write a PL/SQL block of code for the following requirements:- Schema: 1. Borrower(Rollin, Name, DateofIssue, NameofBook, Status) 2. Fine(Roll_no,Date,Amt) • Accept roll_no & name of book from user. • Check the number of days (from date of issue), if days are between 15 to 30 then fine amount will be Rs 5 per day. • If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day. • After submitting the book, status will change from I to R. • If condition of fine is true, then details will be stored into fine table. **Frame the problem statement for writing PL/SQL block inline with above statement.**
4	Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data

	should be skipped. **Frame the separate problem statement for writing PL/SQL block to implement all types of Cursors inline with above statement. The problem statement should clearly state the requirements.**
5	PL/SQL Stored Procedure and Stored Function. Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825 category is Higher Second Class Write a PL/SQL block for using procedure created with above requirement. Stud_Marks(name, total_marks) Result(Roll,Name, Class) **Frame the separate problem statement for writing PL/SQL Stored Procedure and function, inline with above statement. The problem statement should clearly state the requirements.**
6	Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers). Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in Library_Audit table. **Frame the problem statement for writing Database Triggers of all types, in-line with above statement. The problem statement should clearly state the requirements.**
Group B Large Scale Databases	
7	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution).
8	Implement aggregation and indexing with suitable example using MongoDB. Use Zipcode Dataset (download from url https://media.mongodb.org/zips.json) and import in mongoDB and perform following operations a. Return States with Populations above 10 Million. b. Return Average City Population by State c. Return Largest and Smallest Cities by State d. Return States with Population e. Create single field index f. Create a compound index
9	Implement Map reduce operation with suitable example using MongoDB. Use Movies Dataset. Write the map and reduce methods to determine the average ratings of movies. The input consists of a series of lines, each containing a movie number, user number, rating, and a timestamp: The map should emit movie number and list of rating, and reduce should return for each movie number a list of average rating.
Group C Mini Project : Database Project Life Cycle	
10	Write a program to implement MongoDB database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC.
11	Implement MYSQL/Oracle database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit,) using ODBC/JDBC.

12	Using the database concepts covered in Part-A & Part-B & connectivity concepts covered in Part C, students in group are expected to design and develop database application with following details: **Requirement Gathering and Scope finalization** **Database Analysis and Design:** • Design Entity Relationship Model, Relational Model, Database Normalization **Implementation :** • Front End : Java/Perl/PHP/Python/Ruby/.net • Backend : MongoDB/MYSQL/Oracle • Database Connectivity : ODBC/JDBC **Testing : Data Validation** Group of students should submit the Project Report which will be consist of documentation related to different phases of Software Development Life Cycle: Title of the Project, Abstract, Introduction, scope, Requirements, Data Modeling features, Data Dictionary, Relational Database Design, Database Normalization, Graphical User Interface, Source Code, Testing document, Conclusion. Instructor should maintain progress report of mini project throughout the semester from project group and assign marks as a part of the term work

Reference Books

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

CO310: Skill Based Credit Course			
Teaching Scheme		**Examination Scheme**	
Theory:	**1 Hrs. / Week**	**CIA :**	**50 Marks**
Credits:	1	**Total:**	50 Marks

Course Objectives:

The major objectives of skill based credit course inclusion are -

- To make students aware about the current skill set requirements in the industry and
- To give them exposure to the latest technology trends in collaboration with industry experts.
- To bring opportunities to the learners to think, design and implement solutions to the real time problems as per the Industry standards.
- To make students proficient in the selected skill set.

Course Outcomes:

The major outcomes expected from this course are, after the completion of this course, learner will be able to -

- To choose the current skill set requirements in the industry as per his or her choice.
- To explore the acquired knowledge of skill set in the application design and development.
- To apply the latest technology knowledge during the development of solutions to the real time problems as per the Industry standards.

General Guidelines:

This course is intended to make students competent for the particular skill set requirement of the Industry identified by the Department in consultation with the Industry Experts. The department will clearly state the detailed syllabus in the curriculum based on BoS Approval for the learner's reference. The learners will be able to select a particular skill set credit course as per his or her choice and capabilities. The department will run this course in collaboration with the Industry Expert. The respective staff-incharge involved in the conduction of this course, will ensure that he/she will also get trained in the respective skill set and will assist learners later on in the assessment and implementation process.

Skill based Credit Courses offered for the Department of Computer Engineering:

1. **DevOps and Automation**
2. **3D Design Visualization**
3. **Advanced Java Programming**

1] DevOps and Automation

Pre-requisites: Basic Knowledge of Software Engineering

Course Objectives:

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.

The overall objective of this course is to provide students with practical experience in applying agile methodology to their work environment.

1. Understand the differences between conventional and agile approaches
2. Estimate in an incremental and iterative fashion using practical techniques
3. Plan increment and release cycles
4. Capture and apply metrics
5. Understand scaling issues
6. Apply agile principles to a range of decision possibilities
7. Learn DevOps for CI/CD using containers, container orchestration and piplelines

Course Outcomes:

1. CO1: Be able to compare and contrast the differences between Agile and other project management methodologies
2. CO2: Be able to interpret and apply various principles, phases and activities of the Scrum methodology
3. CO3: Be able to identify and use various tools for Agile development and CI/CD
4. CO4: Be able to understand and implement DevOps principles for CI/CD

Unit I: Introduction to DevOps (1 hour)

Background of SDLC, Agile, ITIL and Need for DevOps, History of DevOps, Role of a DevOps Engineer, Terminologies in DevOps

Unit II: Version Control systems (3 hours)

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

Unit III: Configuration Management Tools (3 hours)

Introduction to Configuration Management tools, Types of Configuration Management Tools : Push-based & 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

Unit IV: Vagrant and Containerization (3 hours)

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 DockerFile, Docker Compose and Docker Swarm, Difference between Docker Swarm and Kubernetes for Container Orchestration

Unit V: CI/CD Pipelines and Continuous Monitoring (3 hours)

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)

Unit VI: DevOps Capabilities (2 hours)

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

Reference Books:

1. Emily Freeman, DevOps For Dummies, John Wiley & Sons (2019), ISBN: 1119552222, 9781119552222

2. Joakim Verona, Practical DevOps – Second Edition, May 2018, Packt Publishing, ISBN: 9781788392570

3. Lorin Hochstein & Rene Moser, Ansible : Up and Running, 2nd Edition, O'Reilly Media, ISBN-13: 978-1491979808

2] 3D Design Visualization

Topics:

1. Principle of Design
2. Digital Design
3. Introduction to 3D Graphics
4. 3D Asset Modelling
5. 3D Asset look and feel Development
6. Lighting and Rendering

3] Advanced Java Programming

Topics:

1. JDBC
2. Socket programming
3. Java Applet/Java Script/JSP

(MC 311) Mandatory Learning Courses [MLC] (Non Credit Course) for TY B. Tech Course Curriculum w. e. f A.Y. 2021-22

Important Note:

● The department has to finalize MLC from the given choices and will prepare suitable course contents at departmental level only.

● The departments are informed to finalize MLC for SEM I and SEM II immediately and will take its approval in the BoS Meeting.

● Department will keep record of its smooth conduction and activity details.

SEMESTER V

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

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

Each institution will offer a range of introductory courses in different art forms: music, dance, theatre, 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

Behavioral and Interpersonal skills (non-verbal skills / behaviors, nonaggression)

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 following.

• 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.

• To train the students for communicating effectively in both formal as well as in informal settings.

• To help the students to understand the importance of non-verbal aspects of effective communication.

• To help the students to understand Emotion and emotional intelligence, Managing ones' own emotional reservoirs, effective dealing with emotions at work

• 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.

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

SEMESTER VI

CO312: Internet of Things			
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 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 and implement secure infrastructure for IoT applications.
5. To learn real world application scenarios of IoT along with its social 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 IoT.	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 devices communicate 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) and Program Specific Outcomes (PSOs):

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

COURSE CONTENTS

Unit I	**Introduction 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	**IoT: 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	6	CO3

	Communication APIs, Sensor Networks, IoT Design Methodology, Four pillars of IoT (M2M, SCADA, WSN, DCM) # Case Studies: Home Automation using IoT communication models and IoT Communication APIs.		
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: Key Applications 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, ISBN: 1540335011.

R5: Brian Russell, Drew Van Duren, Practical Internet of Things Security - Second Edition,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/

CO313: System Programming and Operating System			
Teaching Scheme		**Examination Scheme**	
Lectures:	**3Hrs. / 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: 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	Analyse
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) and Program Specific Outcomes (PSOs):

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

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**	8	CO1
Unit II	**Macro Processor, Linkers and Loader s**	**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**	8	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	8	CO3
	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.**		
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**	7	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 **Case Study: Memory Management in Windows/Linux/Android**	7	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 and Disk Structure, Protection, File System Structure, File System implementation, Directory Implementation, Allocation methods, Free Space management.	6	CO6
	Case study: UNIX File system, Operating System Virtualization		

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
3. 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/
4. 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
5. https://www.udemy.com/course/system-programming/

CO314A: Software Testing and Quality Assurance (STQA)			
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: Software Engineering & Design

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Course Objectives:

1. To understand fundamentals concepts of software testing.
2. To learn and understand Black box testing.
3. To develop a comprehensive approach towards building White box testing.
4. To understand Testing Strategies, software quality and assurance systems.
5. To learn Testing 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. **Analyse** real world application scenarios of software testing.	**4**	**Analyse**
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, software quality and assurance systems.	**3**	**Apply**
5. **Apply** and analyse Testing planning and Management.	**3**	**Apply**
6. **Apply** automated tools for different types of application	**3**	**Apply**

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

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

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

Course Contents

Unit-I	**Introduction to Software Testing**	**No. of hours**	**COs**
	Need of testing, Basics of Software Testing, Testing Principles, Goals, Software Testing Life Cycle, Defects, Defect management, Verification and validation, Test Plan.	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.	6	CO2
Unit-III	**White Box Testing**	No. of Hours	
	Introduction, Need of white box testing, Testing types, Static testing by humans, Structural Testing – Control flow testing, Loop Testing, Design of test cases, Challenges in White box testing, Case-studies of White-Box testing.	6	CO3

Unit-IV	Testing Strategies and Quality Management	No. of Hours	
	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 Assurance. Elements of SQA, SQA Tasks, Goals, and Metrics, Formal Approaches to SQA, Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan.	6	CO4
Unit-V	**Test Planning and Management**	No. of Hours	
	Requirement Traceability matrix, essentials, Work bench, Important Features of Testing Process, Misconceptions, Principles, salient and policy of Software testing, Test Strategy, Test Planning, Testing Process and number of defects found, Cost aspect, establishing testing policy, methods, structured approach, categories of defect, Defect/ error/ mistake in software, Developing Test Strategy and Plan, Testing process.	6	CO5
Unit-VI	**Automation Testing**	No. of Hours	
	Agile Testing, Model based testing, Need for Automation, Keyword driven automation, Data driven automation, Manual testing versus Automated testing, Automated Testing Tools, Selection of tool, Introducing Selenium, Brief History of The Selenium Project, Selenium‟s Tool Suite, Selenium-IDE, Selenium RC, Selenium Webdriver, Selenium Grid, Test Design Considerations, Junit.	8	CO6
Books:			

Text Books:
T1: Ron Patton," Software Testing", Pearson Educations, ISBN-978-0-672-32798-8. T2: M. G. Limaye," Software Testing Principles, Techniques and Tools", Tata McGraw Hill.
ISBN-978-0070-139909 00-7013990-3 T3: A.B. Mathur, "Fundamental of software Testing", Pearson. ISBN: 9788131794760
Reference Books:
R1: Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing principles and Practices", Pearson. ISBN- 97881-7758-1218 R2: Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847. R3: Stephen Kan, "Metrics and Models in Software Quality Engineering", Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086

CO314B: Advanced Database Management System		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs. / Week	**In-Sem Exam:**	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Continuous Assessment:**	**20 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 fundamental concepts of parallel databases.
2. To provide a strong formal foundation in distributed database concepts, technology and practice.
3. To understand Database Architectures and Semistructured data storage techniques.
4. To learn and understand the concept of object oriented databases .
5. To learn and understand emerging trends of databases.
6. To learn various Big data technologies

Course Outcomes (COs):

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

Title	Bloom's Taxonomy	
	Level	Descriptor
1. Understand the basic concept and use of parallel database systems.	2	Understand
2. Understand the basic concept and use of distributed database systems.	2	Understand
3. Design databases with semistructured database storage techniques.	3	Apply
4. Design application by using object oriented database concept.	3	Apply
5. Understand and apply the concept of different emerging database models for real time application development.	3	Apply
6. Understand and apply basic concepts of Bigdata and Hadoop for big data analytics.	3	Apply

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

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

Course Contents

Unit-I	**Parallel Databases**	**No.of Hours**	**COs**
	Introduction, Parallel database architecture, speedup, scale-up I/O parallelism, Inter-query and Intra-query parallelism, Inter-operational and Intra-operational parallelism, parallel query evaluation, Design of parallel systems, Implementation issues of Parallel query evaluation, Design of parallel systems, Comparison of Inter-query and Intra-query parallelism.	06 Hrs.	CO1
Unit-II	**Distributed Databases**	No.of Hours	COs
	Introduction, Study of DDBMS architectures, Comparison of Homogeneous and Heterogeneous Databases, Analysis of Concurrency control in distributed databases, Implementation of Distributed query processing. Distributed data storage, Distributed transactions, Commit protocols, Availability, Distributed query processing, Directory systems-ldap, Distributed data storage and transactions.	08 Hrs.	CO2
Unit-III	**Specialty Databases**	**No.of Hours**	**COs**

	Overview of client server architecture, Databases and web architecture, N-tier architecture, XML, Introduction, Structure of XML Data, XML Document Schema, DTD, Querying and Transformation: XQuery, FLOWR, XPath, XML validation, Web server, API to XML, Storage of XML Data, XML Applications: web services, Web based system, Implementation of XML validations, Use of web servers. XML and DTD implementation, Use of Web service like Amazon web service or Microsoft Azure.	06 Hrs.	CO3
Unit-IV	**Object Oriented Database**	**No.of Hours**	**COs**
	Introduction**,** Limitations of Relational databases, The need of Object oriented databases, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Data types (arrays, multi-set etc) and structure in Object oriented databases using SQL, Object-Identity and Reference Types in SQL, ODL and OQL, Implementing O-R Features, Persistent Programming Languages, Object-Oriented versus Object-Relational, An Example of Object oriented and object relational database implementation.	06 Hrs.	CO4
Unit-V	**Emerging Trends in databases**	**No.of Hours**	**COs**
	Multimedia database, Geography databases, Gnome databases, Knowledge databases, deductive databases and semantic databases, Spatial database, Information visualization, Mobile databases, Web databases (JDBC, ODBC), Personal databases, Digital libraries, Data grids, Wireless networks and databases.Distributed Caching, In-Memory databases, Graph databases- Neo4j.	06 Hrs.	CO5

Unit-VI	Introduction to Big data and Hadoop	No.of Hours	COs
	Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Ecosystem- **Pig** : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. **Hive**: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. **Hbase** : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. **Big SQL** : Introduction, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	08 Hrs.	CO6

Books:

Text Books:

T1: Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition

T2: Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.

Reference Books:

R1: Rob Coronel, Database systems: "Design implementation and management", 4th Edition, Thomson Learning Press

R2: Raghu Ramkrishnan, Johannes Gehrke, "Database Management Systems", Second Edition, McGraw Hill International Edition

R3: Channda Ray, Distributed Database Systems, Pearson.

R4: Saheed K. Rahimi, Distributed Database Systems, Wiley India.

R5: V.K. Jain, Big Data and Hadoop, Khanna Book Publishing, Delhi

CO314C: Wireless Sensor Network		
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 Electronics and Data Communication, Computer Network

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Course Objectives:

1. To learn and understand Data Communication Concepts and Techniques.
2. To learn and understand different Wireless Communication Algorithms and Techniques.
3. To learn and understand different Concepts of WSN.
4. To learn and understand different protocols for Wireless Network
5. To learn and understand the functionalities of specialized protocols used in Wireless Network.
6. To learn and understand different applications in Wireless Network.

Course Outcomes (COs):

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1. Understand multiplexing techniques and wireless standards.	2	Understand
2. Understand wireless transmission and switching techniques.	2	Understand
3. Learn and understand wireless sensor network concepts.	2	Understand
4. Design, Setup, Install and configure Wireless Sensor Network.	3	Apply
5. Design and implement different routing algorithms for Wireless Network.	3	Apply
6. Develop different applications using Wireless Network.	3	Apply

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

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

Course Contents

Unit-I	**Introduction to Wireless Communication**	**No. of Hours**	**COs**
	Introduction, Multiplexing techniques: TDM, FDM, and CDMA, TD-SCDMA, LTETDD, LTE-FDD. LAN standards: Wireless LAN, WiMAX, ZigBee, Bluetooth, Infrastructure based (satellite N/W, Cellular N/W) and Infrastructure less (Adhoc N/W) wireless topologies, VLAN, VPN.	7 Hrs.	1
Unit-II	**Overview of Wireless Network**	**No. of Hours**	**COs**
	Wireless Transmission: Electromagnetic Spectrum, Radio, Micro Waves, Infrared, Light wave, Spread Spectrum Systems, modem Switching Techniques: Circuit Switching, Packet Switching and Message Switching. Hardware Components: Transceivers, Access Points and wireless routers.	7 Hrs.	2
Unit-III	**Basic Concepts of WSN**	**No.of Hours**	**COs**

	Background of Sensor Network Technology, Basic Overview of the Technology: Basic Sensor Network Architectural Elements, Typical sensing node, Brief Historical Survey of Sensor Networks. Applications of WSN: Building Automation, Sensors and Robots, Health Care and Military Applications. Basic WSN Technology: Sensor Node Technology, Hardware and Software, Sensor Taxonomy, Network Organization and Tracking. RFID based data communication, Architecture, Frame formats, CSMA/CA.	7 Hrs.	3
Unit-IV	**Data Link Layer**	**No.of Hours**	**COs**
	Link Layer: Error control, Framing, Link management. MAC Layer: Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols. Networking Sensors: ZigBee, Sensor MAC(S-MAC) protocol for WSN. Naming and Addressing: Fundamentals, Address and name management in wireless sensor networks.	7 Hrs.	4
Unit-V	**Routing Protocols**	**No.of Hours**	**COs**
	Routing Strategies (Proactive and Reactive), Geographic and Energy aware routing, Attribute based routing. Routing Techniques: Flooding, SPIN. Mobile Networking: Mobile IP, AODV, DSDV, DSR.	7 Hrs.	5
Unit-VI	**Applications of Wireless Network**	**No.of Hours**	**COs**
	Wireless Application Protocol (WAP),WML. Case Study: MANET, Cellular Network, Wireless Sensor Network, Military and Surveillance Applications.	7 Hrs.	6

Books:
Textbooks:
T1: Kazim Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks: Technology, Protocols and Applications", Wiley ISBN: 978-81-265-2730-4 (Students Edition). T2: Fang Zhaho, Leonidas Guibas, "Wireless Sensor Networks: An information Processing Approach", Elsevier ISBN: 978-81-8147-642-5.
Reference Books:
R1: Holger Karl and Andreas Willig "*Protocols and Architectures for Wireless Sensor Networks",* John Wiley & Sons, Ltd., ISBN: 0-470-09510-5. R2: Waltenegus Dargie,Christian Poellabauer, " Fundamentals of wireless sensor networks Theory and practice", John Wiley and Sons, Ltd., ISBN 978-0-470-99765-9.

CO315 : IoT Basics			
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: Digital Electronics, Computer Network

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Course Objectives:

1. To understand the functionalities of various single board embedded platforms fundamentals.
2. To introduce the working of Microcontrollers and its connectivity
3. To understand the basic concepts of IoT.
4 To recognize various sensors, actuators and how they are used.
5. To learn IoT networking and different IoT platforms.
6. To learn real world application scenarios of IoT.

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

Course Outcomes	Bloom's Taxonomy	
	Level	**Descriptor**
1) Understand embedded platform fundamentals, operating systems for IoT systems.	2	Understand
2) Understand the System on chip and components used.	2	Understand
3) Compare the concepts of IoT with the Computer	2	Understand
4) Compare and understand the working of sensors and actuators	4	Analyse
5) Use the basic networking concepts and IoT platforms.	3	Apply
6) Demonstrate the different real applications using IoT.	3	Apply

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

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

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

COURSE CONTENTS

Unit I	**Introduction to Embedded Systems**	**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	6	CO1
Unit II	**System-On-Chip**	**No. of Hours**	**COs**
	Microcontrollers, Microcontroller Properties, Components of Microcontrollers, System-On-Chip and its examples, Components of Embedded Systems, Introduction to embedded processor.	6	CO2
Unit III	**IoT 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	6	CO3
Unit IV	**Sensors and Actuators**	**No. of Hours**	**COs**
	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	CO4
Unit V	**Platforms for IoT**	**No. of Hours**	**COs**

	Basics of IoT Networking, Networking Components, Internet Structure, Connectivity Technologies, IoT communication models	6	CO5
	and IoT Communication APIs, Sensor Networks, IoT Design Methodology, Four pillars of IoT (M2M, SCADA, WSN, DCM)		
Unit VI	**IoT Application / Case study**	**No. of Hours**	**COs**
	Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry. Case Studies: Home Automation, Smart parking, Forest Fire 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: Key Applications 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, ISBN: 1540335011.

R5: Brian Russell, Drew Van Duren, Practical Internet of Things Security - Second Edition,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/

IT315: Object Oriented Programming with C++/Java		
Teaching Scheme	**Examination Scheme**	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**
Prerequisite Course: Computer Fundamentals & Programming		

Course Objectives

1. To understand the basics of object oriented programming paradigm and principles.
2. To understand classes and objects.
3. To understand inheritance and polymorphism.
4. To understand exception handling mechanisms.
5. To understand multithreading.
6. To understand the library.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the basics of object oriented programming paradigm and principles..	**2**	**Understand**
CO2	**Use** classes and objects to write object oriented programs.	**3**	**Apply**
CO3	**Use** inheritance and polymorphism.	**3**	**Apply**
CO4	**Use** exception handling mechanism.	**3**	**Apply**
CO5	**Understand** multithreaded programming.	**3**	**Apply**
CO6	**Use** inbuilt library functions.	**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	-	-	3	-	-
CO2	2	2	3	-	1	-	-	1	2	2	-	-	3	-	-
CO3	2	2	3	2	1	-	-	1	2	2	1	-	3	-	2
CO4	2	-	3	-	1	-	-	1	2	2	1	-	3	-	2
CO5	2	-	2	2	1	-	1	1	2	2	1	-	3	-	2
CO6	2	-	2	2	1	1	-	1	2	2	1	3	3	-	2

Course Contents			
Unit-I	**Object Oriented Programming Paradigm and Principles**	**No. of Hours**	**COs**
	Procedure and object oriented paradigm, Basic Principles of Object Oriented Programming: Data abstraction and encapsulation, Inheritance, Polymorphism.	08	CO1
Unit-II	**CLASSES AND OBJECTS**	**No. of Hours**	**COs**
	Defining classes and objects, visibility, constructors, instance and static members, array of object.	08	CO2
Unit-III	**INHERITANCE AND POLYMORPHISM**	**No. of Hours**	**COs**
	Inheritance types, single inheritance, multiple inheritance, syntax, abstract class. Overloading and overriding functions/methods, dynamic polymorphism.	08	CO3
Unit-IV	**EXCEPTION HANDLING**	**No. of Hours**	**COs**
	Try-catch block, multiple catch, nested try catch, finally.	08	CO4
Unit-V	**MULTITHREADING**	**No. of Hours**	**COs**
	Introduction, main thread, creating child thread, inter-thread communication, synchronization.	08	CO4
Unit-VI	**LIBRARY**	**No. of Hours**	**COs**
	String, Stream, Standard Template Library/Networking, Date and Time.	08	CO6

Text Books:

1. E. Balagurusamy, "Object Oriented Programming with C++ and Java", 8th Edition, McGraw Hill.
2. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill, 2017.
3. Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill, 2003.

Reference Books:

1. Bjarne Stroustrup, "C++ Programming Language", 4th Edition, Addison Wesley.
2. Somashekara M.T., "Object Oriented Programming with Java", PHI.
3. Vasapannarava, et al, "Object Oriented Programming Using C++ and Java" Pearson.

eLearning Resources

1. NPTEL Course: Programming in Java, https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2. NPTEL Course: An Introduction to Programming Through C++, https://onlinecourses.nptel.ac.in/noc22_cs42/preview
3. NPTEL Course: Advanced C++, https://onlinecourses.swayam2.ac.in/aic20_sp01/preview
4. NPTEL Course: Java Business Application, https://onlinecourses.swayam2.ac.in/aic20_sp14/preview
5. Tutorials: Java T Point, https://www.javatpoint.com/java-tutorial , https://www.javatpoint.com/cpp-tutorial

ET315 : Artificial Intelligence			
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 : Basics of Statistic, Fundamentals of programming

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Course Objectives :

1. To learn key components of the Artificial Intelligence system.
2. To convey the ideas in AI research and programming language related to emerging technology.
3. To know the concepts of machine learning, pattern recognition, and natural language processing.
4. To elaborate the numerous applications and huge possibilities in the field of AI that go beyond the normal human imagination.

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

Course Outcomes	Course Outcome(s)Statement	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Demonstrate the key components of intelligent agents	**2**	**Understand**
CO2	Analyze various uninformed search and informed search strategies.	**4**	**Analyse**
CO3	Apply knowledge representation techniques and problem solving strategies to common AI applications.	**3**	**Apply**
CO4	Categorize different Learning Techniques	**4**	**Analyse**
CO5	Explain various pattern recognition techniques	**4**	**Analyse**
CO6	Review the components of Natural Language Understanding .	**5**	**Evaluate**

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

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

CO6	2	-	-	2	-	-	-	-	-	-	-	-	-	-

Course Contents

Unit-I	**Foundation**	No.of Hours	COs
	Intelligent Agents, Agents and environments, Good behavior, The nature of environments, structure of agents, Problem Solving, problem solving agents, example problems, Searching for solutions, uniformed search strategies, avoiding repeated states, searching with partial information.	8 Hrs.	**CO1**
Unit-II	**Searching Techniques**	No.of Hours	COs
	Search and exploration, Informed search strategies, heuristic function, local search algorithms and optimistic problems, local search in continuous spaces, online search agents and unknown environments, Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP, Games: Optimal decisions in games, Alpha-Beta Pruning,	8 Hrs.	**CO2**
Unit-III	**Knowledge Representation**	No.of Hours	COs
	First order logic, representation revisited, Syntax and semantics for first order logic, Knowledge engineering in first order logic, Inference in First order logic, prepositional versus first order logic, unification and lifting, forward chaining, backward chaining, Resolution, Knowledge representation.	8 Hrs.	**CO3**
Unit-IV	**Learning**	No.of Hours	COs
	Learning from observations: forms of learning, Inductive learning, Learning decision trees, Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning.	8 Hrs.	**CO4**
Unit-V	**Pattern Recognition**	No.of Hours	COs
	Basic steps of pattern recognition system, Principal Component Analysis,Linear Discriminant Analysis, Classification, Object Recognition- Template Matching theory,Prototype Matching Theory,Pattern Mining- Apriori Algorithm,Speech Recognition,	8 Hrs.	**CO5**

Unit-VI	Natural Language Understanding	No.of Hours	COs
	Why NL, Formal grammar for a fragment of English, Syntactic analysis, Augmented grammars, Semantic interpretation, Ambiguity and disambiguation, Discourse understanding, Grammar induction, Probabilistic language processing, Probabilistic language models.	8 Hrs.	**CO6**

Books:

Text Books:

T1:Stuart Russell, Peter Norvig, "Artificial Intelligence", A Modern Approach, Pearson Education/Prentice Hall of India.
T2: Parag Kulkarni, Prachi Joshi, "Artificial Intelligence- Building Intelligent Systems" PHI Learning Pvt Ltd
T3:Munesh Chandra Trivedi " A classical approach to Artificial Intelligence" , Khanna Publishing House

Reference Books:

R1: Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd.
R2: George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education/ PHI.
R3: Deepak Khemani, "A First Course in Artificial Intelligence", Mc Graw Hill Education(India), 2013, ISBN : 978-1-25-902998-1
R4: Chandra S. S.& H.S.Anand " Artificial Intelligence and Machine Learning" PHI Publishing
R5: R.B. Mishra "Artificial Intelligence" PHI Publishing.

Guidelines for Continuous Assessment:- Unit Test will be conducted for 10 marks and Related Online Courses on NPTEL/Coursera/Udemy/Simply learn platform will be completed for 10 marks

ME315 : ENTERPRISE RESOURCE PLANNING			
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: (if any) Database Management System

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Course Objectives:

1. Basic concepts of ERP systems for manufacturing or service companies, and the differences among MRP, MRP II, and ERP systems;
1. Apply the principles of ERP systems, their major components, and the relationships among these components.
2. The knowledge of typical ERP systems, and the advantages and limitations of implementing ERP systems.
3. To comprehend the technical aspects of ERP systems
4. To be able to map business processes using ERP concepts and techniques

Course Outcomes (COs):

CO1. Classify different processes of the organization and relationship among all processes.
CO2. Examine systematically the planning mechanisms in an enterprise, and identify all components in an ERP system and the relationships among the components
CO3. To describe the Generic Model of ERP and General ERP Implementation Methodology
CO4. To apply the concepts of BPR, SCM
CO5. To demonstrate knowledge of SAP
CO6. To apply the concepts of CRM

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		01			03				02	01	02				
CO2		01			03				02	01	02				
CO3		01			03				02	01	02				
CO4		01			03				02	01	02				
CO5		01			03				02	01	02				
CO6		01			03				02	01	02				

Course Contents

Unit-I	**Introduction to Enterprise Resource Planning**	No.of Hours	COs
	Introduction of the term Business Process Reengineering(BPR) ,BPR Methodology, Current BPR Tools ,Introduction to material requirement planning (MRP), Definition of Enterprise Resource Planning (ERP); Evolution of ERP; Characteristics, Features, Components and needs of ERP; ERP Vendors; Benefits & Limitations of ERP Packages	03	CO1
Unit-II	**Enterprise Modeling and Integration of ERP**	No.of Hours	COs
	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration	03	CO2
Unit-III	**ERP Architecture and Implementation Methodology of ERP**	No.of Hours	COs
	Generic Model of ERP system; Core Modules functionality; Types of ERP architecture, Client Server Architecture, Web-based Architecture, Service Oriented Architecture (SOA) ; Difficulty in selecting ERP, Approach to ERP selection,General Implementation Methodology of ERP, Vanilla Implementation; Evaluation Criteria of ERP packages;	03	CO 3
Unit-IV	**Introduction to SAP**	No.of Hours	COs
	SAP, Integrated SAP Model, SAP Architecture, SAP R/3 System & mySAP, SAP Modules;	03	CO 4
Unit-V	**ERP for Supply Chain Management**	No.of Hours	COs
	.Definition of Supply Chain Management (SCM); Supply Chain Council's SCOR Model; Stevens Model of Supply Chain Management; Aims of SCM; SCM Key,Benefits of SCM; ERP Vs SCM; Key SCM Vendors	03	CO 5

Unit-VI	**Customer Relationship Management**	No.of	COs
		Hours	
	Definition of Customer Relationship Management (CRM); CRM Evolution; CRM Delivery Processes, CRM support Processes; CRM Analysis Processes; CRM components	03	CO6

Books:

Text Books:

T1. Enterprise Systems For Management, Luvai F. Motiwalla, Jeff Thompson, Pearson Education., 2nd Ed., 2011. ISBN-10: 0132145766 | ISBN-13: 978- 0132145763

T2. Enterprise Resource Planning, Ravi Shankar, S.Jaiswal, Galgotia Publication Pvt. Ltd., 1st Ed., 1999. ISBN 81-203-0417-9

T3. Enterprise Resource Planning, second edition, Alexis Leon, Tata McGraw-Hill, 2008. ISBN 9780070656802

T4. Concepts in Enterprise Resource Planning, Third Edition,Bret Wagner & Ellen Monk©2009 | Course Technology ISBN 10: 1-4239-0179-7 | ISBN 13: 978-1-4239-0179-2

Reference Books:

R1. CRM at the speed of Light : Social CRM strategies, tools and techniques for engaging your customers : 4th edition by Paul Greenberg , McGraw Hill ,2009

R2. Supply Chain Management Casebook : The Comprehensive Coverage and Best Practices in SCM , by Chuck Munson , Pearson FT Press 2013, **ISBN**-13: 978-0- 13-336723-**2**

R3. Definitive Guide to Supply Chain Best Practices, The Comprehensive Lessons and Cases in Effective SCM , by Robert Frankel , Pearson FT Press , 2014

R4. Enterprise Resource Planning by Mary Sumner , Prentice Hall , 2005

EE315: Renewable Energy Systems

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

Prerequisite Course:
1. Basic Mechanical Engineering & Basic Electrical Engineering

Course Objectives

1. To create awareness about the importance of renewable technology for sustainable future.
2. Impart the knowledge of solar power generation and wind power generation.
3. Introduce forth coming renewable technologies and storage systems in renewable generation

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Determine need of various power generation systems	2	Understanding
CO2	Relate solar power generation and its utilization.	3	Applying
CO3	Analyse wind power generation and its utilization.	4	Analysing
CO4	Explain biomass power generation and its utilization.	2	Understanding
CO5	Analyse trending renewable energy sources and energy storage systems.	4	Analysing
CO6	Relate principles of storage technologies and their applications	3	Applying

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

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

Course Contents			
UNIT-I	**Introduction to Renewable Energy Systems**	**Hrs.**	**COs**
	Energy sources: classification of energy sources, introduction to renewable energy, renewable energy trends, and key factors affecting renewable energy supply, advantages and disadvantages of RES and their uses.	6	CO1
UNIT-II	**Solar Energy**	**Hrs.**	**CO**
	PV power generation, basic principle of power generation in PV cell, technology for fabrication of photovoltaic devices, efficiency of PV cell, characteristics curves of PV cell, solar thermal power generation, solar thermal conversion: basics, solar concentrator and tracking system, flat plate collectors- liquid and air type, theory of flat plate collectors, selective coatings, advanced collectors: ETC, Solar Pond	8	CO2
UNIT-III	**Wind Energy**	**Hrs.**	**CO**
	Power available in wind, wind turbine power & torque characteristics, types of rotors, characteristics of wind rotor, local effects, wind shear, turbulence & acceleration effects, measurement of wind, wind speed statistics, energy estimation of wind regimes, capacity factor, aerodynamics of wind turbines, airfoil, lift & drag characteristics, power coefficient & tip speed ratio characteristics, electrical generator machines in wind energy systems	8	CO3
UNIT-IV	**Biomass Energy**	**Hrs.**	**CO**
	Overview of biomass as energy source, biomass as a fuel, physicochemical and thermal characteristics of biomass as fuel, biochemical conversion of biomass for energy production, liquid biofuel, energy plantation- overview on energy plantation, basis of selecting the plants for energy plantation, waste land utilization through energy plantation.	8	CO4
UNIT-V	**Forthcoming Renewable Technologies**	**Hrs.**	**CO**
	Geothermal Energy Generation, ocean-thermal energy generation, tidal energy generation, magneto hydro dynamic power generation- working, layout, different components, advantages, limitations,	8	CO5
UNIT-VI	**Storage Technologies**	**Hrs.**	**CO**
	Introduction, need for storage for RES, basic thermodynamic and electrochemical principles, classification, traditional energy storage system- battery, fuel cell, principle of operation, types, applications for power generation.	8	CO6
Text Books:			
[T1] Boyle, Godfrey, "Renewable Energy", (2nd edition), Oxford University Press, 2004. [T2] G. S. Sawhney, "Non-Conventional Resources of Energy", PHI Publication 2012. [T3] G.D. Rai, Non conventional energy sources, Khanna publication			
References:			

[R1] Gary-L. Johnson Wind Energy Systems Tata Mc-Graw-Hill Book Company.
[R2] S. P. Sukhatme, J. K. Nayak Solar Energy- Principles of Thermal Collection and Storage (3rd ed.), Tata McGraw-Hill Publication.
[R3] Paul Gipe Wind Power, Renewable Energy for Home, Farm, and Business.
[R4] G.N. Tiwari,Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa Publication

E-References

[1] https://nptel.ac.in/courses/121/106/121106014/
[2] https://nptel.ac.in/courses/103/103/103103206/
[3] https://onlinecourses.swayam2.ac.in/nou22_ge17/course

PR316 : Intellectual Property Rights and Entrepreneurship development			
Teaching Scheme		**Examination Scheme**	
Theory	**2 Hrs. / Week**	**In-Sem Exam:**	**15**
Credits:	**2**	**End-Sem Exam**	**25 Marks**
		Continuous Assessment:	**10**
		Total:	**50 Marks**

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Prerequisite Course: NIL

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Course Objectives:

1.To introduce student with IPR

2. To explain IPR procedure in India such as Patents, Designs and Trademarks

3. To make aware of the economic importance of IPRs.

4. To develop the ability to search and analyse the IPRs.

5. To Instill a spirit of entrepreneurship among the student participants.

6. To give insights into the Management of Small Family Business.

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

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

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

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

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 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:**	4	5

	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 Economic and 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:

1. Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI, New Delhi
2. The Indian Patent act 1970.
3. The copyright act 1957
4. Manual of patent office practice and procedure of Govt. of India.
5. Manual of Designs Practice and Procedure of Govt. India
6. Manual of Trademarks Practice and Procedure of Govt. India
7. Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India
8. Intellectual Property Rights- A Primer, R. Anita Rao & Bhanoji Rao, Eastern BookCo.

9. The Dynamics of Entrepreneurial Development & Management by Desai, Vasant, Himalaya Publishing House, Delhi.
10. Managing Small Business by Longenecker, Moore, Petty and Palich, Cengage Learning, India Edition.
11. Cases in Entrepreneurship by Morse and Mitchell, Sage South Asia Edition.
12. Entrepreneurship – Indian Cases on Change Agents by K Ramchandran, TMGH.

Reference Books:

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.

PR317 : Intellectual Property Rights and Entrepreneurship development Lab			
Teaching Scheme		**Examination Scheme**	
Practical	**2 Hrs. / Week**	**In-Sem Exam:**	**–**
Credits:	**1**	**Term Work**	**50 Marks**
		Continuous Assessment:	–
		Total:	**50 Marks**

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List of experiments: The term work shall consist following experiments/reports completed within the semester.

1. Searching for patent, design, trademarks, and copy rights at various databases and its report preparation.
2. Patent draft preparation for a sample invention
3. Design draft preparation for a sample design
4. Trademark draft preparation for a sample Trademark/Device
5. Copyright draft preparation for a sample documents/audio/video
6. Report preparation of patent Infringement
7. Preparation of Detailed project report for new business/industry/startup
8. Visit to industry to understand entrepreneurship and its report preparation

HS318: Corporate Readiness			
Teaching Scheme		**Examination Scheme**	
Lectures:	**1 Hrs. / Week**	**In-Sem Exam:**	**-**
Practical	**2 Hrs. / Week**	**Term Work**	**50**
Credits:	**2**	**Continuous Assessment:**	**-**
		Total:	**50**

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Prerequisite Course: (Quantitative aptitude, Verbal and non verbal communication)

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Course Objectives:

1. To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.

2. To develop required aptitude skills.

3. To design the functional and chronological resume.

4. To demonstrate the importance of critical thinking ability and expression in group discussions

5. To prepare students for the various professional interviews.

6. To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs): After successful completion of this course students should be able to

1. Interpret placement processes of various organizations and modern jobs search approach.

2. Summarize their skill set to be mentioned in the resume.

3. Develop the presentation skills and group discussion.

4. Apply critical thinking required to solve aptitude problems.

5. Conclude the situation based on the given dataset.

6. Prepare them ready for employment.

Course Contents

Unit-I	Placement Awareness	No.of Hours	COs
	Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures.	02 Hrs.	CO 1
Unit-II	**Resume Writing**	**No.of Hours**	**COs**
	Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit.	02 Hrs.	CO2
Unit-III	**Group Discussion and Presentation skills**	**No.of Hours**	**COs**
	Why GDs are implemented commonly, Aspects which make up a Group Discussion, Tips on group discussion **,** do's and don'ts of GD and Presentation skills.	02 Hrs.	CO3
Unit-IV	**Logical Reasoning I**	**No.of Hours**	**COs**
	Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Attention to Details, Flowcharts ,Crypt arithmetic	06 Hrs.	CO4
Unit-V	**Logical Reasoning II**	**No.of Hours**	**COs**
	Data Interpretation, Data Sufficiency	04 Hrs.	CO5
Unit-VI	**Logical Reasoning III**	**No.of Hours**	**COs**
	Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle	06 Hrs.	CO6
Learning Resources :			
Text Books:			

T1 : A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal

T2: Reasoning verbal and non verbal by B. S. Sijwali.

Reference Books:

R1: Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical)
R2: Analytical Reasoning by MK Panday
R3: Logical and analytical reasoning by k. Gupta
R4: Multi dimensional reasoning by Mishra & Kumar dr. Lal

E- Books :
https://themech.in/quantitative-aptitude-and-logical-reasoning-books/
https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

E-learning Resources/MOOCs/ NPTEL Course Links: (

1. https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/
2. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/
3. https://www.livecareer.com/resume/examples/web-development/e-learning-developer

CO318: IoT Lab			
Teaching Scheme		**Examination Scheme**	
Practical:	**2 Hrs. / Week**	**Term Work**	**-**
Credits:	**1**	**Oral Examination**	**75**
		Total	**75**

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Prerequisite Course: Digital Electronics, Computer Network

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Course Objectives:

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

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

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

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

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

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

Suggested List of Assignment

Group A

1. Study of sensors and actuators used for IOT and create a report on it.
2. Identify different boards like Raspberry-Pi, Beagle bone, Arduino and other microcontrollers.
3. Study of different operating systems for Raspberry-Pi / Beagle bone / Arduino. Understanding the process of installing the OS on Raspberry-Pi / Beagle bone / Arduino.
4. Study of Connectivity and configuration of Raspberry-Pi / Beagle bone 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

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

Group C

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

CO319: System Programming and Operating System Lab			
Teaching Scheme		**Examination Scheme**	
Lectures:	**2 Hrs. / Week**	**PR Exam:**	**75 Marks**
Credits:	1	**TW:**	
		Continuous Assessment:	
		Total:	**75 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 assemblers.
2. To learn 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 techniques 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 Macroprocessor	3	Apply
3. Handle tools like LEX & YACC	3	Apply
4. Analyse and Implement Preemptive and Non-Preemptive process scheduling schemes	4	Analyse
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) and Program Specific Outcomes (PSOs):

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

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**

List of Assignments

1. Design suitable data structures and implement pass-I of a two-pass assembler for apseudo-machine using object oriented features. 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 the syntax analysis phase of the compiler to recognize simple and compound sentences given in the 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):
T1: John Donovan, “System Programming”, McGraw Hill, ISBN 978-0--07-460482-3. T2: Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07 - 463579 – 4 T3: Silberschatz, Galvin, Gagne, "Operating System Principles", 9th Edition, Wiley, ISBN 978-1-118-06333-0
Reference Books(R):
R1: Alfred V.Aho,Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, “Compilers-Principles,Techniques and Tools”, Pearson,ISBN:978-81-317-2101-8 R2:John R. Levine, Tony Mason, Doug Brown, “Lex and Yacc”,O’Reilly & Associates,Inc,ISBN:1-56592-000-7

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

2019 Pattern

Curriculum

(B. Tech. Sem-VII & VIII 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 Final Year Computer Engineering Program Curriculum Structure and Syllabus for semester VII & VIII of Pattern 2019 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

Director
Sanjivani College of Engineering,
Kopargaon

SRES's Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to SPPU Pune)

COURSE STRUCTURE- 2019 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING

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

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COURSE STRUCTURE- 2019 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING

SEMESTER VII

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	
PROJ	CO401	Professional Internship-III	-	-	-	2	-	-	-	-	50	-	50
PCC	CO402	Compiler Construction	3	-	-	3	20	30	50	-	-	-	100
PCC	CO403	Data Mining and Warehousing	3	-	-	3	20	30	50	-	-	-	100
PEC	CO404	Professional Elective – III	3	-	-	3	20	30	50	-	-	-	100
OEC	CO405	Open Elective - II	-	-	-	3	25	-	75	-	-	-	100
OEC	CO406	Open Elective III: Online Course through MOOCs	2	-	-	2	20	-	30	-	-	-	50
LC	CO407	Data Mining and Warehousing Laboratory	-	-	2	1	-	-	-	-	-	50	50
LC	CO408	Professional Elective – III Laboratory	-	-	2	1	-	-	-	-	50	-	50
PROJ	CO409	Project Stage- I		-	4	2		-	-	-	50	-	50
MLC	MC410	Mandatory Learning Course-VII	1	-	-	NC	-	-	-	-	-	-	**PASS/ FAIL**
Total			12	-	08	20	105	90	255	150	150	50	**650**

Mandatory Learning Course-VII: A. Botnet of Things
B. Quantum Computing

Professional Elective-III	**Open Elective-II (NPTEL)**	**Open Elective-III (Coursera)**
CO404 A Cloud Computing (CC)	CO405A Deep Learning	CO406A Linux and Private Cloud Administration on IBM Power Systems
CO404 B Soft Computing (SC)	CO405B Data Structure and Algorithm using Java	CO4065BNatural Language Processing
CO404 C Data Science and Analytics (DSA)		

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COURSE STRUCTURE- 2019 PATTERN

FINAL YEAR B. TECH: COMPUTER ENGINEERING

SEMESTER VIII

Cat.	Code	Course Title	Teaching Scheme				Evaluation Scheme						
			L (hrs)	T (hrs)	P (hrs)	Credits	Theory			Practical			Grand Total
							CIA	ISE	ESE	TW	OR	PR	
PCC	CO411	High Performance Computing (HPC)	3	-	-	3	20	30	50	-	-	-	100
PCC	CO412	Machine Learning (ML)	3	-	-	3	20	30	50	-	-	-	100
PCC	CO413	Cyber Security (CS)	3	-	-	3	20	30	50	-	-	-	100
PEC	CO414	Professional Elective - IV	3	-	-	3	20	30	50	-	-	-	100
LC	CO415	HPC+ML Laboratory	-	-	2	1	-	-	-	-	-	50	50
LC	CO416	Cyber Security Laboratory	-	-	2	1	-	-	-	-	50	-	50
PROJ	CO417	Project Stage- II	-	-	8	4	-	-	-	100	50	-	150
MLC	MC418	Mandatory Learning Course-VIII	1	-	-	NC	-	-	-	-	-	-	PASS/ FAIL
Total			13	-	12	18	80	120	200	100	100	50	650

Mandatory Course-VIII: A. Gamification
B. Emotional Intelligence

Professional Elective-IV
CO414A Business Intelligence (BI)
CO414 B Image Processing and Pattern Recognition (IPPR)
CO414 C Artificial Neural Network and Deep Learning (ANNDL)

SEMESTER VII

CO401 : Professional Internship-III	
Teaching Scheme	**Evaluation Scheme**
Lectures: - Hrs./Week	**Oral Exam (OR): 50 Marks**
Tutorials: - Hrs./ week	**Total : 50 Marks**
Credits: 2	

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Prerequisite Course: (if any) -

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Course Objectives:

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

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

Course Outcomes (COs):

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

CO No.	Title	Bloom's Taxonomy	
		Level	Descriptor
CO1	To **demonstrate** professional competence through industry internship.	3	Demonstrate
CO2	To **apply** knowledge gained through internships to complete academic activities in a professional manner.	3	Apply
CO3	To choose appropriate technology and tools to **solve** given problem.	3	Solve
CO4	To demonstrate abilities of a responsible professional and use ethical practices in day to day 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	PO1	PO1	PO1	PSO	PSO	PSO

										0	1	2	1	2	3
CO1	2	2	2	2	3	1	1	1	1	2	1	1	2	1	1
CO2	1	2	2	2	3	2	1	1	1	2	2	1	2	1	1
CO3	-	-	-	-	-	1	-	-	2	2	1	1	-	2	-
CO4	2	-	-	-	-	2	2	3	-	1	-	2	2	-	1
CO5	-	-	-	-	-	1	2	1	1	1	2	1	1	-	2
CO6	-	-	-	-	-	1	-	-	2	1	-	1	1	-	2

Guidelines:

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

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

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

Duration:

Internship is to be completed after semester 6 and before commencement of semester 7 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 7.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry[1].

Students must register at Internshala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the VI th semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their VIth semester examination and before academic schedule of semester VII.
Student can take internship work in the form of the following but not limited to:

1. Working for consultancy/ research project,
2. Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
3. Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,

4. Development of new product/ Business Plan/ registration of start-up,
5. Industry / Government Organization Internship,
6. Internship through Internshala,
7. In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
8. Research internship under professors, IISC, IIT's, Research organizations,
9. NGOs or Social Internships, rural internship,
10. Participate in open source development.

Internship Diary/ Internship Workbook:

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

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

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

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

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

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

1. Depth of knowledge and skills
2. Communication & Presentation Skills
3. Team Work
4. Creativity
5. Planning & Organizational skills
6. Adaptability
7. Analytical Skills
8. Attitude & Behavior at work
1. Societal Understanding
2. Ethics
3. Regularity and punctuality
4. Attendance record
5. Diary/Work book

6. Student's Feedback from External Internship Supervisor

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

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

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

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

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

Feedback from internship supervisor (External and Internal)

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

Reference:

- https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf
- https://internship.aicte-india.org/

TOP

CO402: Compiler Construction	
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) Discrete Mathematics, Theory of Computation

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Course Objectives:

1. To learn and understand Lexical Analysis and Lexical Analyzer Generator (LEX).
2. To learn and understand Syntax Analysis and Syntax Analyzer Generator (YACC).
3. To understand Syntax-Directed Definitions and Translations.
4. To understand the Intermediate Code Generation.
5. To understand various ways for optimizing the intermediate code.
6. To understand different algorithms for generating the target machine code.

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	Demonstrate the Lexical Analyzer for certain language.	3	Apply
CO2	Demonstrate the Syntax Analyzer for certain language.	3	Apply
CO3	Write and evaluate the Syntax Directed Definition.	3	Apply
CO4	Write the intermediate code in various forms for different types of input statements	3	Apply
CO5	Apply different code optimization techniques to generate the optimized code	3	Apply
CO6	Apply different code generation algorithms to generate efficient target Code	3	Apply

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

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

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

Course Contents

Unit-I	**Lexical Analysis**	No.of Hours	COs
	Introduction, Language Processors, Structure of a Compiler, Role of the lexical analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator LEX, Design of a Lexical Analyzer Generator.	07 Hrs.	CO1
Unit-II	**Syntax Analysis**	No.of Hours	COs
	Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using Ambiguous grammars, Parser Generators YACC.	07 Hrs.	CO2
Unit-III	**Syntax Directed Translation**	No.of Hours	COs
	Syntax-Directed Definitions, S-attributed definitions, L-attributed definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation- Construction of Syntax Trees , Syntax-Directed Translation Schemes.	07 Hrs.	CO3
Unit-IV	**Intermediate Code Generation**	No.of Hours	COs
	Variants of Syntax Trees, Three-Address Code, Types and Declarations, Assignment Statements, Translation of Expressions, Type Checking, Control Flow, Backpatching, Switch-Statements, Intermediate Code for Procedures	07 Hrs.	CO4
Unit-V	**Code Optimization**	No.of Hours	COs

	Introduction, Principal sources of optimization, Peephole optimization, Optimization of basic blocks, Loops in flow graphs, Introduction to global data-flow analysis, Iterative solution of data-flow equations, Code-improving transformations	07 Hrs.	CO5
Unit-VI	**Code Generation**	No.of Hours	COs
	Issues in the Design of Code Generator, Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Next-use information, Simple Code Generator, Register Allocation and Assignment, DAG representation of basic blocks, Generating code form dags, Dynamic programming code-generation	07 Hrs.	CO6

Books:

Text Books:

1.A V Aho, R Sethi, J D Ullman, “Compilers: Principles, Techniques, and Tools”, Pearson Edition, ISBN 81-7758-590-8

2.Dick Grune, Bal, Jacobs, Langendoen, “Modern Compiler Design”, Wiley, ISBN 81-265-0418-8

Reference Books:

1.K Muneeswaran, “Compiler Design”, Oxford University press, ISBN 0-19-806664-3

2. R Levin, T Mason, D Brown, “Lex and Yacc”, O’Reilly, 2000 ISBN 81-7366-061-X

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

4.Anthony J. Dos Reis, “Compiler Construction Using Java, JavaCC and Yacc”, Wiley, ISBN 978-0-470-94959-7.

5.K. Cooper, L, Torczon, "Engineering a Compiler", Morgan Kaufinann Publishers, ISBN 81-8147-369-8

E-Resources

1. PDF Compiler Construction eBook Download Full – eBook Makes
2. Compiler Construction | Download book (freebookcentre.net)
3. https://onlinecourses.nptel.ac.in/noc20_cs13/preview

4. https://nptel.ac.in/courses/106108113

TOP

CO403: Data Mining and Warehousing	
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) 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.	Statement of Course Outcome	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.	4	Analyze
CO3	Ability to **e**xplore the data warehouse and its design.	4	Analyze
CO4	Examine the hidden patterns in the data	3	Apply
CO5	Apply the mining process by frequent pattern analysis techniques.	3	Apply
CO6	Demonstrate the Classification techniques for realistic data.	3	Apply

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

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

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 versus Continuous Attributes.	7 Hrs.	CO1
Unit-II	**Data Pre-processing**	No.of Hours	COs
	Introduction to Data Pre-processing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score normalization and decimal scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data Discretization: Binning, Histogram Analysis.	6 Hrs.	CO2
Unit-III	**Data Warehouse**	No.of Hours	COs
	Data Warehouse, Operational Database Systems and Data Warehouses(OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model, Concept Hierarchies, Data Warehouse Architecture, The Process of Data Warehouse Design, A three-tier data warehousing architecture, Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP.	6 Hrs.	CO3
Unit-IV	**Cluster Analysis: Measuring Similarity & Dissimilarity**	No.of Hours	COs
	Measuring Data Similarity and Dissimilarity, Proximity Measures for Nominal Attributes and Binary	7 Hrs.	CO4

	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.		
Unit-V	**Frequent Pattern Analysis**	No.of Hours	COs
	Market Basket Analysis, Frequent item set, closed item set & Association Rules, mining multilevel association rules, constraint based association rule mining, Generating Association Rules from Frequent Item sets, Apriori Algorithm, Improving the Efficiency of Apriori, FP Growth Algorithm. Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rules.	6 Hrs.	CO5
Unit-VI	**Classification**	No.of Hours	COs
	Introduction, classification requirements, methods of supervised learning, decision trees- attribute selection, tree pruning, ID3, scalable decision tree techniques, rule extraction from decision tree, Regression, Bayesian Belief Networks, Training Bayesian Belief Networks, Classification Using Frequent Patterns, Associative Classification, Lazy Learners-k-Nearest-Neighbour Classifiers, Case-Based Reasoning, Multiclass Classification, Metrics for Evaluating Classifier Evaluating the Accuracy of a Classifier.	8 Hrs.	CO6
Books:			
Text Books:			
1. Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers, ISBN:9780123814791, 9780123814807.			

2. Mohammed J. Zaki, Wagner Meira Jr., “Data Mining and Analysis”, Cambridge University Press, ISBN:9781316614808.
Reference Books:
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
E-Resources:-
1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview 2. https://in.coursera.org/specializations/data-warehousing

TOP

CO404 A: Cloud 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: Computer Network, Operating System

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Course Objectives:

1. To study cloud computing fundamentals.
2. To understand 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 monitoring and security aspects.

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

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the fundamentals and roots of cloud computing	2	Understand
CO2	Install and create virtualization environments that forms the basics for cloud	6	Create
CO3	Study and Analyse different cloud file systems. Compare available cloud file systems	4	Analyse
CO4	Develop Open source type of cloud	6	Create
CO5	Understand Service Level Agreements in cloud services offered by cloud service provider to cloud service consumer	2	Understand
CO5	Design and Analyse the IoT sensor data by sending data on cloud.	4	Analyse

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

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

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

Course Contents

Unit I	**Introduction to Cloud Computing**	**No. of Hours**	**COs**
	Roots of Cloud Computing: Distributed computing (Cluster and Grid), Virtualization, Internet Techniques(Web services and SOA) & Autonomic computing. Cloud Fundamentals: cloud definition, hardware and software resources, cloud computing reference model, benefits of cloud computing, limitations of cloud computing, cloud computing service models and deployment models.	5	CO1
Unit II	**Virtualization**	**No. of Hours**	**COs**
	Virtualization: Definition, types of virtualization, types of hypervisors, virtualization tools and mechanisms- Xen, VMware. Issues with virtualization, advantages of virtualization. Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management. Virtualization for Data-Center Automation, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and XAMP)	6	CO2
Unit III	**Data Storage and Security in Cloud**	**No. of Hours**	**COs**
	Storage system architecture, Big data, Block and level storage virtualization, Virtual Provisioning, and automated storage tiering, VLAN, VSAN and benefits, Cloud file systems: GFS and HDFS, BigTable, Hbase and Dynamo. Features and comparisons among GFS, HDFS. Cloud Storage Providers. Securing the Cloud- General Security, Advantages of Cloud-Based Solutions. Disaster Recovery- Understanding the Threats.	6	CO3
Unit IV	**Cloud Implementation**	**No. of**	**Cos**

		Hours	
	Cloud Computing Open Source Technologies: Open Stack, Eucalyptus. **Amazon Web Services:** Services offered by Amazon- EC2(Creating a instance, installing web server and configuring a server), AWS Storage and Content Delivery, Identify key AWS storage options, EBS (Describe Amazon EBS, Creating an Elastic Block Store Volume, Adding an EBS Volume to an Instance, Snap shot- ing an EBS Volume. S3 (Create an Amazon S3 bucket and manage associated objects). AWS Load Balancing Service-Introduction Elastic Load Balancer, Creating and Verifying Elastic Load Balancer. **Google:** Services offered by Google- Google compute engine (Creating an instance, installing web server and configuring a server), Google Storage-S3 (Create a google bucket and manage associated objects).	7	CO4
Unit V	**Cloud Monitoring and Management**	**No. of Hours**	**Cos**
	Interoperability and Service Monitoring: Issues with interoperability, Vendor lock-in, Interoperability approaches. SLA Management, Metering Issues, and Report generation. Resource Management and Load Balancing: Virtual machine migration, Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Scheduling Techniques for Advance Reservation, Capacity Management to meet SLA Requirements, various load balancing techniques.	6	CO5
Unit VI	**Cloud and Internet of Things**	**No. of Hours**	**COs**
	Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Cyber-Physical	6	CO6

	System), Online Social and Professional Networking. Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.		

Books:

Text Books(T):

T1. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.

T2. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more" , Wiley Publications, ISBN: 978-0-470-97389-9.

T3.Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476.

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. Barrie Sosinsky,"Cloud Computing", Wiley India, ISBN: 978-0-470-90356-8.

R4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press.

E-Resources:-

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

CO404 B : Soft 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)

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Course Objectives:

1. To know the basics behind the Design and development 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	--	1	2	3	--
CO2	3	2	2	3	--	--	--	--	--	1	--	1	2	3	--
CO3	1	2	3	3	--	--	--	--	--	1	--	1	2	3	--
CO4	1	2	3	3	--	--	--	--	--	1	--	1	2	3	--
CO5	1	2	3	3	--	--	--	--	--	1	--	1	2	3	--
CO6	1	2	3	3	--	--	3	--	--	1	--	1	2	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,	6Hrs.	CO1
Unit-II	**Artificial Neural Networks : An Introduction**	No.of Hours	COs
	Fundamental Concepts, Evolution of Neural Netwok, Basic Model of Artificial Neural Network, Important terminologies of ANNs, Mc-Culloch – Pitts Neuron, Hebb Network	6Hrs.	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 Propogations Learning, Special Networks, ANNs Applications	6Hrs.	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 Reasoning, Fuzzy Decision Making, Fuzzy Logic Control Systems. Defuzzification,	6Hrs.	CO4

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	6Hrs.	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.	6Hrs.	CO6

Books:

Text Books: (Max. 2-3 Books with details as per given example)

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:(Min. 04 Books with details as per given example)

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

E-Resources:-

1. https://onlinecourses.nptel.ac.in/noc22_cs54/preview
2. https://in.coursera.org/learn/neural-networks-deep-learning

TOP

CO404 C: Data Science and Analytics	
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) 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 association rule mining algorithm
4. To study supervised classification algorithms
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	Students able to understand lifecycle approach to data science and big data analytics projects	2	Understand
CO2	Students able to apply analytic techniques and tools to analyze big data, create statistical models, and identify insights that can lead to actionable results.	3	Apply
CO3	Students able to understand the association rule mining and logistical regression.	2	Understand
CO4	Students able to understand the classification algorithm	2	Understand
CO5	Design and develop an Big data application using classification algorithms	2	Understand
CO6	Students able to apply big data visualization techniques	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

Course Content

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 Analytic 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	**Association Rules and Regression**	No.of Hours	COs
	Advanced Analytical Theory and Methods: Association Rules- Overview, a-priori algorithm, evaluation of candidate rules, case study-transactions in grocery store, validation and testing, diagnostics. Regression- linear, logistics, reasons to choose and cautions, additional regression models.	7 Hrs.	CO 3
Unit-IV	**Classification**	No.of Hours	COs
	Decision trees- Overview, general algorithm, decision tree algorithm, evaluating a decision tree. Naïve Bayes – Bayes‟ Algorithm, Naïve	7 Hrs.	CO 4

	Bayes‟ Classifier, smoothing, diagnostics. Diagnostics of classifiers, additional classification methods.		
Unit-V	**Data Analytics Applications**	No.of Hours	COs
	How is Analytics used? 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

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. https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs45/preview

TOP

CO405 A: Deep Learning	
Teaching Scheme	**Evaluation Scheme**
Lectures: - 12 weeks online	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: Working knowledge of Linear Algebra, Probability Theory. It would be beneficial if the participants have done a course on Machine Learning.

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Course Objectives:

1. To explore the Deep Learning.
2. To study the concepts of Deep Learning.
3. To introduce Autoencoders Techniques
4. To enable the students to know regularization.
5. To understand the CNN in deep learning & examine the case studies of deep learning.
6. To examine the different architectures like Recurrent Neural Networks

Course Outcomes (COs):

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

CO No.	Title	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Discuss** the basics of Deep learning	2	Understand
CO2	**Understand** the Gradient Descent and its usage.	2	Understand
CO3	**Apply** various Autoencoders.	3	Apply
CO4	**Understand** various Regularization Techniques.	2	Understand
CO5	**Describe** Convolutional Neural Networks and its applications.	2	Understand
CO6	**Describe** Recurrent Neural Networks and its applications.	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
CO2	--	--	2	2	--	--	--	--	--	--	2	--	--	3	--
CO3	1	--	--	2	--	--	--	--	--	--	--	--	--	1	--
CO4	--	--	--	--	--	--	2	--	--	--	--	--	--	1	
CO5	2	--	2	3	--	--	1	--	--	--	2	--	--	2	2

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

Course Content

Unit-I	**Introduction to Deep Learning**	No.of Hours	COs
	History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm. Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks.	2 weeks	CO1
Unit-II	**Gradient Descent**	No.of Hours	COs
	Feedforward Neural Networks, Backpropagation Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis	2 weeks	CO2
Unit-III	**Autoencoders**	No.of Hours	COs
	Principal Component Analysis and its interpretations, Singular Value Decomposition. Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders	2 weeks	CO3
Unit-IV	**Regularization**	No.of Hours	COs
	Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization	2 weeks	CO4

Unit-V	**Convolutional Neural Networks**	No.of Hours	COs
	Learning Vectorial Representations Of Words Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks	2 weeks	CO5
Unit-VI	**Recurrent Neural Networks**	No.of Hours	COs
	Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs Encoder Decoder Models, Attention Mechanism, Attention over images	2 weeks	CO6

Books:

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

Reference Books:

1. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
2. Deep learning, Rajiv Chopra,Khanna book Publishing Co. New Delhi

E-Resources:-

1. https://onlinecourses.nptel.ac.in/noc21_cs05/preview

TOP

CO405 B Data Structure and Algorithm using Java	
Teaching Scheme	**Evaluation Scheme**
Lectures: - 12 weeks online	**Continuous Internal Assessment (CIA): 25 Marks**
Credits: 3	**End-Sem Exam (ESE): 75 Marks**
	Total: 100 Marks

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Prerequisite Course: C/C++/Java, data structures and algorithms.

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Course Objectives:

1. To understand various operations on data stored in Linear Data Structures such as Arrays.
2. To understand and implement traversing operations on Linear Data Structures such as Linked lists, Stacks, Queues.
3. To learn and understand various operations on Binary Trees.
4. To represent and implement data using graph data structure.
5. To learn various data searching and sorting techniques.
6. To implement shortest path algorithms and greedy algorithms using Graph Data Structure.

Course Outcomes (COs):

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

CO No.	Title	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** how to store data in different linear data structures.	2	Understand
CO2	**Discuss** traversing operations in Linked lists, Stacks, Queues.	2	Understand
CO3	**Interpret** various operations on trees for given problem statement.	2	Understand
CO4	**Implement** data operations for Graph theory.	3	Apply
CO5	**Apply** appropriate searching and sorting techniques for the specified problem.	3	Apply
CO6	**Construct** solution for given specific problem using Graph data structure.	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	3	2	--
CO2	2	3	2	2	--	--	--	--	--	--	--	2	3	2	--
CO3	3	3	3	--	--	--	--	--	--	--	--	3	3	3	--
CO4	3	3	3	2	2	--	--	--	--	--	--	3	3	3	--
CO5	2	3	2	--	--	--	--	--	1	--	--	2	3	2	--

CO6	3	3	3	2	2	--	--	--	--	--	--	3	3	3	--

Course Contents

Unit-I	**Arrays and its Operations**	No.of Hours	COs
	1D array, list and vector, 2D matrices and tables of objects, Java implementation of 1D and 2D arrays and its operations	2 weeks	CO1
Unit-II	**Linked Lists Implementation**	No.of Hours	COs
	Linked lists and its various operations, stack and queue, Java implementation of linked lists, stack and queue.	2 weeks	CO2
Unit-III	**Binary Trees and its implementation**	No.of Hours	COs
	Binary trees: Representation and operations. Variations of binary tree: Binary search tree, Height balanced search tree, Heap tree, Java implementation of binary trees and its variations	2 weeks	CO3
Unit-IV	**Graph Data Structures**	No.of Hours	COs
	Graph: Structure, representation and operations, Java implementations of graph data structures	2 weeks	CO4
Unit-V	**Algorithms (Part-I) Implementation**	No.of Hours	COs
	Algorithms (Part-I): Searching and sorting algorithms, Java implementation of Part-I algorithms	2 weeks	CO5
Unit-VI	**Algorithms (Part-II) Implementation**	No.of Hours	COs
	Algorithms (Part-II): Greedy algorithms, shortest path algorithms, Java implementation of Part-II algorithms	2 weeks	CO6
Books:			
Text Books:			

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:
R1: Classic Data Structures (2nd Edition) Debasis Samanta, Prentice Hall India R2: Java: The Complete Reference Hebert Schildt, Mc Graw Hill R3: Object-Oriented Programming with C++ and Java Debasis Samanta, Prentice Hall India R4: Swayam-NPTEL online course entitles Programming in Java Debasis Samanta
E-Resources:-
1. https://onlinecourses.nptel.ac.in/noc22_cs92/preview

CO406 A: Linux and Private Cloud Administration on IBM Power Systems	
Teaching Scheme	**Evaluation Scheme**
Lectures: - 2 Hrs. / Week	**Continuous Internal Assessment (CIA): 20 Marks**
Credits: 2	**End-Sem Exam (ESE): 30 Marks**
	Total: 50 Marks

There are 3 Courses in this Specialization

Course Name	Week No.	Content	No of hrs
Fundamentals of Red Hat Enterprise Linux	1	**Getting Started with Red Hat Enterprise Linux** Describe and define open source, Linux, Linux distributions, and Red Hat Enterprise Linux.	1
	2	Accessing the Command Line	3
	3	Managing Files From the Command Line	4
	4	Creating, Viewing, and Editing Text Files	1
	5	Managing Local Linux Users and Groups	3
	6	Controlling Access to Files with Linux File System Permissions	3
	7	Monitoring and Managing Linux Processes	4
	8	Installing and Updating Software Packages	1
Linux System Administration with IBM Power Systems	1	Virtualization with IBM Power Systems	2
	2	Installing Red Hat Enterprise Linux, System management strategies	5
	3	All about Systemd	3
	4	IBM service and productivity tools, Cloud computing	4
Private Cloud Management on IBM Power Systems	1	Introduction to private cloud, Working with your private cloud	6
	2	System administration on private cloud	3
	3	Images and virtual machines, Advanced features of IBM Cloud PowerVC Manager	5
E-Resources;-	https://www.coursera.org/specializations/linux-private-cloud-administration-power-systems#courses		

TOP

CO406 B: Natural Language Processing	
Teaching Scheme	**Evaluation Scheme**
Lectures: - 2 Hrs. / Week	**Continuous Internal Assessment (CIA): 20 Marks**
Credits: 2	**End-Sem Exam (ESE): 30 Marks**
	Total: 50 Marks

There are 4 Courses in this Specialization

Course Name	Week No.	Content	No of hrs
Natural Language Processing with Classification and Vector Spaces	1	**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!	11
	2	**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!	7
	3	**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.	8
	4	**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.	8
Natural Language Processing with Probabilistic Models	1	**Autocorrect** Learn about autocorrect, minimum edit distance, and dynamic programming, then build your own spellchecker to correct misspelled words!	7
	2	**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!	6
	3	**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!	9
	4	**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.	9

Natural Language Processing with Sequence Models	1	**Neural Networks for Sentiment Analysis** Learn about neural networks for deep learning, then build a sophisticated tweet classifier that places tweets into positive or negative sentiment categories, using a deep neural network.	7
	2	**Recurrent Neural Networks for Language Modelling** Learn about the limitations of traditional language models and see how RNNs and GRUs use sequential data for text prediction. Then build your own next-word generator using a simple RNN on Shakespeare text data!	6
	3	**LSTMs and Named Entity Recognition** Learn about how long short-term memory units (LSTMs) solve the vanishing gradient problem, and how Named Entity Recognition systems quickly extract important information from text. Then build your own Named Entity Recognition system using an LSTM and data from Kaggle!	5
	4	**Siamese Networks** Learn about Siamese networks, a special type of neural network made of two identical networks that are eventually merged together, then build your own Siamese network that identifies question duplicates in a dataset from Quora.	6
Natural Language Processing with Attention Models	1	**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.	9
	2	**Text Summarization** Compare RNNs and other sequential models to the more modern Transformer architecture, then create a tool that generates text summaries.	7
	3	**Question Answering** Explore transfer learning with state-of-the-art models like T5 and BERT, then build a model that can answer questions.	12
	4	**Chatbot** Examine some unique challenges Transformer models face and their solutions, then build a chatbot using a Reformer model.	9
E-Resources:-	https://www.coursera.org/specializations/natural-language-processing		

TOP

CO407: Data Mining and Warehousing Laboratory	
Teaching Scheme	**Evaluation Scheme**
Practical: 2 Hrs./ Week	**Practical Exam (PR): 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.	Statement of Course Outcome	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.	4	Analyze
CO3	Ability to **e**xplore the data warehouse and its design.	4	Analyze
CO4	Examine the hidden patterns in the data	3	Apply
CO5	Apply the mining process by frequent pattern analysis techniques.	3	Apply
CO6	Demonstrate the Classification techniques for realistic data.	3	Apply

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

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

CO6	2	2	2	3	2	3	2	--	--	2	--	--	2	2	3

List of Assignments
1. Implement Data pre-processing tasks.
2. Implement Frequent pattern analysis using Apriori algorithm.
3. Visualize the Clusters Using Suitable tool (Weka).
4. Visualize the Decision tree classification algorithm Using Suitable tool (Weka).
5. 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

TOP

CO408A: Cloud Computing Laboratory	
Teaching Scheme	**Evaluation Scheme**
Lectures: 2 Hrs. / Week	**Oral Exam (OR): 50 Marks**
Credits: 1	**Total: 50 Marks**

Prerequisite: Computer Network, Operating System

Course Objectives:

1. To study cloud computing fundamentals.
2. To understand virtualization environment in cloud computing.
3. To study PaaS and IaaS cloud services.
4. To study the cloudsim cloud simulator.

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

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Install and create virtualization environments that forms the basics for cloud	6	Create
CO2	Understand the fundamentals and roots of cloud computing through own cloud implementation.	2	Understand
CO3	Able to deploy application on cloud as a part of PaaS service of Cloud.	3	Apply
CO4	Develop a website on cloud and access the website through various terminal/ end devices.	6	Create
CO5	Study and Understand the Open Stack architecture which forms the in-house private cloud.	2	Understand
CO6	Install and configure Cloudsim Toolkit and demonstrate cloudlet example.	4	Analyse

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

CO PO Mapping Table:

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO

	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3
CO1	1	3	3	-	1	-	1	-	-	-	2	-	-	-	-
CO2	-	3	3	-	-	-	-	-	-	-	2	-	-	2	1
CO3	2	3	3	-	1	-	-	-	-	-	2	-	2	-	-
CO4	2	3	3	-	1	-	-	-	-	-	2	-	-	3	2
CO5	-	-	3	2	-	-	-	-	-	-	2	-	-	-	1
CO6	-	-	3	2	-	-	-	-	-	-	2	-	-	3	3

LABORATORY ASSIGNMENTS

Title of the Assignment
1. Install and configure VirtualBox or VM-Ware to create virtual machines in order to understand basic concepts of virtualization.
2. Install and configure owncloud over the existing LAN in the Laboratory to understand the integration of various tools like Apache Web server, My SQL and PHP.
3. Demonstrate an assignment to install and configure Google App Engine as a Platform-as-a-Service.
4. Study the Open Stack Architecture to explore private cloud.
5. Install and configure Cloudsim Toolkit and demonstrate cloudlet example.
6. Create a website on the virtual machine created on the cloud and access the website from various terminal devices.
7. Mini-Project: Setup your own cloud for Software as a Service (SaaS) over the existing LAN in your laboratory. In this assignment you have to write your own code for cloud controller using open source technologies without HDFS. Implement the basic operations may be like to upload and download file on/from cloud in encrypted form.
Books:
Text Books:
.Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill. .Dr. Kris Jamsa, " Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more" , Wiley Publications, ISBN: 978-0-470-97389-9. .Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476.
Reference Books:

.Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039.
.Buyya, “Mastering Cloud Computing”, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0.
.Barrie Sosinsky,"Cloud Computing", Wiley India, ISBN: 978-0-470-90356-8.
.Kailash Jayaswal, “Cloud computing", Black Book, Dreamtech Press.

TOP

CO408 B : Soft Computing Laboratory		
Teaching Scheme	**Evaluation Scheme**	
Lectures: 2 Hrs. / Week	**Oral Exam (OR): 50 Marks**	
Credits: 1	**Total : 50 Marks**	

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Prerequisite Course: (if any)

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Course Objectives:

1. To know the basics behind the Design and development 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

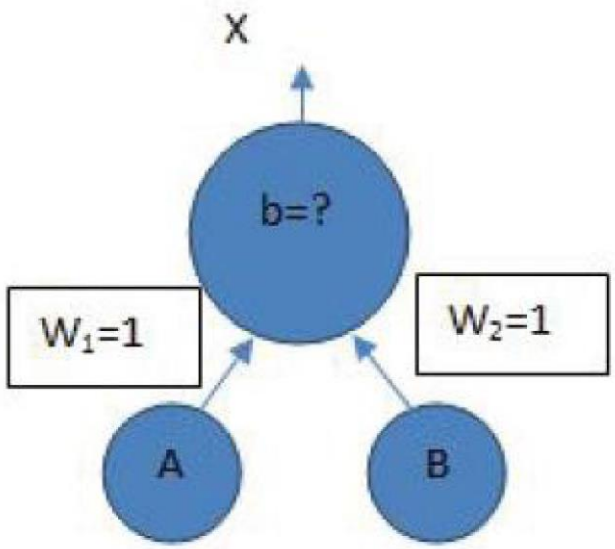
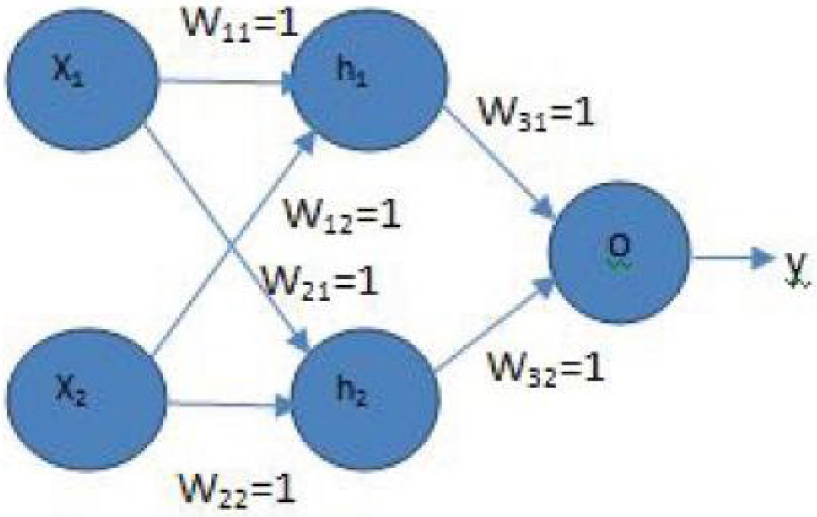
Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

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

Laboratory Contents

Sr. No.	Title
1	Implement Union, Intersection, Complement and Difference operations on fuzzy sets.
2	Implement genetic algorithm for benchmark function (eg. Square, Rosenbrock function etc) Initialize the population from the Standard Normal Distribution. Evaluate the fitness of all its individuals. Then you will do multiple generation of a genetic algorithm. A generation consists of applying selection, crossover, mutation, and replacement. Use: • Tournament selection without replacement with tournament size s • One point crossover with probability Pc • bit-flip mutation with probability Pm • use full replacement strategy
3	Implement basic logic gates using Mc-Culoch-Pitts or Hebbnet neural networks.
4	Write a program to find the Boolean function to implement following single layer perceptron. Assume all activation functions to be the threshold function which is 1 for all input values greater than zero and 0, otherwise.

	
5	The figure shows a single hidden layer neural network. The weights are initialized to 1"s as shown in the diagram and all biases are initialized to 0"s. Assume all the neurons have linear activation functions. The neural network is to be trained with stochastic (online) gradient descent. The first training example is [x1=1, x2=0] and the desired output is 1. Design the back-propagation algorithm to find the updated value for W11 after backpropagation. Choose the value that is the closest to the options given below: [learning rate =0.1] 
6	**Mini-Project 1** on Genetic Algorithm: Apply the Genetic Algorithm for optimization on a dataset obtained from UCI ML repository. For Example: IRIS Dataset or Travelling Salesman Problem or KDD Dataset

7	**Mini-Project 3** on Fuzzy Logic: Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox or Octave or Python.

CO408 C: Data Science and Analytics Laboratory	
Teaching Scheme	**Evaluation Scheme**
Practical: 2 Hrs./ Week	**Oral Exam (OR): 50 Marks**
Credits: 1	**Total: 50 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 association rule mining algorithm
4. To study supervised classification algorithms
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	Students able to understand lifecycle approach to data science and big data analytics projects	2	Understand
CO2	Students able to apply analytic techniques and tools to analyze big data, create statistical models, and identify insights that can lead to actionable results.	3	Apply
CO3	Students able to understand the association rule mining and logistical regression.	2	Understand
CO4	Students able to understand the classification algorithm	2	Understand
CO5	Design and develop an Big data application using classification algorithms	2	Understand
CO6	Students able to apply big data visualization techniques	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

List of Assignments

1. Download the Iris flower dataset or any other dataset into a DataFrame. (eg https://archive.ics.uci.edu/ml/datasets/Iris) Use Python/R and Perform following –

a. How many features are there and what are their types (e.g., numeric, nominal)?

b. Compute and display summary statistics for each feature available in the dataset. (eg. minimum value, maximum value, mean, range, standard deviation, variance and percentiles Data Visualization- Create a histogram for each feature in the dataset to illustrate the feature distributions. Plot each histogram.

c. Create a boxplot for each feature in the dataset. All of the boxplots should be combined into a single plot. Compare distributions and identify outliers.

2. Download Pima Indians Diabetes dataset. Use Naive Bayes‟ Algorithm for classification Load the data from CSV file and split it into training and test datasets.

a. summarize the properties in the training dataset so that we can calculate probabilities and make predictions.

b. Classify samples from a test dataset and a summarized training dataset.

3. Detecting Parkinson's Disease: We have started using data science to improve healthcare and services – if we can predict a disease early, it has many advantages on the prognosis. So in this data science project idea, we will learn to detect Parkinson's Disease with Python. This is a neurodegenerative, progressive disorder of the central nervous system that affects movement and causes tremors and stiffness. This affects dopamine-producing neurons in the brain and every year, it affects more than 1 million individuals in India.

4. Credit Card Fraud Detection Project: By now, you've begun to understand the methods and concepts. Let's move on to some advanced data science projects. In this project, we'll use R with algorithms like **Decision Trees**, Logistic Regression, Artificial Neural Networks, and Gradient Boosting Classifier. We'll use the Card Transactions dataset to classify credit card transactions into fraudulent and genuine. We'll fit the different models and plot performance curves for them.
https://data-flair.training/blogs/data-science-machine-learning-project-credit-card-fraud-detection/

5. Use Movies Dataset. Write the map and reduce methods to determine the average ratings of movies. The input consists of a series of lines, each containing a movie number, user number, rating, and a

timestamp: The map should emit movie number and list of rating, and reduce should return for each movie number a list of average rating.

6. Trip History Analysis: Use trip history dataset that is from a bike sharing service in the United States. The data is provided quarter-wise from 2010 (Q4) onwards. Each file has 7 columns. Predict the class of user. Sample Test data set available here https://www.capitalbikeshare.com/trip-history-data

7. Bigmart Sales Analysis: For data comprising of transaction records of a sales store. The data has 8523 rows of 12 variables. Predict the sales of a store. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problem-big-mart-sales-iii/

8. Twitter Data Analysis: Use Twitter data for sentiment analysis. The dataset is 3MB in size and has 31,962 tweets. Identify the tweets which are hate tweets and which are not. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problemtwitter-sentiment-analysis/

9. Time Series Analysis: Use time series and forecast traffic on a mode of transportation. Sample Test data set available here https://datahack.analyticsvidhya.com/contest/practice-problemtime-series-2/

10. K Means Clustering Project: For this project we will attempt to use KMeans Clustering to cluster Universities into to two groups, Private and Public. It is very important to note, we actually have the labels for this data set, but we will NOT use them for the KMeans clustering algorithm, since that is an unsupervised learning algorithm.When using the Kmeans algorithm under normal circumstances, it is because you don't have labels. In this case we will use the labels to try to get an idea of how well the algorithm performed, but you won't usually do this for Kmeans, so the classification report and confusion matrix at the end of this project, don't truly make sense in a real world setting!.
https://amete.github.io/DataSciencePortfolio/Udemy/Python-DS-and-ML-Bootcamp/K_Means_Clustering_Project.html

TOP

CO409: Project Stage-I	
Teaching Scheme	**Evaluation Scheme**
Practical: 04 Hrs. / Week	**Oral Presentation (OR): 50 Marks**
Credits: 02	**Total: 50 Marks**

Course Objectives:

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

Course Outcomes (COs):

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

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

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

- The student shall complete the partial work of the Project which will consist of problem statement, literature review, SRS, Model and Design.
- The student is expected to complete the project at least up to the design phase.
- As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic.
- The student shall submit the duly certified progress report of Project work Stage-I in standard

format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.

- The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.
- Follow guidelines and formats as mentioned in Project Workbook recommended by the Department Board of Studies.

TOP

MC410A: Botnet of Things		
Teaching Scheme	**Evaluation Scheme**	
Theory: 1 Hrs. / Week		
Credits: -		

This course aims to provide an understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities. It gives an outline of the techniques for developing a secure application.

Course Objectives:

1. To Understand the various IoT Protocols
2. To Understand the IoT Reference Architecture and Real World Design Constraints
3. To learn the concept of Botnet

Course Outcome:

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

1. Implement security as a culture and show mistakes that make applications vulnerable to attacks.
2. Understand various attacks like DoS, buffer overflow, web specific, database specific, web - spoofing attacks.
3. Demonstrate skills needed to deal with common programming errors that lead to most security problems and to learn how to develop secure applications

Course Contents:

1. Introduction

2. IRC-Based Bot Networks

3. Anatomy of a Botnet: The Gaobot Worm

4. IoT Senosors and Security : Sensors and actuators in IoT, Communication and networking in IoT, Real-time data collection in IoT, Data analytics in IoT , IoT applications and requirements, Security threats and techniques in IoT, Data trustworthiness and privacy in IoT, Balancing utility and other design goals in IoT , Future of Botnets in the Internet of Things, Thingbots, Elements of Typical IRC Bot Attack , Malicious use of Bots and Botnet

5. Service Layer Protocols and Security : Security: PHP Exploits, Cross-Site Scripting and Other Browser-Side Exploits, Bots and Botnets, Service Layer -oneM2M, ETSI M2M, OMA, BBF –Security in IoT Protocols –MAC 802.15.4 , 6LoWPAN, RPL, Application Layer Transport and Session layer

protocols- transport Layer (TCP, MPTCP, UDP, DCCP, SCTP) - (TLS, DTLS) – Session Layer - HTTP, CoAP, XMPP, AMQP, MQTT

Books:

1. Bernd Scholz - Reiter, Florian Michahelles, “Architecting the Internet of Things”, Springer ISBN 978 – 3 – 642 – 19156 - 5 e - ISBN 978 – 3 -642 - 19157 - 2,

2. Threat Modeling, Frank Swiderski and Window Snyder,Microsoft Professional, 1 st Edition 2004

3. Gunter Ollmann 2007. The Phishing Guide Understanding and Preventing Phishing Attacks. IBM Internet Security Systems.

4. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978 – 1 – 118 – 47347 - 4, Willy Publications

5. White Papers :- https://www.sans.org/reading-room/whitepapers/malicious/bots-botnet-overview-1299

6. https://www-01.ibm.com/marketing/iwm/dre

7. Mike Kuniavsky, “Smart Things: Ubiquitous Computing User Experience Design,” Morgan Kaufmann Publishers.

TOP

MC410B: Quantum Computing		
Teaching Scheme	**Evaluation Scheme**	
Theory: 1 Hrs. / Week		
Credits: -		

Quantum computation and quantum information is the study of the information processing tasks that can be accomplished using quantum mechanical systems. Sounds pretty simple and obvious, doesn't it? Like many simple but profound ideas it was a long time before anybody thought of doing information processing using quantum mechanical sys- tems. To see why this is the case, we must go back in time and look in turn at each of the fields which have contributed fundamental ideas to quantum computation and quantum information -quantum mechanics, computer science, information theory, and cryptography.

Course Objectives:

1. To understand basic concepts of quantum computing
2. To learn quantum search algorithms
3. To apply quantum information for solving real world problem

Course Outcome:

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

1. design efficient quantum algorithms
2. apply quantum algorithms for several basic promise problems
3. learn the hidden subgroup problems and their role in quantum computing

Course Contents:

1. Fundamental concepts: Introduction and overview, Quantum computation, quantum algorithm, Introduction to quantum mechanics, The postulates of quantum mechanics

2. Quantum computation: Quantum circuits, The quantum Fourier transform and its applications, Quantum search algorithms, Quantum computers: physical realization

3. Quantum information: Quantum noise and quantum operations, Distance measures for quantum information, Quantum error-correction, mEntropy and information, Quantum information theory

Books:

1. Michael A. Nielsen and Isaac L. Chuang, “Quantum Computation and Quantum Information”, ISBN: 9780521635035.

2. Mikio Nakahara and Tetsuo Ohmi, "Quantum Computing", CRC Press 2008.

3. N. David Mermin, "Quantum Computer Science", Cambridge 2007

TOP

SEMESTER VIII

CO411: 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 frameworks.	2	Understand

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

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

Course Contents

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

	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 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 CUDA- C. Apache Hadoop, Apache Spark, Apache Flink, OpenCL,	6Hrs.	CO6

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

CO412: Machine Learning	
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) 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 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	Students are able to distinguish different learning based applications.	2	Understand
CO2	Apply different pre-processing methods to prepare training data set for machine learning	3	Apply
CO3	Apply the Regression Techniques to various problems	3	Apply
CO4	Apply the Bayesian algorithm to various problems	3	Apply
CO5	Apply the classification & ensemble techniques.	3	Apply
CO6	Ability to apply Clustering techniques for data.	3	Apply

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

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

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	7 Hrs.	CO 3

	Elastic Net, 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‟ Theorem, 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 Algorithm.	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-	7 Hrs	CO 6

	Dendrograms, Agglomerative clustering in Scikit- learn, Connectivity Constraints		

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 4. Nikhil Buduma, “Fundamentals of Deep Learning”, O‟REILLY publication, second edition 2017, ISBN: 149192561

E-Resources:-

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

CO413: Cyber Security	
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 Network, Discrete Mathematics

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Course Objectives:

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

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

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

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

	P	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS

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

Course Content

Unit-I	**Security Basics**	No.of Hours	COs
	Introduction, Elements of Information Security, Security Policy, Techniques, Steps, Categories, Operational Model of Network Security, Basic Terminologies in Network Security. Threats and Vulnerability, Difference between Security and Privacy.	07 Hrs.	CO1
Unit-II	**Data Encryption Techniques And Standards**	No.of Hours	COs
	Introduction, Encryption Methods: Symmetric, Asymmetric, Cryptography, Substitution Ciphers. Transposition Ciphers, Stenography applications and limitations, Block Ciphers and methods of operations, Feistal Cipher, Data Encryption Standard (DES), Triple DES, DES Design Criteria, Weak Keys in DES Algorithms, Advance Encryption Standard (AES).	06 Hrs.	CO2
Unit-III	**Public Key And Management**	No.of Hours	COs
	Public Key Cryptography, RSA Algorithm: Working, Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, Elliptic Curve: Arithmetic, Cryptography, Security, Authentication methods, Message Digest, Kerberos, X.509 Authentication service. Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.	07 Hrs.	CO3
Unit-IV	**Security Requirements**	No.of Hours	COs
	IP Security: Introduction, Architecture, IPV6, IPv4, IPSec	06 Hrs.	CO4

	protocols, and Operations, AH Protocol, ESP Protocol, ISAKMP Protocol, Oakley determination Protocol, VPN. WEB Security: Introduction, Secure Socket Layer (SSL), SSL Session and Connection, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol. Electronic Mail Security: Introduction, Pretty Good Privacy, MIME, S/MIME, Comparison. Secure Electronic Transaction (SET). Firewall And Intrusion - Firewall Introduction, Characteristics and types, Benefits and limitations. Firewall architecture, Intrusion detection, IDS: Need, Methods, Types of IDS,		
Unit-V	**Attacks and Hacking**	No.of Hours	COs
	DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks. Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing, Introduction to Ethical Hacking, Anonymity, Information Gathering, Scanning Networks, Vulnerability Analysis, Operating System Hacking, Hacking Wireless Networks, Cloud Hacking, IoT Hacking,	07 Hrs.	CO5
Unit-VI	**Confidentiality And Cyber Forensic**	No.of Hours	COs
	Introduction to Personally Identifiable Information (PII), Cyber Stalking, PII impact levels with examples Cyber Stalking, Cybercrime, PII Confidentiality Safeguards, Information Protection Law: Indian Perspective, Introduction to digital forensics, Analysis tools for digital forensics.	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. Matt Bishop, "Computer Security: Art and Science", 1st Edition, Pearson Education, 2002, ISBN 0201440997. 4. Charlie Kaufman, Radia Perlman and Mike Spencer, "Network security, private communication in a public world", 2nd Edition, Prentice Hall, 2002, ISBN 9780130460196. 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

TOP

CO414A: Business Intelligence	
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: Data mining, Data Analytics

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Course Objectives:

1. To learn & develop problem solving abilities using Mathematics
2. To learn & explore decision support systems
3. To understand data warehouse modelling & distributed data warehouse technology.
4. To study algorithmic examples in distributed, concurrent and parallel environments
5. To explore data Analytics life cycle.
6. To learn & manage BI Systems.
7. To learn different BI Tools.

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

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand fundamental concepts in Business Analytics & Intelligence	2	Understand
CO2	Apply case studies in Business Analytic and Intelligence using mathematical models.	3	Apply
CO3	Apply BI to Make Business Decisions	3	Apply
CO4	Demonstrate a survey on applications for Business Analytic and Intelligence.	2	Understand
CO5	Apply problem solutions for multi-core or distributed, concurrent/Parallel environments	3	Apply
CO6	Apply recent BI Tools for various Applications.	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	3	--	3	--	--	--	--	--	--	--	--	--	3	--	3
CO2	--	--	--	3	--	--	--	--	--	--	--	--	3	2	
CO3	--	--	--	--	3	--	--	--	--	--	--	--	--	--	3
CO4	2	--	2	2	--	--	--	--	--	--	--	--	2	--	--
CO5	--	--	--	3	--	--	--	--	--	--	--	--	2	3	--
CO6	--	--	2	--	--	--	--	--	--	--	--	--	--	3	2

Course Contents

Unit-I	**Concepts with Mathematical treatment**	**No.of Hours**	**COs**
	Introduction to data, Information and knowledge, Decision Support System, Theory of Operational data and informational data, Introduction to Business Intelligence, Defining BI Cycle, BI Environment and Architecture, Identify BI opportunities, Benefits of BI. Role of Mathematical model in BI, Factors Responsible for successful BI Project, Obstacle to Business Intelligence in an Organization	06Hrs.	CO1
Unit-II	**Decision Making Concepts**	**No.of Hours**	**Cos**
	Concepts of Decision Making, Techniques of Decision Support System (DSS),Development of Decision Support System (DSS), Applications of DSS, Role of Business Intelligence in DSS.	06Hrs.	CO2
Unit-III	**Data-Warehouse**	**No.of Hours**	**Cos**
	Introduction: Data warehouse Modelling, data warehouse design, data-ware-house technology, Distributed data warehouse, and materialized view	06Hrs.	CO3
Unit-IV	**Data Pre-processing and outliers**	**No.of Hours**	**Cos**

	Data Analytics life cycle, Discovery, Data preparation, Pre-processing requirements, data cleaning, data integration, data reduction, data transformation, Data discretization and concept hierarchy generation, Model Planning, Model building, Communicating Results & Findings, Operationalizing, Introduction to OLAP. Real-world Applications, types of outliers, outlier challenges, Outlier detection Methods, Proximity-Based Outlier analysis, Clustering Based Outlier analysis.	08Hrs.	CO4
Unit-V	**Designing and managing BI systems**	**No.of Hours**	**Cos**
	Determining infrastructure requirements, planning for scalability and availability, managing and maintenance of BI systems, managing BI operations for business continuity	06 Hrs.	CO5
Unit-VI	**Business Intelligence Applications**	**No.of Hours**	**Cos**
	BI Tools SAP Business Intelligence Tool, Yellowfin BI Tool, Microstrategy BI Tool for powerfull dashboarding & data analytics, Sisense BI Tool,SAS BI Tool, Microsoft Power BI a web-based business analytics tool,Data analytics, business analytics, ERP and Business Intelligence,Looker BI Tool,.Tableau Business Intelligence tool for data discovery and data visualisation **BI Applications in** CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications, BI Applications in Fraud Detection,BI Applications in Retail Industry.	08Hrs.	CO6
Books:			
Text Books:			

1. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support,10th Edition. Pearson/Prentice Hall, 2015.ISBN-13: 978-0-13-305090-5, ISBN-10: 0-13-305090-4; 2. Business Process Automation, Sanjay Mohapatra, PHI
Reference Books:
1. Introduction to business Intelligence and data warehousing, IBM, PHI. 2. Data mining concepts and techniques, Jawai Han, Michelline Kamber, Jiran Pie,Morgan Kaufmann Publishers 3rd edition. 3. Data Mining for Business Intelligence, WILEY Ken W. Collier,Agile Analytics: Avalue driven Approach to Business Intelligence and Data Warehousing, Pearson Education,2012, ISBN-13 978 8131786826
E-Resources:
1. https://onlinecourses.nptel.ac.in/noc20_mg11/preview

TOP

CO414 B: Image Processing and Pattern Recognition	
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: Image Processing, Machine Learning

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Course Objectives:

1. To learn & understand fundamentals of Image Processing.
2. To learn image enhancement and restoration techniques.
3. To learn image compression & segmentation techniques.
4. To study the fundamentals of pattern recognition and its learning techniques.
5. To study general approaches of classifications as Bayes Classification, Nearest Neighbor Rule etc.
6. To study various Nonparametric Techniques.

Course Outcomes (COs):

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

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand basics of Image Processing.	2	Understand
CO2	Understand image enhancement and restoration techniques.	2	Understand
CO3	Describe and use image compression & segmentation techniques.	3	Apply
CO4	Understand fundamentals of pattern recognition and its learning techniques.	2	Understand
CO5	Understand the principles of Bayesian parameter estimation and apply them in relatively simple probabilistic models	3	Apply
CO6	Apply Maximum-likelihood parameter estimation in relatively complex probabilistic models, such as mixture density models and hidden Markov models.	3	Apply

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

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

Course Content

Unit-I	**Introduction to Image Processing**	No.of Hours	COs
	What is Digital Image processing? Fundamental steps in Digital Image processing, Components of an Image Processing System, Image sampling and Quantization: Basic concept in Sampling and Quantization, Representing Digital Images, Spatial and Gray Level resolution. Basic relationships between pixels.	6 Hrs.	CO1
Unit-II	**Image Enhancement and Restoration**	No.of Hours	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. Blind deconvolution, Super resolution imaging.	6 Hrs.	CO2
Unit-III	**Image Compression and Segmentation**	No.of Hours	COs
	Compression: Introduction, Error criterion, Lossy Compression methods, Lossless compression methods.	6 Hrs.	CO3

	Segmentation**:** Introduction, Region extraction, Pixel based approach, Multi level thresholding, Local thresholding, Region based approach, GrowCut region growing, Colour image segmentation.		
Unit-IV	**Introduction to Pattern Recognitions**	No.of Hours	COs
	Pattern recognition System- sensing, Segmentation, feature extraction, classification,post processing.Design Cycle-Learning and Adaption. Supervised Learning, Unsupervised Learning, Reinforcement Learning.	6 Hrs.	CO4
Unit-V	**Bayesian Decision Theory**	No.of Hours	COs
	Introduction- Bayesian Decision Theory, Minimum Error Rate Classification, Classifiers, Discriminant Functions and Decision Surfaces,The normal Density, Error Bounds for Normal Densities-Missing and Noisy Features.	6 Hrs.	CO5
Unit-VI	**Maximum Likelihood and Bayesian Parameters Estimations**	No.of Hours	COs
	Introduction-maximum likelihood, Estimation-Bayesian Estimation, Bayesian parameter, Estimation-Sufficient Statistics-Component Analysis and Discriminants-Hidden Markov Models.	6 Hrs.	CO6

Books:

Text Books:

1. Rafel Gonzallez and R. Woods Digital Image Processing, Second edition.
2. Bhabatosh *Chanda a*nd Dwijesh Dutta Majumder *Digital Image Processing And Analysis*.
3. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
4. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press,2009
5. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

Reference Books:

1. Richard. E.G., Johnsonbaugh and Jost.S. “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt. Ltd., New Delhi, 1999.
2. Duda R.O. and Hart P.E., “Pattern Classification and Scene Analysis”, Wiley, New York, 1973.
3. Morton Nadler and Eric Smith P.,”Pattern Recognition Engineering”, John Willey and Sons, New York, 1993. 4. Tou and Gonzalez R.,” Pattern Recognition Principles”, Addision Wesley, 1974.
4. Rober J. Schalkoff, “Pattern Recognition – Statistical, Structural and Neural Approaches”, John Wiley & Sons Inc, New York, 1992.
5. Milan Sonka Vaclav Hlavac Roger Boyle,Image Processing, Analysis, and Machine Vision, Second Edition, Thomson Publication

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ee56/preview
2. https://nptel.ac.in/courses/108103174

TOP

CO414C: Artificial Neural Networks & Deep Learning	
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) Data Mining ,Machine Learning

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Course Objectives:

1. To explore the Artificial Neural Networks & Deep Learning.
2. To study the concepts of Artificial Neural Networks.
3. To introduce dimensionality reduction techniques
4. To enable the students to know regularization.
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	Students able to understand basics of ANN & Deep learning	2	Understand
CO2	Students can apply Various (ANN) Deep learning model.	3	Apply
CO3	Understand the realign high dimensional data using reduction techniques	2	Understand
CO4	Understand and implement regularization in deep learning	2	Understand
CO5	Able to Apply the Recurrent Neural Network Language Model.	3	Apply
CO6	Understand and Analyse the CNN in deep learning & Applications.	4	Analyse

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

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

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

Course Content

Unit-I	**Introduction to ANN & Deep Learning**	No.of Hours	COs
	History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm Multilayer Perceptrons (MLPs), Sigmoid Neurons, Gradient Descent,	07 Hrs.	CO1
Unit-II	**Artificial Neural Networks(ANN)**	No.of Hours	COs
	Feedforward Neural Networks, Dimension, Deep Vs Shallow Networks, Generative Adversarial Networks (GAN), Semi-supervised Learning	06 Hrs.	CO2
Unit-III	**Dimensionality Reduction**	No.of Hours	COs
	Principal Component Analysis and its interpretations, Singular Value Decomposition , Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders	07 Hrs.	CO3
Unit-IV	**Regularization**	No.of Hours	COs
	Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout	06 Hrs.	CO4
Unit-V	**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.	CO5

Unit-VI	**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.	CO6
Books:			
Text Books:			
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016. 2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.			
Reference Books:			
1. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015. 2. Deep learning, Rajiv Chopra, Khanna book Publishing Co. New Delhi			
E-Resources:			
1. https://nptel.ac.in/courses/117105084			

CO415: HPC and ML LAB	
Teaching Scheme	**Evaluation Scheme**
Practical: 2 Hrs./ Week	**Practical Exam (PR): 50 Marks**
Credits: 1	**Total: 50 Marks**

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

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Machine Learning Lab

Course Objectives:

1. To understand the need for machine learning for various problem solving
2. To understand 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	Students are able to distinguish 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 parallel algorithms for different algorithms using concurrent or parallel environments.	3	Apply
CO5	Apply parallel algorithms for sorting and searching applications.	3	Apply
CO6	Apply parallel computing techniques for data mining algorithms.	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	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

List of Assignments (Machine Learning Lab)

1. Assignment on Linear Regression:

Create a linear regression model where height is input or predictor variable and weight is output or response variable. After the LR model is created, print the accuracy of this model and predict the weight of the person whose height is 180 cms.

These are values of height and their respective weights as mentioned below:

Values of height (in cms.)

151, 174, 138, 186, 128, 136, 179, 163, 152, 131

Values of weight (in kgs)

63, 81, 56, 91, 47, 57, 76, 72, 62, 48

2.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

3. Apply the Principal Component Analysis for feature reduction on IRIS Dataset.

4. Implement Naïve Bayes algorithm on any dataset.

5. Assignment on k-Means: Apply the k-Means on any Dataset.

List of Assignments (HPC Lab)

6. Parallel Implementation of the K Nearest Neighbors Classifier
7. **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

8. **Parallel Sorting Algorithms-**

For Bubble Sort and Merger Sort, based on existing sequential algorithms, design and implement parallel algorithm utilizing all resources available

List of Mini Projects(HPC Lab): (Any one)

1. **Compression Module (Image /Video)**

Large amount of bandwidth is required for transmission or storage of images. This has driven the research area of image compression to develop parallel algorithms that compress images.

OR

For video: RGB To YUV Transform concurrently on many core GPU

2. **Database Query Optimization -** Long running database Query processing in parallel.
3. Apply the Genetic Algorithm for optimization on a dataset obtained from UCI ML repository. For Example: IRIS Dataset or Travelling Salesman Problem or KDD Dataset.
4. Apply the Support vector machine for classification on a dataset obtained from UCI ML repository. For Example: Fruits Classification or Soil Classification or Leaf Disease Classification

Machine Learning Lab 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 4. Nikhil Buduma, "Fundamentals of Deep Learning", O"REILLY publication, second edition 2017, ISBN: 14919256

HPC Books:

Text Books:

3. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2

4. Jason sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3.

Reference Books:

5. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984

6. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884

7. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann,1999, ISBN 978-1-55860-343-1

8. Rod Stephens, " Essential Algorithms", Wiley, ISBN: *ISBN*: 978-1-118-61210-1.

TOP

CO416: Cyber Security Laboratory	
Teaching Scheme	**Evaluation Scheme**
Lectures: 2 Hrs. / Week	**Oral Exam (OR): 50 Marks**
Credits: 1	**Total: 50 Marks**

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

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Course Objectives:

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

Course Outcomes (COs):

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

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

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

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS

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

Laboratory Contents

List of Assignments (Any Eight)

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

List of Mini Projects: (Any one)

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

TOP

CO417: Project Stage-II	
Teaching Scheme	**Evaluation Scheme**
Practical: 08 Hrs. / Week	**Oral Presentation (OR): 50 Marks**
	Term work (TW): 100 Marks
	Total: 150 Marks

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Prerequisite Course: —Project Stage-I

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Course Objectives:

1. To follow SDLC meticulously and meet the objectives of proposed work
2. To test rigorously before deployment of system
3. To validate the work undertaken
4. To consolidate the work as furnished report

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

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	Show evidence of independent investigation critically analyse the results and their interpretation.	3	Apply
CO2	Report and present the original results in an orderly way and placing the open questions in the right perspective.	3	Apply
CO3	Link techniques and results from literature as well as actual research and future research lines with the research.	3	Apply
CO4	Appreciate practical implications and constraints of the specialist subject	3	Apply

Guidelines:

In Project Work Stage–II, the student shall complete the remaining project work which consists of

- Selection of Technology and Tools,
- Installations,
- UML implementations, testing,
- Results,
- Performance discussions using data tables per parameter considered for the improvement with

existing/known algorithms/systems,

- Comparative analysis and validation of results and conclusions.
- The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is duly certified by the concerned guide and head of the Department/Institute.
- Follow guidelines and formats as mentioned by the Department Board of Studies.
- Students must submit and preferably publish at least one technical paper in the conferences.
- Students must participate in at least one project competition.
- Final term work submissions in the prescribed format given by the guides consisting of a project report consisting of a preliminary report prepared in term-I, detailed design (all necessary UML diagrams) document, User Interface design, Laboratory assignments on test cases and test results generated by selected project testing tool, conclusions, appendix (if necessary), glossary, tools used and references at the end of Term-II after checking, removing/ avoiding the plagiarism.

Term-II Project Laboratory Assignments:

1. Review of design and necessary corrective actions taking into consideration the feedback report of Term I assessment, and other competitions/conferences
2. Project workstation selection, installations along with setup and installation report preparations.
3. Programming of the project functions, interfaces and GUI (if any) as per 1st Term termwork submission using corrective actions recommended in Term-I assessment of Term-work.
4. Test tool selection and testing of various test cases for the project performed and generate various testing result charts, graphs etc. including reliability testing.

MC418A: Gamification	
Teaching Scheme	**Evaluation Scheme**
Theory: 1 Hrs. / Week	
Credits: -	

Gamification is the application of game-design elements and game principles in non-game contexts. Gamification commonly employs game design elements to improve user engagement, organizational productivity, flow, crowd sourcing, employee recruitment and evaluation, ease of use, usefulness of systems, exercise, traffic violations, voter apathy, and more.

Course Objectives:

1. To develop problem solving abilities using gamification
2. To apply gamifications for Web Applications
3. To apply gamifications for Mobile Applications

Course Outcome:

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

1. To write survey on the gamification paradigms.
2. To write programs to solve problems using gamification and open source tools.
3. To solve problems for multi-core or distributed, concurrent/Parallel environments

Course Contents:

1. Gaming Foundations: Introduction, Resetting Behavior, Replaying History, Gaming foundations: Fun Quotient, Evolution by loyalty, status at the wheel, the House always wins.

2. Developing Thinking: Re-framing Context, Player Motivation, Case studies for Thinking: Tower of Hanoi.

3. Opponent Moves in Gamification: Reclaiming Opposition, Gamed Agencies, Remodeling design, Game Mechanics, Case study of Maze Problem.

4. Game Design: Game Mechanics and Dynamics: Feedback and Re-enforcement, Game Mechanics in depth, putting it together, Case study of 8 queens problem.

5. Advanced tools, techniques and applications: Gamification case Studies, Coding basic game Mechanics, Instant Gamification Platforms, Mambo.io(Ref:http://mambi.io), Installation and use of BigDoor (Open Source http://bigdoor.com),ngageoint/gamification-server (ref: https://github.com/ngageoint/gamification-server

Books:

1. Mathias Fuchs, Sonia Fizek,Paolo Ruffino, Niklas Schrape, Rethinking Gamification, Meson Press, ISBN (Print): 978-3-95796-000-9 , http://projects.digital-cultures.net/meson-press/files/2014/06/9783957960016-rethinking-gamification.pdf, ISBN (PDF): 978-3-95796-001-6,

2. Gabe Zechermann, Christopher Cunningham, Gamification Design, Oreilly, ISBN: 978-1-449-39767-8, ftp://ftp.ivacuum.ru/i/WooLF/% B2011%5D%20Gamification%20by%20Design.pdf

3. http://press.etc.cmu.edu/files/MobileMediaLearning-DikkersMartinCoulter-web.pdf

MC418B: Emotional Intelligence	
Teaching Scheme	**Evaluation Scheme**
Theory: 1 Hrs. / Week	
Credits: -	

This Emotional Intelligence (EI) training course will focus on the five core competencies of emotional intelligence: self-awareness, self-regulation, motivation, empathy and interpersonal skills. Participants will learn to develop and implement these to enhance their relationships in work and life by increasing their understanding of social and emotional behaviors, and learning how to adapt and manage their responses to particular situations. Various models of emotional intelligence will be covered.

Course Objectives:

1. To develop an awareness of EI models
2. To recognize the benefits of EI
3. To understand how you use emotion to facilitate thought and behavior
4. To know and utilize the difference between reaction and considered response

Course Outcomes:

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

1. Expand your knowledge of emotional patterns in yourself and others
2. Discover how you can manage your emotions, and positively influence yourself and others
3. Build more effective relationships with people at work and at home
4. Positively influence and motivate colleagues, team members, managers
5. Increase the leadership effectiveness by creating an atmosphere that engages others

Course Contents:

1. Introduction to Emotional Intelligence (EI) : Emotional Intelligence and various EI models, The EQ competencies of self-awareness, self-regulation, motivation, empathy, and interpersonal skills, Understand EQ and its importance in life and the workplace

2. Know and manage your emotions: emotions, The different levels of emotional awareness, Increase your emotional knowledge of yourself, Recognize „negative" and „positive" emotions. The relationship between emotions, thought and behavior, Discover the importance of values, The impact of not managing and processing „negative" emotions, Techniques to manage your emotions in challenging situations

3. Recognize emotions in others : The universality of emotional expression, Learn tools to enhance your ability to recognize and appropriately respond to others' emotions, Perceiving emotions accurately in others to build empathy

4. Relate to others: Applying EI in the workplace, the role of empathy and trust in relationships, Increase your ability to create effective working relationships with others (peers, subordinates, managers, clients, Find out how to deal with conflict, Tools to lead, motivate others and create a high performing team.

Books:

1. Daniel Goleman," Emotional Intelligence – Why It Matters More Than IQ," , Bantam Books, ISBN-10: 055338371X13: 978-0553383713

2. Steven Stein , "The EQ Edge" , Jossey-Bass, ISBN : 978-0-470-68161-9

3. Drew Bird , "The Leader"s Guide to Emotional Intelligence" , ISBN: 9781535176002

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