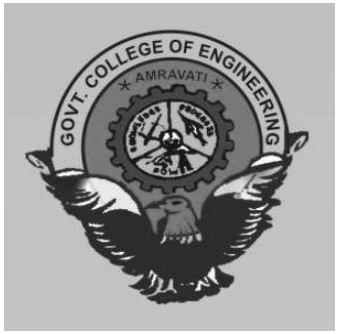
GOVT. COLLEGE OF ENGINEERING AMRAVATI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



PROPOSED CURRICULUM

Of

SECOND YEAR

B. TECH. (Computer Science and Engineering)

2020- 2021

Semester I

Teaching Scheme							Evaluation Scheme						
Category	**Course Code**	**Course Title**	**Theory**	**Tutorial**	**Practical**		**Theory**			**Practical**		**Total**	**Credits**
			Hrs/week	**Hrs/week**	**Hrs/week**	**Total**	**MSE**	**TA**	**ESE**	**ICA**	**ESE**		
MC	SHU100	Induction Program	Two weeks mandatory audit course										0
BSC	SHU121	Physics	3	1	---	4	30	10	60	---	---	100	4
BSC	SHU122	Calculus and Linear Algebra	3	1	---	4	30	10	60	---	---	100	4
ESC	EEU121	Basic Electrical Engineering	3	---	---	3	30	10	60	---	---	100	3
ESC	CEU121	Engineering Mechanics	3	---	---	3	30	10	60	---	---	100	3
HSMC	SHU123	English	2	---	---	2	---	---	60	---	---	60	2
BSC/LC	SHU124	Physics Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	EEU122	Basic Electrical Engg Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CEU122	Engineering Mechanics Lab	---	---	2	2	---	---	---	50	---	50	1
HSMC/LC	SHU125	English Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	MEU121	Workshop Practice I	---	---	2	2	---	---	---	50	---	50	1
		Total	14	2	10	26	120	40	300	250	0	710	21

Semester II

Teaching Scheme							Evaluation Scheme						
Category	**Course Code**	**Course Title**	**Theory**	**Tutorial**	**Practical**		**Theory**			**Practical**		**Total**	**Credits**
			Hrs/week	**Hrs/week**	**Hrs/week**	**Total**	**MSE**	**TA**	**ESE**	**ICA**	**ESE**		
BSC	SHU221	Chemistry	4	--	---	4	30	10	60	---	---	100	4
BSC	SHU222	Integral calculus and differential equations	3	1	---	4	30	10	60	---	---	100	4
ESC	CSU221	Programming for Problem solving	3	---	---	3	30	10	60	---	---	100	3
ESC	MEU221	Engineering Graphics	2	---	---	2	30	10	60	---	---	100	2
ESC	MEU222/ ETU221	Basic Mechanical Engineering/ Basic Electronics Engineering	2	---	---	2	30	10	60	---	---	100	2
BSC/LC	SHU223	Chemistry Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CSU222	Programming for Problem solving Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU223	Engineering Graphics Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU224	Workshop Practice II	---	---	2	2	---	---	---	50	---	50	1
		Total	14	1	12	27	150	50	300	200	0	700	21

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

MSE Duration: 1.30 Hrs all courses

Important Note:

MEU222 for only Electrical, Electronics & TC, Computer Science, Information Technology and Instrumentation Engineering branch

ETU221 for only Civil and Mechanical Engineering branch

In Semester I, the students of Civil, Mechanical, Electrical & Instrumentation Engineering shall be offered group A courses, and that of

Electronics & TC, Computer Science and Information Technology shall be offered group B courses. In Semester II, vice versa.

There should be direct correspondence of group A and group B courses.

Sr. No.	Group A Courses		Group B Courses	
	Course Code	**Title of Course**	**Course Code**	**Title of Course**
1	SHU121	Physics	SHU221	Chemistry
2	EEU121	Basic Electrical Engineering	CSU221	Programming for Problem solving
3	CEU121	Engineering Mechanics	MEU221	Engineering Graphics
4	SHU123	English	SHU223	Chemistry Lab
5	SHU124	Physics Lab	CSU222	Programming for Problem solving Lab
6	EEU122	Basic Electrical Engineering Lab	MEU223	Engineering Graphics Lab
7	CEU122	Engineering Mechanics Lab		
8	SHU125	English Lab		

Category of Course	Definition	Credits
BSC	Basic Science Courses	**18**
ESC	Engineering Science Courses	**21**
HSMC	Humanities and Social Sciences including Mgt.Courses	**3**
	Total Credits	**42**

GOVERNMENT COLLEGE OFENGINEERING, AMRAVTI.
Department of Computer Science & Engineering
Scheme for B. Tech. (Computer Science & Engineering)

SEM III

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical			
			Theory Hrs	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	
ESC	ETU331	Analog and Digital Integrated Circuit	3	--	-	3	30	10	60	--	--	100	3
PCC	CSU321	Data Structure & Algorithms	3	--	-	3	30	10	60	--	--	100	3
PCC	CSU322	Discrete Mathematics	3	--	-	3	30	10	60	--	--	100	3
BSC	SHU321B *SHU322B	Transform and Linear Algebra Differential Equation and Transform	3	1	-	4	30	10	60	--	--	100	4
HSMC	SHU323	Introduction to Constitution of India	1	--	-	1	30	20	--	--	---	50	0
HSMC	SHU324	Effective Technical Communication	0	--	-		30	20	--	--	--	50	3
ESC-LC	ETU332	Analog and Digital Integrated Circuit Lab	--	--	4	4	--	--	--	25	25	50	2
PCC-LC	CSU323	Data Structure & Algorithms Lab	--	--	4	4	--	--	--	25	25	50	2
PCC-LC	CSU324	IT Workshop (Sci Lab/MATLAB)	1	--	4	4	--	--	--	50	50	100	3
	Total		14	1	12	12	150	70	330	100	100	750	23

SEM IV

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical			
			Theory Hrs	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	
PCC	CSU421	Object Oriented Programming	3	--	-	3	30	10	60	--	--	100	3
PCC	CSU422	Computer Organization and Architecture	3	--	-	3	30	10	60	--	--	100	3
PCC	CSU423	Operating System	3	--	-	3	30	10	60	--	--	100	3
PCC	CSU424	Design and Analysis of Algorithms	3	--	-	3	30	10	60	--	--	100	3
PCC	CSU425	Organizational Behavior		---	---	3	30	10	60	---	---	100	3
MC	SHU422	Environmental Studies	1	--	-	1	30	20	--	--	--	50	0
PCC	CSU 426	Object Oriented Programming Lab	--	--	4	4	--	--	--	25	25	50	2
PCC-LC	CSU427	Computer Organization	--	--	4	4	--	--	--	25	25	50	2
PCC-LC	CSU428	Operating Systems Lab	1	--	4	4	--	--	--	50	50	100	3
	Total		14	--	12	28	150	70	330	100	100	750	23

SEM V

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PCC	CSU521	Database management systems	3	--	--	3	30	10	60			100	3
PCC	CSU522	Formal Language and Automata Theory	3	1	--	4	30	10	60			100	4
PCC	CSU523	Java and Python Programming	3	---	---	3	30	10	60			100	3
PCC	CSU524	Computer Networks	3	---	---	3	30	10	60			100	3
PEC	CSU525	Program Elective-I	3	---	---	3	30	10	60			100	3
PCC-LC	CSU526	Database management systems Lab	---	---	4	4	---	---	---	25	25	50	2
PCC-LC	CSU527	Java and Python Programming Lab	---	---	4	4	---	---	---	25	25	50	2
PCC-LC	CSU528	Computer Networks Lab	---	---	4	4	---	---	---	25	25	50	2
	Total		15	1	12	28	150	50	300	75	75	650	22

SEM VI

Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**						**Credits**
							Theory			**Practical**		**Total**	
			Theory Hrs/week	**Tutorial Hrs/week**	**Practical Hrs/week**	**Total**	**MSE**	**TA**	**ESE**	**ICA**	**ESE**		
PCC	CSU621	Complier Design	**3**	---	---	**3**	30	10	60			100	3
PCC	CSU622	Software Engineering	**3**	---	---	**3**	30	10	60			100	3
PEC	CSU623	Program Elective-II	**3**	---	---	**3**	30	10	60			100	3
PEC	CSU624	Program Elective-III	**3**	---	---	**3**	30	10	60			100	3
OEC	CSU633	Open Electve-I	**3**	---	---	**3**	30	10	60			100	3
PCC-LC	CSU626	Complier Design Lab	--	--	**4**	**4**				25	25	50	2
PCC-LC	CSU627	Minor Project	--	--	**4**	**4**				25	25	50	3
	Total		15		8	23	150	50	300	50	50	600	20

SEM VII

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	Credits
PCC	CSU721	Digital Signal Processing	**3**	---	---	**3**	30	10	60			100	3
PCC	CSU722	Cyber Security	**3**	---	---	**3**	30	10	60			100	3
PCC	CSU723	Software Project Management	**3**	---	---	**3**	30	10	60			100	3
PEC	CSU724	Program Elective-IV	**3**	---	---	**3**	30	10	60			100	3
OEC	CSU733	Open Elective-II	**2**	---		**2**	30	10	60			100	3
PROJ	CSU726	Seminar	---	----	**2**	**2**				50	---	50	1
BSC	SHU725	Human Values and Ethics	**1**			**1**	30	20	--			50	0
	Total		16		2	18	150	70	330	50	---	600	16

SEM VIII

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	Credits
PEC	CSU821	Program Elective-V	**3**	---	---	**3**	30	10	60			100	3
PEC	CSU822	Program Elective-VI	**3**	---	---	**3**	30	10	60			100	3
PROJ	CSU823	A. Project OR B. Industry Internship Project	---	---	**24**	**24**	---	---	---	200	200	400	12
	Total		5		24	29	60	20	120	200	200	600	18

Note: Students going for internship at Industry will complete theory courses through online platform such as MOOCs, NPTL etc or by self-study mode and will either directly appear for ESE only (Total Internal Marks (CT1+CT2) will be awarded proportional to marks secure in ESE) or they can appear for CT1 and CT2. TA marks will be awarded as per industrial project performance.

BSC Basic Science Courses
PEC Professional Elective courses
HSMC Humanities and Social Sciences including Management courses
LC Laboratory course
SI Summer Industry Internship
PCC Professional core courses
ESC Engineering Science Courses
OEC Open Elective courses
MC Mandatory courses
PROJ Project

Program Elective Courses

Program Elective-I (CSU525)	**Program Elective-II (CSU623)**	**Program Elective-III (CSU624)**	**Program Elective-IV (CSU724)**	**Program Elective-V (CSU821)**	**Program Elective-VI (CSU822)**
(A)Graph Theory	(A)Advanced Algorithms	(A) Parallel and Distributed Algorithms	(A)Computational Complexity	(A)Computational Geometry	(A)Queuing Theory and Modelling
(B)System Analysis & Design	(B) Distributed Systems	(B) Embedded Systems	(B) Low Power VLSI Circuits and Systems	(B)Advanced Operating Systems	(B)Fault Tolerant Computing
(C) Artificial Intelligence	(C) Machine Learning	**(C)** Data Mining	(C) Soft Computing	(C) Speech and Natural Language Processing	(C)Data Analytics
(D) Electronic Design Automation	(D) Computer Graphics	(D) Cloud Computing	(D) Human Computer Interaction	(D) Internet of Things	(D) Image Processing

Open Elective Courses (To be offered by Computer Science and Engineering Department)

Open Elective-I (CSU633)	**Open Elective-II (CSU733)**
Web Designing	Introduction to Computer Network
Data structure and Algorithm	Introduction to Database

PO-PSO

PO's:

PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO's:

PSO1: Students at the time of graduation will be able to apply fundamental knowledge of theoretical computer science and critically analyse problems to provide computer based solutions for engineering applications.

PSO2: Design and develop solutions by following standard software engineering principles and implement by using suitable programming languages and platforms.

PSO3: Develop system solutions involving both hardware and software modules.

Department of COMPUTER SCIENCE & ENGINEERING
Equivalence Scheme
Programme Name: - Computer Science & Engineering

Sr. No.	Course code with Name of course(old)		Credit	Course code with Name of course (new)		Credit
	SHU 304	Engineering Mathematics-III	3	**NO EQUIVALANCE**		
	ETU 311	Electronic Device & Circuits	3	**NO EQUIVALANCE**		
	CSU 301	Programming Methodology	4	**NO EQUIVALANCE**		
	CSU 302	Computer Organization & Architecture	4	CSU422	Computer Organization & Architecture	3
	CSU 303	Discrete Mathematics & Graph Theory	3	CSU322	Discrete Mathematics	3
	SHU 305	General Proficiency II	2	**NO EQUIVALANCE**		
	ETU 312	Electronic Device & Circuits Lab	1	**NO EQUIVALANCE**		
	CSU 304	Programming Methodology Lab	1	**NO EQUIVALANCE**		
	CSU 305	Computer Organization & Architecture Lab	1	CSU427	Computer Organization & Architecture Lab	1
	CSU 306	Linux Administration-I Lab	1	**NO EQUIVALANCE**		
	CSU 401	Numerical Methods & Computer Programming	3	**NO EQUIVALANCE**		
	CSU 402	Data Structure	4	CSU321	Data structure and Algorithms	3
	CSU 403	Object Oriented Programming	3	CSU421	Object Oriented Programming	3
	ETU 411	Analog & Digital ICs	3	**NO EQUIVALANCE**		
	ITU 402	Data Communication	3	**NO EQUIVALANCE**		
	CSU404	Data Structure Lab	2	CSU323	Data structure and Algorithms Lab	2
	CSU405	Object Oriented Programming Lab	1	CSU 426	Object Oriented Programming Lab	2
	ETU412	Analog & Digital ICs Lab	1	**NO EQUIVALANCE**		
	ITU403	Data Communication	1	**NO EQUIVALANCE**		

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Sr. No.	Course code with Name of course(old)		Credit	Course code with Name of course (new)		Credit
		Lab				
	CSU406	System Administration – II Lab	1	**NO EQUIVALANCE**		
	NO EQUIVALANCE			ETU331	Analog & Digital Integrated Circuit	3
	NO EQUIVALANCE			SHU323	Humanities	3
	NO EQUIVALANCE			SHU322	Introduction to Constitution of India	0
	NO EQUIVALANCE			CSU324	IT Workshop (Sci Lab/MATLAB	3
	CSU602 Operating System		3	CSU423	Operating System	3
	ITU501 Design and Analysis of Algorithms		3	CSU424	Design and Analysis of Algorithms	3
	NO EQUIVALANCE			CSU425	Organizational Behaviour	3
	NO EQUIVALANCE			SHU421	Environmental Sciences	0
	NO EQUIVALANCE			SHU321E	Transform And Linear Algebra	2
	CSU608 Operating System Lab		1	CSU428	Operating Systems Lab	2
	CSU606 Design and Analysis of Algorithm Lab		1	CSU429	Design and Analysis of Algorithm Lab	2

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ETU331 ANALOG AND DIGITAL INTEGRATED CIRCUIT

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objective:

- **I.** Understand basic analog and digital electronics.
- **II.** Learn the properties of semiconductor and operational amplifiers.
- **III.** Understand the concept of combinational and sequential logic and their application.
- **IV.** Understand the basics of Timer 555 and memories.

Basic concept and application of BJT & MOSFET:
Metal Oxide Semiconductor Field-Effect Transistors (MOSFET) and their Applications: MOSFET as an amplifier, small-signal equivalent circuits, single-stage MOSFET amplifier (common-source mode); MOSFET as a switch.

Operational amplifiers: Properties and characteristics study of typical opamp, Performance limitations, linear application of opamps, IC 741 opamp and its application, Feedback: basic concepts of negative feedback; four ideal feedback topologies;

Oscillators: basic principles of sinusoidal oscillation; Example circuits; Types and characteristics of voltage series feedback, current series feedback, current shunt feedback, and voltage shunt feedback. Barkhausen criteria, RC oscillators - Wein Bridge and phase shift, LC oscillators- Hartley, colpitt's, clapp and crystal oscillators. General features of a time base signal, UJT relaxation oscillator.

Multivibrator: Monostable , Astable and Bistable multivibrator.

Introduction and application of Ic 555:
Pin configuration, Basic of 555 timer, block diagram, working principle of IC555 and data sheet and its application, waveform generator, important features of 555 timer, 555 timer as astable multivibrator and monostable multivibrator, 555 timer as oscillator, 555 timer as RAMP generator,

Combination digital circuits:
Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization

Sequential Digital Circuits:
A 1-bit memory, the circuit properties of Bi-stable latch, the SR flip flop, J- K, T and D types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to

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parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Memories:
Introduction and classification of ROM, ROM organization, Static and Dynamic RAM, DRAM Refreshing, Representative circuits for cells using BJT and FET's, Timing diagrams of memories, Memory expansion using IC's, Flash memory, CCD, Magnetic Memories.

Course Outcomes:
After completion of the course students will able to-
ETU331.1 Describe the functioning and selection of OP-AMP as per application.

ETU331.2 Design and testing of OP-AMP based circuits.

ETU331.3 Design and implement Combinational and Sequential logic circuits.

ETU331.4 Describe the functioning of memories and their application

Text Books:

1. Electronic Devices and Circuits (2nd edition, 2008), by J. Millman, C. Halkias and Satyabrata jit, Tata McGraw Hill.
2. Sedra A. S. and Smith K. C., Microelectronic Circuits, Oxford University Press (2006).
3. The art of electronics. by Paul Horowitz and Winfield Hill (1998)
4. Logic and Computer Design Fundamentals. Morris Menno (2007)

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CSU321 DATA STRUCTURE AND ALGORITHM

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objective:

- **I.** To impart the knowledge of data structures and algorithms.
- **II.** To analyse the algorithm with respect to time and space which will prove the efficiency of algorithm.
- **III.** To assess how the choice of data structures and algorithm design methods impacts the performance of programs
- **IV.** To convert algorithms into efficient programs

Basic of Data Structure and Algorithm: Understanding the concept of Problem Solving, Design of Algorithms and Data Structures. Basic Terminologies: Elementary Data Organizations, Data Structures Operations and Types, Abstract Data Type (ADT),Writing Algorithms, Mathematical Notations and Functions, Algorithmic Notation, Introduction to Searching Algorithms: Linear and Binary Search, Analysis of an Algorithm: Complexity and Rate of Growth, Asymptotic Notations, Time-Space Trade-Off, Dictionaries, Introduction to Sorting Algorithms: Bubble, Selection, Insertion, Quick, Merge, Radix

Note: In this unit all the algorithms are implemented through a basic data structure called Array

Linked List: Introduction to Linked List, Types of Linked List, Representation of Linked List in Memory**,** Algorithms of several operation on Linked List and there analysis**,** String Processing: Storing Strings, String Operations, Word/Text Processing, String Pattern Matching Algorithms.

Stack and Queue: Introduction to Stack, Representation of Stack in Memory using Array and Linked List, Arithmetic Expression, Polish Notation, Application of Stack, Tower of Hanoi Problem, Recursion, Introduction to Queue, Representation of Queue in Memory using Array and Linked List, Types of Queues, Application of Queues.

Tree: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, Red Black Tree**,** Tree operations on each of the trees and their algorithms with complexity analysis**,** Applications of Binary Trees**,** Introduction to B Tree (Disk Based Data Structure)**,** Heap Sort.

Graph: Graph: Basic Terminologies and Representations**,** Graph search and traversal algorithms and complexity analysis, Minimum Spanning Tree Algorithms (Kruskal and Prim), Single Source Shortest Path (Dijkstra's) and Shortest Path Algorithms (Warshalls)**,** Hashing in Data Structures.

Text Book

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al. 2nd edition Computer Science Press

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Course Outcomes

CSU321.1 Understand basic terminology of data organization with the available data structures and their behaviour.

CSU321.2 Analysing and understanding, the implementation of data structures on computer memory so that, one must able to choose appropriate data structure for a given specific problem.

CSU321.3 After implementation a student must be capable of doing quantitative analysis of algorithm.

CSU321.4 Demonstrate ability to devise an efficient algorithm and transform into efficient code.

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CSU322 DISCRETE MATHEMATICS

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objective:

I. Learn basic terminology, formal logic, proofs, sets, relations, functions, recursion
II. Use formal logic proof and logical reasoning to solve problems
III. Relate the ideas of mathematical induction to recursion and recursively defined structures
IV. Learning graphs, trees and related algorithms ,Relate, interpret and apply these concepts to various areas of computer science

Sets, Relation and Function: Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cartesian Products, Image of a Set, Operations and Laws of Sets, Binary Relation, Partial Ordering Relation, Equivalence Relation, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Cantor's diagonal argument and the Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic. Basic counting techniques- inclusion and exclusion, pigeon-hole principle, permutation and combination.

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Text Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.

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3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

Reference Books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
3. Discrete Mathematics, Tata McGraw - Hill

Course Outcomes

CSU322.1 For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives

CSU322.2 For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference

CSU322.3 Students would be able to classify its algebraic structure for a given a mathematical problem.

CSU322.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra. To develop the given problem as graph networks and solve with techniques of graph theory.

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SHU321B TRANSFORM AND LINEAR ALGEBRA

Teaching Scheme: 03TH+01TU **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objective:

I. To study about the mathematical tool like z-transform and its properties.
II. To introduce the concept of linear algebra which is important in computer software.
III. To introduce the concept of orthogonally and inner product.
IV. To familiarize the students with basic concepts of probability and conditional probability, continuous and discrete probability distributions.

Z-transform: Definition, Region of Convergence, Properties of Z-transform, Inverse Z-transform: Partial fraction method, Residue method; Convolution Theorem, Application to solution of difference equations with constant coefficients.

Vector spaces: Vector spaces and subspaces, null spaces, column spaces and linear transformations, Linear dependence and independence, bases, coordinate systems, dimensions of vector space.

Random variables and Probability Distributions:
Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, distribution functions, Mean and variance of Binomial, Poisson and Normal distributions.

Basic Statistics:

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression

Text Books:

1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.
2. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 44th edition, 2020.
3. Engineering Mathematics (for semester III), Veerarajan T., Tata McGraw-Hill, New Delhi, 2010.

Reference Books

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003 (Reprint).
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
4. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley, 1968.

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Course Outcomes

After successful completion of the course the students will be able to

SHU321B.1 use the concept of probability and random variables and various discrete and continuous probability distributions in practical problems.
SHU321B.2 Apply the tool of transform in solving engineering problems.
SHU321B.3 Analyse the problems related to engineering with the knowledge of linear algebra.

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SHU322B DIFFERENTIAL EQUATION AND TRANSFORM

Teaching Scheme: 03TH+01TU **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objective:

- **I.** To study about the mathematical tool like z-transform and its properties.
- **II.** To introduce the concept of linear algebra which is important in computer software.
- **III.** To introduce the concept of orthogonally and inner product.
- **IV.** To familiarize the students with basic concepts of probability and conditional probability.
- **V.** To study continuous and discrete probability distributions.

Ordinary differential equations of higher orders:
Linear differential equation with constant coefficient, complementary function, particular integral, complete solution; method of variation of parameters.

Integral Calculus: Beta and Gamma functions and their properties; Evaluation of double integrals (Cartesian & polar), change of order of integration.

Z-transform: Definition, Region of Convergence, Properties of Z-transform, Inverse Z-transform: Partial fraction **method, Residue method; Convolution** Theorem, Application to solution of difference equations with constant coefficients.

Vector spaces: Vector spaces and subspaces, null spaces, column spaces and linear transformations, Linear dependence and independence, bases, coordinate systems, dimensions of vector
Space.

Random variables and Probability Distributions:
Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, distribution functions, Binomial, Poisson and Normal distributions.

Text Books:

1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal,Laxmi Publications, Reprint,2010.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 44th edition, 2020.
3. Engineering Mathematics (for semester III), Veerarajan T., Tata McGraw-Hill, New Delhi,2010.

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Introduction to Probability Theory,P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003(Reprint).

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3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
An Introduction to Probability Theory and its Applications. Feller, Vol. 1, 3rd Ed., Wiley, 1968.

Course Outcomes

After successful completion of the course the students will be able to

SHU322B.1 Use the concept of probability and random variables and various discrete and continuous probability distributions in practical problems.

SHU322B.2 Apply the tool of transform in solving engineering problems.

SHU322B.3 Analyze the problems related to engineering with the knowledge of linear algebra.

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SHU323 INTRODUCTION TO CONSTITUTION OF INDIA

Teaching Scheme: 01 **Total: 01** **Credits: 00**
Evaluation Scheme: 20 TA + 30 MSE **Total Marks: 50**
MSE Duration: 1Hrs. 30 min.

Course Objectives:

I. To acquaint students about constitution of India, Fundamental rights, fundamental duties.

II. To understand electoral process and role of central, state and local government and its administration.

III. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Introduction to Constitution of India
Salient features of the Constitution of India, Preamble of the Constitution, fundamental rights and fundamental duties, Directive Principles of State Policy and relevance of directive principles. Parliamentary Form of Government in India- President, Vice-President, Prime Minister along with council of Minister, Parliament, Supreme court, Electoral process in India. Amendment Procedure.

State executives Governor, chief minister, state legislature, high courts of state

Role and functions of local self-government- Municipalities in India, with special reference to 73rd amendment. Panchayat Raj in India with special reference to 74th amendment.

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

On the successful completion of this course, Students shall be able to-

SHU323.1 Understand and remember the knowledge of basic information about Indian Constitution.

SHU323.2 Apply the knowledge of fundamental rights and fundamental duties.

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SHU 324 EFFECTIVE TECHNICAL COMMUNICATION

Teaching Scheme: 00Th **Credit: 03**
Evaluation scheme: 20TA+30MSE **Total Marks: 50**
MSE Duration: 1Hr30 Min.

Course Objectives

I. **To understand the basics of technical writing and editing**
II. **To understand and analyses the self-development.**

Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Self-Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event reports.

Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Text Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)

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Course outcomes:

On the successful completion of this course, Students shall be able to-

SHU324.1 Understand how critically analyses data from research and incorporate it into assigned technical writing or documents clearly, concisely, logically with effective style and grammar in précised form.

SHU324.2 Exhibit integrates sense of ethical values and personal accountability to form realistic development plans to achieve identified goals with creative analysis of self-assessment and awareness.

SHU324.3 Manifest gained self-confidence, skill of verbal communication along with form ethical values not only to meet the demand of professional world as a coherent whole but to present their prowess/ employability skills in various workplaces effectively in global world as well.

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ETU332 ANALOG & DIGITAL CIRCUITS LAB

Teaching Scheme: 04P **Total: 04** **Credits: 02**
Evaluation Scheme: 25 INT+25 EXT **Total Marks: 50**
ESE Duration: 2Hrs. 30 min.

Course Objective:

I. Understand basic analog and digital electronics.

II. Learn the properties of semiconductor and operational amplifiers.

III. Understand the concept of combinational and sequential logic and their application.

IV. Understand the basics of Timer 555 and memories.

Project-1. Oscillator design, & amplifier design,

Project-2. Sequential design & combinational design

Project-3. Memory design

Project-4. Minor project on Design of LED lighting system for household application; street lighting system; soft starting of DC machine.

Course Outcomes:
After completion of the course students will able to-

ETU332.1 Describe the functioning and selection of OP-AMP as per application.

ETU332.2 Design and testing of OP-AMP based circuits.

ETU332.3 Design and implement Combinational and Sequential logic circuits.

ETU332.4 Describe the functioning of memories and their application

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CSU323 DATA STRUCTURE & ALGORITHM LAB

Teaching Scheme: 04P **Total: 04** **Credits: 02**
Evaluation Scheme: 25 INT + 25 EXT **Total Marks: 50**
ESE Duration: 2Hrs. 30 min.

Course Objective:

I. To impart the knowledge of data structures and algorithms.
II. To analyse the algorithm with respect to time and space which will prove the efficiency of algorithm.
III. To assess how the choice of data structures and algorithm design methods impacts the performance of programs
IV. To convert algorithms into efficient programs

Project 1 will be comprised of static sized array data structure involving sorting, searching, ADT such as dictionaries.

Project 2 will be comprised of linked list different types and string pattern matching algorithms

Project 3 will comprise of applications of stack and queue

Project 4 will comprise of Graph algorithm and its applications

Project 5 will comprise of Tree algorithms and its application

Project 6 will be a major application comprises most of the required contents of syllabus.

Note: Project 1 to 5 can be completed individually or group of two students and Project 6 containing at least 4 different modules which can be completed in the group of 3 to 4 students

Course Outcomes

CSU323.1 Understand basic terminology of data organization with the available data structures and their behaviour.
CSU323.2 Analysing and understanding, the implementation of data structures on computer memory so that, one must able to choose appropriate data structure for a given specific problem.
CSU323.3 After implementation a student must be capable of doing quantitative analysis of algorithm.
CSU323.4 Demonstrate ability to devise an efficient algorithm and transform into efficient code.

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CSU324 IT WORKSHOP (Sci Lab/MATLAB)

Teaching Scheme: 01 Tut + 04P **Total: 05** **Credits: 03**
Evaluation Scheme: 25 INT + 25 EXT **Total Marks: 50**
ESE Duration: 2Hrs. 30 min.

Course Objective:

I. To understand the basics of matlab
II. To Analyse the different functions of Matlab
III. To analyse different data visualization in matlab

Any three Based on given guidelines

Project 1- Digital Signal Processing using Matlab

Project 2- Identifying Vehicle Number plates using Matlab

Project 3- Automatic Certificate Generation using Matlab

Project-4 JPEG Compression using Matlab

Project-5 Portable Media Player

Project -6 Design a GUI that show the export of students data such as students passed and failed in all subject, placement of students in various department visualize that using Matlab

Course Outcome

CSU324.1 students will able to understand the basic of matlab and design the project using matlab

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CSU 421 OBJECT ORIENTED PROGRAMMING

Teaching Scheme: 03T + 1TU **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objectives

I. To Understand and demonstrate the concepts of object-oriented design, polymorphism, information hiding, and inheritance
II. Take a problem and develop the structures to represent objects and the algorithms to perform operations.
III. Use class library to develop projects involving several several C++ files and class libraries.
IV. To understand the concept of C#

Classes and Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction **function.** Implementing operations, Features of object-oriented programming. Encapsulation, overloading, object identity, polymorphism, Friend Function,
Inheritance: Types of Inheritance
Polymorphism: Run time polymorphism, Compile time polymorphism, virtual function
Memory management. File Processing
Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features.
Generic types and collections: templates, exceptions, container
Design patterns. Introduction and classification. Singleton Pattern.
Introduction to C#

Text-Book :

1. Object-Oriented Programming in C++ by Robert Lafore , 4th Edition, Pearson Education ,2002.

2. C++ Programming Language by Bjarne Stroustrup,3rd Edition, Addison-Wesley, 2002.

References Book:

1. Complete Reference C++ by Herbert Schildt ,4th Edition,Tata McGrawHill,2004.

COURSE OUTCOMES

On completion of the course the student should be able to

CSU421.1 Understand the relative merits of C++ as an object oriented programming language
CSU421.2 to produce object-oriented software using C++
CSU421.3 Understand how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism
CSU421.4 Understand advanced features of C++ specifically stream I/O, templates and operator overloading

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CSU422 COMPUTER ORGANIZATION AND ARCHITECTURE

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objective

I. To understand the basic of computer peripherals which computers work
II. To impart the knowledge on micro programming.
III. To analyse how I/O devices are accessed and its principles.
IV. To understand the concept of pipelining techniques.

Introduction: Computer components and its functions, Processing unit, bus architecture, execution of a complete instruction, sequencing of control signals, Computer peripherals, I/O devices such as video terminals, video displays, graphic input devices, printers, magnetic disk, magnetic tape, CDROM systems, Threading and Multithreading .

Addressing modes, their application in implementation of HLL constructs and data structures, instruction formats, expanding op-code method, Micro programmed control, microinstruction format, microinstruction sequencing, bit slice concept.

Arithmetic, number representations and their operations, design of fast address, signed multiplication, Booth's Algorithm, bit-pair recording, division , floating point numbers and operations, guard bits and rounding.

Main memory organization, various technologies used in memory design, higher order memory design, multi module memories and interleaving, cache memory, concept of cache memory, mapping functions, replacement algorithms.

External devices: I/O modules, Programmed I/O, Interrupt I/O, I/O channels
Input-output organization, I/O mapped I/O and memory mapped I/O, Direct Memory Access (DMA), interrupts and interrupt handling mechanisms, device identification, vectored interrupts, interrupt nesting, I/O interfaces, synchronous vs. asynchronous data transfer, I/O channels.

RISC philosophy, pipelining, basic concepts in pipelining, delayed branch, branch prediction, data dependency, influence of pipelining on instruction set design, multiple execution units, performance considerations, basic concepts in parallel processing & classification of parallel architectures. Introduction of Superscalar and vector superscalar.

TextBooks:

1. Computer Organization & Architecture By Stalling W, 6th Edition , Pearson Education 2003

References:

1. Computer Organization & Design, the Hardware/ Software Interface, Patterson D. A, Hennessy J. L.
2. Computer Organization , Hamacher, Carl V. et al, McGraw Hill
3. Structured Computer Organization , Tanenbaum A.S, Prentice Hall of India Ltd

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Course Outcomes:

CSU422.1 Students will learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.

CSU422.2 Students will be able to identify where, when and how enhancements of computer performance can be accomplished.

CSU422.3 Students will learn the sufficient background necessary to read more advance texts as well as journal articles on the field.

CSU422.4 Student will see how to use concepts of computer organization in real-life settings using various PC performance improvements, more recent applications of computer organization in advanced digital systems

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CSU423 –OPERATING SYSTEM

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objectives

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I. To learn Fundamental, the mechanisms of OS to handle processes, threads and their communication

II. To learn the mechanisms involved in memory management in contemporary OS

III. To gain knowledge on operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols

IV. To know the aspects of concurrency management control of asynchronous processes, deadlocks, memory management, processor and disk scheduling and file system organization.

Introduction: Concept of Operating Systems, Goals of Operating System, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Overview of Operating system, multiprogramming, time sharing, real time and distributed operating systems, Concept of Virtual Machine.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, **Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms. **Inter-process Communication and Process Synchronization:** Critical Section, Race Conditions, Mutual Exclusion, Semaphores, Classical IPC Problems

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, fragmentation and Paging, **Virtual Memory**: Hardware and control structures, Page fault, Page Replacement algorithms.

File Management: Access methods, File operation, Directory structure, File System structure, Allocation methods, File Protection.

Case study: UNIX Operating System

Text Books:

1. Operating System concepts and principles, A. Silberschatz & P.B. Galvin, 8th Edition Wiley India, 2009.
2. Modern Operating System ,Tanenbaum, 3rd Edition, Prentice Hall India, ,2003.

Reference Books:

1. Operating Systems: Internals and design Principle, W. Stallings, 6thEdition, Pearson Education(LPE) , 2009.
2. Design of Linux Operating system, M.J. Bach, 3rd Edition, Prentice Hall, 2004.
3. www.nptel.iitm.ac.in
4. www.nptel.iitkgp.ac.in

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Course Outcome

Students will able to

CSU423.1 lean**,** Describe, contrast and compare differing structures for operating systems

CSU423.2 Understand the process management policies and scheduling of processes by CPU

CSU423.3 Evaluate the requirement for Process synchronization, deadlock and memory management.

CSU423.4 Interpret various OS functions used in Linux

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CSU424 – DESIGN AND ANALYSIS OF ALGORITHMS

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objectives

I. To write rigorous correctness proofs for algorithms designed using different algorithm design techniques and understand there efficiency using different analysis methods.

II. Synthesize efficient algorithms in common engineering design situations.

III. To emphasize the relationship between algorithms and programming

IV. To demonstrate familiarity with NP-Complete problems

Algorithms: Algorithms as Technology, Algorithm Design Techniques, Asymptotic notations of analysis of algorithms, analysing control structures, complexity, worst case and average case analysis. **Mathematical foundations**: summation of arithmetic and geometric series, bounding summations using integration, recurrence relations.

Sorting Algorithms: Sorting Algorithms and there analysis using incremental approach such as insertion sort, bubble sort, selection sort, sorting in linear time.

Greedy method: basic strategy, application to job sequencing with deadlines problem, Elements of Greedy Methods.

Divide and conquer: Divide and conquer basic strategy, Recurrences, binary search, quick sort, merge sort. Maximum sub array and matrix multiplication problem.

Dynamic programming: basic strategy, Rod Cutting Problem, Elements of Dynamic Programming.

Graph and Tree Algorithms: Elementary Graph Algorithms, DFS, BFS, minimum cost spanning trees, single source shortest path, Network Flow, Topological Sorting

Backtracking basic strategy, 8- Queen's problem, graph colouring, Hamiltonian cycles etc.

Advance Topics: Basic Concepts of NP-hard and NP-complete problems, non-deterministic algorithms, Randomization Algorithms and Approximation Algorithms, RSA Cryptography Algorithm, Compression.

Text Books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al. Computer Science Press

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Reference Books

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Course Outcomes

CSU424.1 Students will be Analyze the asymptotic performance of algorithms.

CSU424.2 Students will be understood the rigorous correctness proofs for algorithms.

CSU424.3 Students will be Demonstrate a familiarity with major algorithms and data structures.

CSU424.4 Students will be Apply important algorithmic design paradigms and methods of analysis.

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CSU425 - ORGANIZATIONAL BEHAVIOUR

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objective

I. To give a basic perspective of Management theories and Practices.
II. To study other functional areas of management and to provide the students with the conceptual framework and the theories underlying Organizational Behaviour.

Role of Management – Concept – Significance – Functions – principles of Management - Patterns of Management: Scientific – Behavioral – Systems – Contingency

Decision Making & Controlling – Process – Techniques. Planning – Process – Problems — Making It Effective. Controlling - System of Controlling – Controlling Techniques – Making Controlling Effective

Organizational Behavior – Introduction to OB – Organizing Process – Depart mentation Types – Making Organizing Effective - Understanding Individual Behavior – Perception – Learning – Personality Types – Johor window- Transactional Analysis

Group Dynamics & Motivation – Benefits of Groups – Types of Groups – Group Formation and Development, Motivation – Concept of Motivation - Motivational Theories of Maslow, Herzberg, David Mc Cleland, and Porter and Lawler

Leadership and Organizational Culture and Climate: Leadership – Traits Theory – Managerial Grid – Transactional Vs Transformational Leadership – Qualities of good Leader, Change Management – Conflict Management

Textbook:

1. Organizational Behaviour, Stephen P. Robbins, Pearson Education.
2. Management and Organizational behavior, Pierce Gardner, Cengage.

References:

1. Organizational Behavior , Mishra .M.N ,Vikas
2. Management and Organizational Behaviour, Subbarao P, Himalaya Publishing House. Organizational Behavior, S.S. Khanka, S. Chand

Course Outcome

CSU425.1 Students will learn the principles of Management in management system.

CSU425.2 Students will be able to Organizational Behavior.

CSU425.3 Students will learn the Concept of Motivation.

CSU425.4 Students will learn the Understanding Individual Behavior, Qualities of good Leader, Change Management – Conflict Management

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SHU422 ENVIROMENTAL STUDIES

Teaching Scheme: 01 **Total: 01** **Credits: 00**
Evaluation Scheme: 20 TA + 30 MSE **Total Marks: 50**
MSE Duration: 1Hrs. 30 min.

Course Objective

I. To critically evaluate the science and policy ramifications of diverse energy portfolios on air and water quality, climate, weapons proliferation and societal stability;

II. To apply quantitative reasoning skills to environmental problems including basic calculations related to energy, water, and air issues and the use of statistical methods in data analysis and argumentation.

The Multidisciplinary Nature of Environmental Studies:- Definition, scope and importance, Need for public awareness.

Social issues and Environment:- From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rainwater harvesting, and watershed management Resettlement and rehabilitation of people, problems.

Environmental ethics:- Issues and possible solution, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation. Consumerism and Waste products, Environment protection act, Air (prevention & control) act, Water (prevention and control) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation.

Human population and environment:- Environment and human health, Human rights, Role of Information Technology in Environment and human health, Public awareness.

Natural Recourses: - Conventional energy resources: definition, classification, composition, energy content types: coal, petroleum, natural gases, hydro geothermal, nuclear, environmental implication of energy uses. Non-conventional energy resources: solar energy, wind energy, tidal energy, geothermal energy, hydropower and biogas.

Ecosystem and Biodiversity:-Concept of ecosystem, Structure and function of ecosystem, Producer, consumer, decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystem: Forest ecosystem, Grass land ecosystem, Desert ecosystem Aquatic ecosystem (Rivers and ocean).

Introduction- definition: genetics, species and ecosystem, diversity. Biogeographically classification of India. Conservation of biodiversity- In-situ and Ex-situ conservation of Biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as mega diversity nation. Hot spot of biodiversity.

Environmental Pollution:- Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste, Management, Causes effects and control measures, Role of individual in prevention of pollution, Hazardous waste management, Biomedical waste management, Disaster management: floods, earthquake, cyclone and landslides.

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Text Book

1. The Biodiversity of India, Bharucha Erach ,Marin Publishing Pvt. Ltd., Ahmedabad
2) Brunner R.C., 1989,Hazardous Waste Incineration, McGraw Hill Inc.
3) Marine pollution, Clark R.S., Clanderson Press Oxford (TB)
4) Environmental Chemistry, De A.K. Wiley Estern Lmt.
5) Environmental Chemistry, Sharma B.K., 2001 Goel Publ., House, Meerat.
6) Environmental Management, Wagner K.D., 1998, W.B. Saunders Co., Philadel phia, USA
7) Environmental Studies, Benny Joseph, 1st edition,2005,Tata Mcgraw-Hill Publ.

Course outcome

After studying the course, the students will be able to:

SHU421.1 Convey the Environmental awareness among peoples.
SHU421.2 Apply Conservation of various natural resources and environmental factors.
SHU421.3 Aware about social and environmental issues.

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CSU 426 OBJECT ORIENTED PROGRAMMING LAB

Teaching Scheme: 04T **Total: 04** **Credits: 02**
Evaluation Scheme: 25 INT + 25 EXT **Total Marks: 50**
ESE Duration: 2Hrs. 30 min.

Course Objectives

I. To Understand and demonstrate the concepts of object-oriented design, polymorphism, information hiding, and inheritance
II. Take a problem and develop the structures to represent objects and the algorithms to perform operations.
III. Use class library to develop projects involving several several C++ files and class libraries.
IV. To understand the concept of C#

Project-1. To developed Student Information System
Project-2. To Developed Employee information system
Project-3. To Developed Banking System

COURSE OUTCOMES

On completion of the course the student should be able to

CSU426.1 Understand the relative merits of C++ as an object oriented programming language
CSU426.2 to produce object-oriented software using C++
CSU426.3 Understand how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism
CSU426.4 Understand advanced features of C++ specifically stream I/O, templates and operator overloading

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CSU 427 COMPUTER ARCHITECTURE LAB

Teaching Scheme: 04T **Total: 04** **Credits: 02**
Evaluation Scheme: 25 INT + 25 EXT **Total Marks: 50**
ESE Duration: 2Hrs. 30 min.

Course Objectives

I. To understand the basic of computer peripherals which computers work
II. To impart the knowledge on micro programming.
III. To analyse how I/O devices are accessed and its principles.
IV. To understand the concept of pipelining techniques.

Project: 1 Designing I/O devices such as video terminals, video displays**.**

Project: 2 Designing and organizing main memory

Project: 3 Designing and simulations of simple processors**.**

Project: 4 Design ALU using Logisim**.**

Course Outcomes:

CSU427.1 Students will learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
CSU427.2 Students will be able to identify where, when and how enhancements of computer performance can be accomplished.
CSU427.3 Students will learn the sufficient background necessary to read more advance texts as well as journal articles on the field.
CSU427.4 Student will see how to use concepts of computer organization in real-life settings using various PC performance improvements, more recent applications of computer organization in advanced digital systems

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CSU 428 OPERATING SYSTEM LAB

Teaching Scheme: 04T **Total: 04** **Credits: 02**
Evaluation Scheme: 25 INT + 25 EXT **Total Marks: 50**
ESE Duration: 2Hrs. 30 min.

Course Objectives

- **I.** To learn Fundamental, the mechanisms of OS to handle processes, threads and their communication
- **II.** To learn the mechanisms involved in memory management in contemporary OS
- **III.** To gain knowledge on operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
- **IV.** To know the aspects of concurrency management control of asynchronous processes, deadlocks, memory management, processor and disk scheduling and file system organization.

Project -1

Create a simulator for scheduling a given set of processes in user space only. The simulator should read from a configuration file a set of parameters for each process: Length of time for which process will execute, priority of the process and the preferred scheduling policy - FIFO or Round Robin, the time at which the process executes and if it is a CPU intensive process _or an I/O intensive process. Apart from this read the quantum of time given to each process and the number of priority levels for scheduling the process. Now simulate a scheduling algorithm which uses FIFO/Round Robin with priority based scheduling. At the end of the run print the following quantities for each process: a. Number of times the process was scheduled. b. A timeline for the process containing the state transitions - Ready, waiting, Running and Terminated and the timestamp for each transition. c. Time taken to complete the process. d. Number of times the process waited for I/O. e. The priority of the process and preferred scheduling algorithm. After printing the above values print the average time of completion for each process. From the calculated parameters determine which scheduling algorithm was better for CPU intensive and I/O intensive processes. Suggest ways in which the scheduling algorithm can be improved and why?

Project -2

Create two processes which communicate using a shared memory segment. The first process finds out the list of all processes running on the system with their name, process id, number of files opened and total time running and creates a linked list containing this data about every process running in the shared memory. The second process reads this linked list and formats it in HTML and saves it in a file. This is done by the processes every half an hour. (Hint: Use jproc file system on Linux to find out process information.)

Project -3

Implement Bankers algorithm for N customer.

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Course Outcome

Students will able to

CSU428.1 lean**,** Describe, contrast and compare differing structures for operating systems

CSU428.2 Understand the process management policies and scheduling of processes by CPU

CSU428.3 Evaluate the requirement for Process synchronization, deadlock and memory management.

CSU428.4 Interpret various OS functions used in Linux

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CSU 429 DESIGN AND ANALYSIS OF ALGORITHMS LAB

Teaching Scheme: 04T **Total: 04** **Credits: 02**
Evaluation Scheme: 25 INT + 25 EXT **Total Marks: 50**
ESE Duration: 2Hrs. 30 min.

Course Objectives

- **I.** To write rigorous correctness proofs for algorithms designed using different algorithm design techniques and understand there efficiency using different analysis methods.
- **II.** Synthesize efficient algorithms in common engineering design situations.
- **III.** To emphasize the relationship between algorithms and programming
- **IV.** To demonstrate familiarity with NP-Complete problems

Project 1 will be comprised of solving any particular problem with incremental approach and Divide & conquer design technique
Project 2 will be develop application based on Dynamic Programming design technique
Project 3 will be develop application based on Greedy Method design technique
Project 4 will be develop application based on Back Tracking design technique
Project 5 will be a major application comprises most of the required contents of syllabus.
Note: Project 1 to 4 can be completed individually or group of two students and Project 5 containing at least 4 different modules which can be completed in the group of 3 to 4 students

Course Outcomes

CSU429.1 Students will be Analyze the asymptotic performance of algorithms.

CSU429.2 Students will be understood the rigorous correctness proofs for algorithms.

CSU429.3 Students will be Demonstrate a familiarity with major algorithms and data structures.

CSU429.4 Students will be Apply important algorithmic design paradigms and methods of analysis.

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Equivalence Scheme for *online courses*

Sr. No.	Course code with Name of course (old/new)		Credit	Course code with Name of course (online)		Name of Online platform	Credit
1.	CSU302	Computer Organization & Architecture	3	noc20-cs64	Computer Architecture & Organization	NPTL	
2.	CSU303	Discrete Mathematics & Graph Theory	3	noc20-cs82	Discrete Mathematics	NPTL	
3	CSU402	Data Structure	4	noc20-cs70	Programming, Data structure and Algorithms using Python	NPTL	
4	CSU403	Object Oriented Technology	4	noc20-cs59	Object Oriented Analysis & Design	NPTL	
5	ITU502	Database management System	3	noc20-cs60	Database management System	NPTL	
6	ITU601	Design and Analysis of Algorithm	3	noc20-cs71	Design and Analysis of Algorithms	NPTL	
7	CSU602	Operating System Design	3	noc20-cs75	Introduction to operating systems	NPTL	
8	CSU604	Software Project Management	3	noc20-cs68	Software Engineering	NPTL	

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GOVT. COLLEGE OF ENGINEERING AMRAVATI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROPOSED CURRICULUM

Of

THIRD YEAR

B. TECH. (Computer Science and Engineering)

2021- 2022

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Department of COMPUTER SCIENCE & ENGINEERING
Equivalence Scheme

Sr. No.	Course code with Name of course(old)	Credit	Course code with Name of course (new)		Credit
	ITU501 System Analysis and Design	3		Program Elective -I	3
	ITU502 Database Management System	3	CSU521	Database Management Systems	3
	CSU501 System Programming	3		No equivalence	
	CSU502 Theory of Computation	3	CSU522	Formal Language and Automata Theory	4
	CSU503 Principles of Management	3		No equivalence	
	ITU503 System Analysis and Design lab	1		No equivalence	
	ITU504 Database Management System lab	1	CSU526	Database Management Systems Lab	2
	CSU504 System Programming Lab	1		No equivalence	
	CSU505 Hardware Lab	1		No equivalence	
	ITU505 System administration-III Lab	2		No equivalence	
	CSU506 Self Study I	2		No equivalence	
	No equivalence		CSU523	Java and Python Programming	3
			CSU525	Program Elective-I	3
			CSU527	Java and Python Programming Lab	2
	ITU601 Design and Analysis of Algorithms	3	CSU424	Design and Analysis of Algorithms	3
	CSU601 Switching Theory and Logic Design	3		No equivalence	
	CSU602 Operating System Design	3	CSU423	Operating Systems	3
	CSU603 Computer Network	3	CSU524	Computer Networks	3
	CSU604 Software Project Management	3	CSU622	Software Engineering	3
	ITU604 Design and Analysis of Algorithms Lab	1		**Shifted to second year** CSU429 Design and Analysis of Algorithms Lab	2
	CSU605 Switching Theory and Logic Design Lab	1		No equivalence	
	CSU606 Operating System	1		**Shifted to second year**	2

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Sr. No.	Course code with Name of course(old)	Credit	Course code with Name of course (new)		Credit
	Design Lab			CSU428 Operating System Lab	
	CSU607 Computer Network Lab	1	CSU528	Computer Networks Lab	2
	CSU608 Minor Project	2	CSU627	Minor Project	3
	CSU609 Self Study II	2		No equivalence	
	CSU610 Industrial Lecture I*	---		No equivalence	
	No Equivalence		CSU621	Complier Design	3
			CSU623	Program Elective-II	3
			CSU624	Program Elective-III	3
			CSU625	Open Elective-I	3
			CSU626	Complier Design Lab	2

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CSU521 DATABASE MANAGEMENT SYSTEM

Teaching Scheme: 03 T **Total: 03** **Credits: 03**
Evaluation Scheme: 30MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. To Understand the basic concepts of DBMS

II. To understand data models, conceptualize and depict a database system using ER diagram.

III. To understand the internal storage structures in a physical DB design.

IV. To know the fundamental concepts of transaction processing techniques.

Introduction: Database System Applications, Purpose of Database System, Views of data, data models, Database Languages, database architecture and components of DBMS, Database System Applications, Database Users and Administrators, Database System Structure, History of Database Systems. Entity-Relationship Model, Basic Concepts, Design Issues, Entity-Relationship Diagram, ER Model, notations, examples.

Relational Model: Relational Data Model, Concept of relations, schema-instance distinction, referential integrity constraints, keys, referential integrity and foreign keys, relational algebra operators, Extended Relational-Algebra Operations SQL: Introduction, data definition in SQL, table, key and foreign key definitions, update behaviours. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses, embedded SQL. Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication.

Relational Database Design: Dependencies and Normal forms, dependency theory, functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, 4NF, and 5NF.
Query processing and optimization Evaluation of relational algebra expressions, query equivalence, join strategies, query optimization algorithms. **Storage strategies** Indices, B-trees, hashing.
Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.
Advanced topics Object-oriented and object relational databases, logical databases, web databases, distributed databases, data warehousing and data mining.

Text Books:

1. "Database System Concepts", by Silberschatz Abraham, Korth Henry F., and Sudharshan S., 6th edition Tata McGraw Hill, Sixth Edition, 2017.
2. "Fundamentals of Database Systems", by Elmasri Ramez and Navathe Shamkant B., Pearson Education, Seventh Edition, 2017.

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Reference Books:

1. "An Introduction to Database Systems", by Date C. J., Kannan A. and Swamynathan S., Pearson Education, Eighth Edition, 2006
2. "MongoDB: The Definitive Guide", by Chodorow Kristina, 2 nd edition, O'Reilly, 2013

Course Outcomes:

CSU521.1 Identify and describe various components of DBMS.

CSU521.2 Apply the basics of SQL and construct queries using SQL.

CSU521.3 **I**llustrate sound knowledge in the theory, principles and applications of database management system.

CSU521.4 Apply and identify issues in data storage, transaction, and concurrency control of DBMS

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CSU522 FORMAL LANGUAGES AND AUTOMATA THEORY

Teaching Scheme: 03T + 01TU **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objectives

I. Develop a formal notation for strings, languages and machines.
II. Design finite automata to accept a set of strings of a language.
III. Prove that a given language is regular and apply the closure properties of languages.
IV. Design context free grammars to generate strings from a context free language and convert them into normal forms.
V. Prove equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
VI. Identify the hierarchy of formal languages, grammars and machines.
VII. Distinguish between computability and non-computability and Decidability and un-decidability

Required background: Knowledge of CSU322 Discrete Mathematics

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.

Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Text-Book :

1. "Introduction to Automata Theory, Languages, and Computation", John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Pearson Education Asia.
2. "An Introduction to Formal Languages and Automata", by Peter Linz, 5th edition, Jones & Bartlett Learning

References Book:

1. "Elements of the Theory of Computation", Harry R. Lewis and Christos H. Papadimitriou, Pearson Education Asia.
2. "Automata and Computability, Undergraduate Texts in Computer Science", Dexter C. Kozen, Springer.

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3. “Introduction to the Theory of Computation”, Michael Sipser, PWS Publishing.
4. “Introduction to Languages and The Theory of Computation”, John Martin, Tata McGraw Hill

COURSE OUTCOMES

On completion of the course the student should be able to

CSU522.1 Write a formal notation for strings, languages and machines.
CSU522.2 Design finite automata to accept a set of strings of a language.
CSU522.3 Determine whether the given language is regular or not.
CSU522.4 Design context free grammars to generate strings of context free language.
CSU522.5 Identify the associations between language classes and machine models.

CSU 523 JAVA AND PYTHON PROGRAMMING

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2 Hours 30 Minutes

Course Objectives

I. Understand and learn the syntax, semantics, and fundamentals of the Java & Python programming language.
II. Understand and learn the concepts of Object Oriented Programming for the problem solving using Java and Python.
III. Understanding the different types of exceptions and its handling mechanism.
IV. Develop the programming skills to create fully functional and efficient real time applications as per the requirements.

Introduction to Java:
Features of Java, Basic Elements of Java Program, Data Types, Variables and its Scope, Type Conversion and Casting, Handling Input and Output. Classes, Object, Methods and Constructor. Exception Handling Mechanism.

Polymorphism, Inheritance, Interfaces and Packages:
Polymorphism, Inheritance and its Types, 'super' keyword, Abstract Classes and Methods, Interfaces, Nested Classes and Interfaces. Packages, Finding Packages and CLASSPATH, Access Protection.

Multithreading Programming in Java:
The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Thread, Thread Priorities, Synchronization, Interthread Communication, Deadlock, Suspending-Resuming-Stopping Thread.

Basic Web Programming:
Applets AWT, Swings, Event Handling in Java, JDBC/ODBC, Java Networking, Servlets

Introduction to Python: About Python, Python Goals, Why Python and its drawbacks, Versions of Python**, Data types, variables, basic input-output operations, Type Conversion, Strings, basic operators, Control Statements.**

Functions, Lists, tuples, and dictionaries: Declaring, Defining and Calling Functions, Basic list, tuples and dictionaries operations.

Errors and Exception in Python: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, Exception Chaining, User-defined Exceptions, Defining Clean-up Actions, Predefined Clean-up Actions

Implementing OOP concepts in Python: Classes, Objects, Constructor, Polymorphism, Inheritance, Packages, and Handling GUI in Python.

Text-Book:

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1. “Java: The Complete Reference, Eleventh Edition”, 11th Edition, Herbert Schildt, Released December 2018, Publisher(s): McGraw-Hill, ISBN: 9781260440249
2. “Object-Oriented Programming with C++ and Java”, Debasis Samanta, Prentice Hall India.
3. “Programming with Python”, T. R. Padmanabhan, Springer, 1st Ed., 2016

References Book:

5. “Programming with Java”, E Balagurusamy, McGraw Hill Education India.
6. “The Java™ Programming Language”, Fourth Edition, Ken Arnold, James Gosling, David Holmes, Addison Wesley Professional
7. “Fundamentals of Python: First Programs”, Kenneth Lambert, Cengage Learning, 1st Ed., 2012.
8. “An Introduction to Python”, Guido van Rossum, Network Theory Ltd, 2011
9. https://docs.python.org/3/tutorial/index.html

References for Java

1. https://ict.iitk.ac.in/product/core-java-eict-with-project-work/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/index.htm
3. https://onlinecourses.nptel.ac.in/noc21_cs03/preview
4. https://nitkkr.ac.in/docs/New%20B.Tech%20(CO)Scheme%20&%20Syllabi.pdf
5. https://www.nitw.ac.in/media/Scheme&Syllabus-2014/BTECH-CSE-Syllabus.pdf
6. https://cse.iitkgp.ac.in/~dsamanta/java/index.htm

References for Python

1. https://docs.python.org/3/tutorial/index.html (Documentation by Python Official Site)
2. https://edube.org/study/pe1
3. https://edube.org/study/pe2
4. https://ict.iitk.ac.in/product/python-eict-with-project-work/
5. https://onlinecourses.nptel.ac.in/noc21_cs33/preview
6. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/

COURSE OUTCOMES

On completion of the course the student should be able to

CSU523.1- Use an integrated development environment to write, compile, run, and test simple object-oriented Java and Python programs.

CSU523.2- Analyze the problem statement and use object oriented programming concepts to solve these problems.

CSU523.3- Analyze the run time exceptions and able to handle those runtime exceptions.

CSU523.4- Create fully functional, usable, interactive and real time applications (desktop, mobile, web, mathematical, scientific, data science applications), games and much more.

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CSU524 COMPUTER NETWORK

Teaching Scheme: 03T **Total – 03** **Credits: 03**

Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**

Duration of ESE: 2hrs.30min.

Course objective:

I. Introduce students to the basic concepts of computer networking.
II. Expose students to core data communication protocols.
III. Solidify understanding of concepts and networking protocols through a series of lab exercises.
IV. Solidify understanding of the inner working of networking protocols by a term project involving with socket programming

.

Introduction to Data communication: Components**,** Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Protocols and Architecture: Course logistics. Layering abstraction, Network architecture and protocols; Performance of networks: delay and throughput.

Application layer: HTTP, TELNET, FTP, EMAIL, Socket Programming, DNS, DHCP,CDNs, server design, SMTP, web services, P2P

Transport layer: UDP and TCP, Reliability and congestion control in TCP, TCP analysis.

Network layer: Introduction, Routing protocols, Inter-domain routing, BGP, Router architecture, Resource allocation and QoS

Data Link layer: Data Link layer Introduction, multiple access protocols, switching, VLANs, MPLS, End-to-End Congestion Control.

Physical layer: Physical layer overview.

Security: Public key and private key cryptography, Firewalls, SDN Overview, Threads and Authentication.

Text Book:

1. "Data Communication and Networking", 4th Edition, Behrouz A. Forouzan, McGraw- Hill.
2. "Networking: A top down Approach Featuring the internet", Jim Kurose,Keith Ross,6th Edition, Addison Wesley,July2002.
3. "Computer Networks, A Systems Approach"Larry Peterson and Bruce Davie.

Reference Book:

1. "Computer Networks", A.S. Tanenbaum, 4th Edition, PHI Publication, 2002.
2. "Data and Computer Communication", William Stallings, 6th Edition, PHI Publication, 2007.
3. www.nptel.iitk.ac.in

Course Outcome:

CSU524.1. Understand the concepts of computer networking.

CSU524.2. Understand core data communication protocols, in particular, the mechanisms required to achieve reliable data communication.

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CSU524.3. Understand core routing algorithms.

CSU524.4. Understand flow control and congestion control used in the Transmission Control Protocol.

CSU524.5.Design and implement simple networked applications.

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PROGRAM ELECTIVE-I
CSU525 (A) GRAPH THEORY

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objectives

I. To understand the fundamental concepts and apply graph theory based tools in solving practical problems
II. To have an idea of matching in graphs and study some applications of matching in day to day life problems.
III. To study the idea of colouring graph, external problems and graphs on surface.
IV. To understand the concept of digraphs, Euler digraphs, random graphs and Hamiltonian digraphs.
V. To convert the everyday problems to graph theory problems and apply proof techniques with proper network flow

(Required background knowledge of CSU322 – Discrete Mathematics)

Basic Concepts: Graphs and digraphs, incidence and adjacency matrices, isomorphism, the automorphism group; **Trees**: Equivalent definitions of trees and forests, Cayley's formula, the Matrix-Tree theorem, minimum spanning trees; **Connectivity**: Cut vertices, cut edges, bonds, the cycle space and the bond space, blocks, Menger's theorem; **Paths and Cycles**: Euler tours, Hamilton paths and cycles, theorems of Dirac, Ore, Bondy and Chvatal, girth, circumference, the Chinese Postman Problem, the Traveling Salesman problem, diameter and maximum degree, shortest paths;

Matching: Berge's Theorem, perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, Petersen's theorem, algorithms for matching and weighted matching (in both bipartitie and general graphs), factors of graphs (decompositions of the complete graph), Tutte's f-factor theorem;

External problems: Independent sets and covering numbers, Turan's theorem, Ramsey theorems; **Colorings**: Brooks theorem, the greedy algorithm, the Welsh-Powell bound, critical graphs, chromatic polynomials, girth and chromatic number, Vizing's theorem; **Graphs on surfaces**: Planar graphs, duality, Euler's formula, Kuratowski's theorem, toroidal graphs, 2-cell embeddings, graphs on other surfaces;

Directed graphs: Tournaments, directed paths and cycles, connectivity and strongly connected digraphs, branching;

Networks and flows: Flow cuts, max flow min cut theorem, perfect square; Dominating sets, the reconstruction problem, intersection graphs, perfect graphs.

Random Graphs: The basic models - use of expectations, simple properties of almost all graphs, almost determined variables – use of variance, Hamiltonian cycles, the phase transition.

Text-Book :

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.

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References Book:

1. "Graph Theory", Frank Harary, Narosa.
2. "Network Flows: Theory, Algorithms, and Applications", R. Ahuja, T. Magnanti, and J. Orlin, Prentice-Hall.
3. "Modern Graph Theory", Bollobas, Bela, Springer
4. "Graph Theory", Diestel, R. Springer

COURSE OUTCOMES

On completion of the course the student should be able to

CSU525 (A).1 Apply principles and concepts of graph theory in practical situations

CSU525 (A).2 Thorough understanding of the concepts in digraph, domination, perfect graphs and random graphs

CSU525 (A).3 Implement the acquired knowledge of graph matching, coloring, surface use and network flow appropriately

CSU525 (A).4 Mastery in executing various proof techniques on different graphs

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PROGRAM ELECTIVE-I

CSU525 (B) SYSTEM ANLYASIS AND DESIGN

Teaching Scheme: 03T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE Duration: 2Hrs. 30 min.

Course Objectives

I. Introduces students to the whole systems development process
II. To introduce variety of new software used by analysts, designers to manage projects
III. Analyse and document systems, design new systems and implement their plans.
IV. Good understanding of project management functions and estimation techniques.

Introduction : System Analysis & Design concepts, Role of system analyst, Review of SDLC, Organization as systems, Levels of management culture, Project fundamentals, Feasibility study, Activity planning & control, Managing analysis & design activities, Sampling and investigating hard data, Interviewing, Planning & conducting interview & reporting, Joint application design, using questionnaires, Planning, designing and administering the questionnaire.

Conservation of a decision-makers behaviour and office environment Prototyping: User Reactions, Approaches to prototyping & developing prototype, Data flow approach to requirements, developing DFDs, Logical & Physical DFDs, examples of DFDs, data dictionary concept, data repository, creating & using data dictionary. Data modelling with entity-relationship diagrams, process modelling with data flow diagrams or use cases.

Overview of process specifications: Structured English, decision tables/trees, decision support system & decision making concepts relevant to DSS, semi structured decisions, Multiple-criteria decision-making.

System Proposal: Ascertaining hardware/software needs, Identifying & forecasting cost/benefit & comparing cost/benefit, writing and presenting the systems proposals, Principles of delivery, output design objectives, designing printed output, screen output, Input design objectives, form design, screen design for input. Website Prototype Evolution, Smartphone App Requirements, PVF WebStore: Conceptual Data Modelling

Introduction to OOSAD and Advance topic in SAD: Object-oriented Analysis, object-oriented design., agile development, extreme programming, rapid application development (RAD), Scrum and the Unified Modeling Language (UML), Modern Methods for Determining System Requirements.

Text-Book:

1. "System Analysis and Design", Kenneth E. Kendall & Julie E.Kendal, 5th Edition, Prentice Hall, 2005.
2. "System Analysis & Design", Yeates, 2nd edition, Pearson publication, 2004

Reference Books:

1. "Fundamentals of System Analysis & Design", J.Fitgerald & A.Fitgerald ,3rd Edition, John Wiley Publication, 1987.

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2. “Modern Systems Analysis and Design," J. A. Hoffer, J. F. George, J. S. Valacich, Prentice Hall 2016
3. “Essentials of systems analysis and design”, Jeffrey A. Hoffer, University of Dayton. ... Prentice Hall 2012
4. https://nptel.ac.in/courses/106/108/106108102/

COURSE OUTCOMES

On completion of the course the student should be able to

CSU525(B).1 A firm basis for understanding the life cycle of a systems development project.

CSU525(B).2 An understanding of the analysis and development techniques required as a team member of a medium-scale information systems development project.

CSU525(B).3 An understanding of the ways in which an analyst's interaction with system sponsors and users play a part in information systems development.

CSU525(B).4 Experience in developing systems project documentation

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PROGRAM ELECTIVE-I

CSU 525 (C) ARTIFICIAL INTELLIGENCE

Teaching Scheme: 03 T Total-03 Credit: 03

Evaluation Scheme: 30MSE+10TA + 60 ESE Total Marks: 100

Duration of ESE: 2:30 hrs

Course Objective

I. To gain a historical perspective of AI and its foundations.

II. To become familiar with basic principles of AI toward problem solving, perception, knowledge representation, and learning.

III. To investigate applications of AI techniques in intelligent agents, artificial neural networks and other models.

IV. To explore the current scope, potential, limitations, and implications of intelligent systems.

Introduction: AI and intelligent agents. Basics of problem-solving: problem representation paradigms, state space, satisfiability vs optimality, pattern classification problems, example domains.

Search Techniques: Problem size, complexity, Solving Problems by Searching such as heuristic search techniques, stochastic search methods, and constraint satisfaction problems

Game Playing: minimax, Knowledge and Reasoning: Building a Knowledge Base, Propositional logic, first order Logic, situation calculus. Theorem Proving in First Order Logic.

Knowledge Acquisition: Uncertain Knowledge and Reasoning, Probabilities, Bayesian Networks. Belief functions, certainty factors, and fuzzy sets.

Learning: Overview of different forms of learning, Learnability theory, Learning Decision Trees, Neural Networks, rule based.

Introduction to Natural Language Processing, AI languages and systems

Text Book

1. "Artificial Intelligence: A Modern Approach", Stuart Russell and Peter Norvig, Prentice-Hall.
2. "Artificial Intelligence: A New Sythesis", Nils J. Nilsson, Morgan-Kaufmann.
3. "AI: Strcutures and Strategies for Complex problem solving", George F.Luger and William A. Stubblefield, 2nd edition, Benjamin Cummings Publishers, 1997.

Reference Book

1. "Introduction to Knowledge Systems", Mark Stefik, Morgan Kaufman, 1995.
2. "Artificial Intelligence", Winston P.H., 3rd edition, Addison Wesley, 1995.
3. "Artificial Intelligence", Shivshankar B Nair, E. Rich and K.Knight, Tata McGraw Hill, 1992.
4. "Artificial Intelligence", E. Charniack and D. McDermott, Addison Wesley, 1987.

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5. “A classical approach to Artificial Intelligence”, Munesh Chandra Trivedi, Khanna Publications
6. “Artificial Intelligence and Machine Learning”, Chandra S.S. & H.S. Anand, PHI Publications
7. https://nptel.ac.in/courses/106/105/106105077/

Course outcomes:

Upon successful completion of this course, the student shall be able to:

CSU 525 (C).1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CSU 525 (C).2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CSU 525 (C).3 Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, artificial neural networks.

CSU 525 (C).4 Demonstrate ability to share in discussions of AI, its current scope and limitations, and societal implications

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PROGRAM ELECTIVE-I

CSU525 (D) ELECTRONIC DESIGN AUTOMATION

Teaching Scheme: 03T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE Duration: 2Hrs. 30 min.

Course Objectives

I. To introduce the fundamental concepts Electronic Design Automation
II. To impart knowledge about the optimization of combinational circuits
III. To enable the students to understand the various techniques for partitioning
IV. To Understanding the concepts of digital circuit and system modelling

Two-level and multi-level logic optimization of combinational circuits, state assignment of finite state machines. Technology mapping for FPGAs. Techniques for partitioning, floor planning, placement and routing. Architectural models, scheduling, allocation and binding for high-level synthesis.
Hardware-software codesign. Test generation, fault simulation, built-in self test, test structures. Verilog and VHDL.

Text-Book :

1. "Application Specific Integrated Circuits", by M.J.S.Smith, Pearson, 2008.
2. "Introduction to PSpice using OrCAD for circuits and electronics", M.H.Rashid, Pearson, 2004.
3. "System Verilog For Design", S.Sutherland, S. Davidmann, P. Flake, (2/e), Springer,2006

Reference Books:

1. "Digital System Design with System Verilog", Z. Dr Mark, Pearson, 2010.
2. "Designer's Guide to the Cypress PSoC,Newnes (An imprint of Elsevier)",Robert Ashby, 2006
3. "The Beginner's Guide to PSoC", O.H. Bailey, Express Timelines Industries Inc.
4. *https://nptel.ac.in/courses/106/105/106105083/*

COURSE OUTCOMES

On completion of the course the student should be able to

CSU525 (D).1 Evaluate the quality of a design mapping and mapping approach

CSU525 (D).2 Design and develop modular programming skills

CSU525 (D).3 Implement design automation algorithms

CSU525 (D).4 Understand and utilize the concepts of digital circuit and system modelling

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CSU 526 DATABASE MANAGEMENT SYSTEMS LABOURTARY

Teaching Scheme: 04 P **Total 04** **Credit: 02**

Evaluation Scheme: 25 ICA + 25 External **Total Marks: 50**

The sample list of programs based on ORACLE or MY SQL is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes

Objectives:

I. To give a good formal foundation on the relational model of data.

II. To present SQL and procedural interfaces to SQL comprehensively.

List of Experiments:

1. SQL and installation of SQL server/oracle.
2. Data Definition Language (DDL) commands in RDBMS
3. Data Manipulation Language (DML) and Data Control Language (DCL)
4. Data types and create a database and write the program to carry out the following operation.
5. Create tables department and employee with required constraints.
6. Working with null values, matching the pattern from the table.
7. Aggregate functions: grouping the result of a query.
8. Set operators, Nested Queries, Joins and Sequences.
9. Views, indexes, database security and privileges: Grant and Revoke commands, Commit and Rollback commands.
10. PL/SQL Architecture, Assignments and Expressions, Writing PL/SQL Code, Referencing Non-SQL parameters.
11. Triggers and Cursor Management in PL/SQL.
12. Procedures and Functions
13. Automatic Backup of Files and Recovery of Files.
14. As a designer identify the views that may have to be supported and create views.
15. Mini Project Using Oracle 9i or MY SQL
16. ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

Lab Outcomes:

On completion of the course the student should be able to

CSU 526.1 Design and implement a database schema for a given problem-domain.

CSU 526.2 Normalize a database.

CSU 526.3 Populate and query a database using SQL DML/DDL commands.

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CSU 527 JAVA AND PYTHON PROGRAMMING LAB

Teaching Scheme: 04P **Total: 04** **Credits: 02**
Evaluation Scheme: 25 ICA + 25 External **Total Marks: 50**
ESE Duration: 3 Hours

Course Objectives

I. Understand and learn the syntax, semantics, and fundamentals of the Java & Python programming language.
II. Understand and learn the concepts of Object Oriented Programming for the problem solving using Java and Python.
III. Understanding the different types of exceptions and its handling mechanism.
IV. Develop the programming skills to create fully functional and efficient real time applications as per the requirements.

LAB Experiments

8 to 10 Experiments for JAVA and PYTHON each based on syllabus in CSU 523 JAVA AND PYTHON PROGRAMMING

Sample List

Note: This is just a sample list of programs to be performed in lab. However course coordinator may prepare their own list

JAVA

Exercise - 1 (Basics)

a). Write a JAVA program to display default value of all primitive data type of JAVA
b). Write a java program that display the roots of a quadratic equation ax2+bx=0. Calculatethe discriminate D and basing on value of D, describe the nature of root.
c). Five Bikers Compete in a race such that they drive at a constant speed which may or maynot be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.
d) Write a case study on **public static void main**

(250 words) Exercise - 2 (Operations, Expressions, Control-flow, Strings)

a). Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
b). Write a JAVA program to sort for an element in a given list of elements using bubble sort c). Write a JAVA program to sort for an element in a given list of elements using merge sort.
d) Write a JAVA program using StringBuffer to delete, remove character.

Exercise - 3 (Class, Objects)

a). Write a JAVA program to implement class mechanism. – Create a class, methods andinvoke them inside main method.
b). Write a JAVA program to implement constructor.

Exercise - 4 (Methods)

a). Write a JAVA program to implement constructor overloading.b). Write a JAVA program implement

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method overloading.

Exercise - 5 (Inheritance)

a). Write a JAVA program to implement Single Inheritance
b). Write a JAVA program to implement multi-level Inheritance
c). Write a java program for abstract class to find areas of different shapes

Exercise - 6 (Inheritance - Continued)

a). Write a JAVA program give example for "super" keyword.
b). Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

Exercise - 7 (Exception)

a).Write a JAVA program that describes exception handling mechanismb).Write a JAVA program Illustrating Multiple catch clauses

Exercise – 8 (Runtime Polymorphism)

a). Write a JAVA program that implements Runtime polymorphism
b). Write a Case study on run time polymorphism, inheritance that implements in aboveproblem

Exercise – 9 (User defined Exception)

a). Write a JAVA program for creation of Illustrating throw b). Write a JAVA program for creation of Illustrating finally
c). Write a JAVA program for creation of Java Built-in Exceptionsd).Write a JAVA program for creation of User Defined Exception **Exercise – 10 (Threads)**
a). Write a JAVA program that creates threads by extending Thread class .First thread display"Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds ,(Repeat the same by implementing Runnable)
b). Write a program illustrating **isAlive** and **join ()**
c). Write a Program illustrating Daemon Threads.

Exercise - 11 (Threads continuity)

a).Write a JAVA program Producer Consumer Problem
b).Write a case study on thread Synchronization after solving the above producer consumerproblem

Exercise – 12 (Packages)

a). Write a JAVA program illustrate class path
b). Write a case study on including in class path in your os environment of your package.c). Write a JAVA program that import and use the defined your package in the previous Problem

Exercise - 13 (Applet)

a).Write a JAVA program to paint like paint brush in applet.
b) Write a JAVA program to display analog clock using Applet.
c). Write a JAVA program to create different shapes and fill colors using Applet.

Exercise - 14 (Event Handling)

a).Write a JAVA program that display the x and y position of the cursor movement usingMouse.
b).Write a JAVA program that identifies key-up key-down event user entering text in aApplet.

Exercise - 15 (Swings)

a).Write a JAVA program to build a Calculator in Swings

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b). Write a JAVA program to display the digital watch in swing tutorial.

Exercise – 16 (Swings - Continued)

a). Write a JAVA program that to create a single ball bouncing inside a JPanel.b). Write a JAVA program JTree as displaying a real tree upside down

Exercise – 16 (Servlets with JDBC)

a). Develop fully functional Login Application

PYTHON

Basics

a) Running instructions in Interactive interpreter and a Python Script

b) Write a program to purposefully raise Indentation Error and correct it

Operations

a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)

b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Control Flow

a) Write a Program for checking whether the given number is a even number or not.

b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10

c) Write a program using a for loop that loops over a sequence. What is sequence?

d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Control Flow -Continued

a) Find the sum of all the primes below two million.

b) Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ... By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

DS

a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure

b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

c) Write a program combine lists that combines these lists into a dictionary.

d) Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?

Files

a) Write a program to print each line of a file in reverse order.

b) Write a program to compute the number of characters, words and lines in a file.

Functions

a) Write a function ball collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.

Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius. If (distance between two balls centers) <= (sum of their radii) then (they are colliding)

b) Find mean, median, mode for the given set of numbers in a list.

c) Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.

d) Write a function dups to find all duplicates in the list.

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e) Write a function unique to find allthe unique elements of a list.

Functions -Problem Solving

a) Write a function cumulative productto compute cumulative product of a list of numbers.
b) Write a function reverse to reverse a list. Without using the reverse function.
c) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

Multi-D Lists

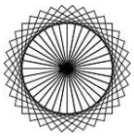
a) Write a program that defines a matrixand prints
b) Write a program to perform additionof two square matrices
c) Write a program to perform multiplication of two square matrices

Modules

a) Install packages requests, flask andexplore them. Using (pip)
b) Write a script that imports requests and fetch content from the page. Eg. (Wiki)
c) Write a simple script that serves a simple HTTPResponse and a simple HTML Page

Graphics

a) Write a GUI for an ExpressionCalculator using tk
b) Write a program to implement thefollowing figures using turtle

COURSE OUTCOMES

On completion of the course the student should be able to

CSU527.1- Use an integrated development environment to write, compile, run, and test simple object-oriented Java and Python programs.

CSU527.2- Analyze the problem statement and use object oriented programming concepts to solve these problems.

CSU527.3- Analyze the run time exceptions and able to handle those runtime exceptions.

CSU527.4- Create fully functional, usable, interactive and real time applications (desktop, mobile, web, mathematical, scientific, data science applications), games and much more.

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CSU528 COMPUTER NETWORK LAB

Teaching Scheme: 04 P **Total 04** **Credits: 02**

Evaluation Scheme: 25 ICA + 25ESE **Total Marks: 50**

Minimum eight experiments shall be performed to cover entire curriculum of CSU627 (Computer Network) and the list given is just a guideline.

Lab Objectives:

I. To implement a simple LAN with hubs, bridges and switches.
II. To describe how computer networks are organized with the concept of layered approach.

List of Experiments:

1. Types of Network Cables.
2. Wired and Wireless NIC.
3. Install and configure Network Devices: HUB, Switch and Routers.
4. Creating a Local Area Network.
5. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration)
6. Network Commands: Ipconfig, Ping / Tracer and NetStat.
7. Network Debugging.
8. Transferring files in LAN.
9. Print server in a LAN, Sharing the Printer.
10. Router Configuration Using Packet Tracer.
11. Connection oriented Client server applications with TCP Assignment.
12. Connectionless Client server applications with UDP Assignment.
13. Programs using RPC remote procedure call
14. Client server applications using concurrent server, Multi-protocol server and super server.
15. Chat and mail server implementation.
16. Implementation of Telnet, FTP
17. Stop and Wait Protocol and Sliding Window.
18. Go back-N And Selective Repeat Protocols.
19. High-Level Data Link Control.
20. Socket Programming and Client – Server Model
21. Network Topologies.
22. Distance Vector Routing Protocol and Link State Vector Routing Protocol.
23. Address Resolution Protocol.
24. Simulate the Implementing Routing Protocols using Border Gateway Protocol (BGP).
25. Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.

Lab Outcomes:

CSU528.1 Understand fundamental underlying principles of computer networking.

CSU528.2 Analyze performance of various communication protocols

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B. ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

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CSU621 COMPILER DESIGN

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 mins.

Course Objectives

I. To understand and list the different stages in the process of compilation.
II. Identify different methods of lexical analysis
III. Design top-down and bottom-up parsers
IV. Identify synthesized and inherited attributes
V. Develop syntax directed translation schemes
VI. Develop algorithms to generate code for a target machine

Required background knowledge: CSU522 Formal Language and Automata Theory

Introduction: Language processor, phases of compilation and overview.
Lexical Analysis (scanner): Role of lexical analyzer, input buffering, specification and recognition of tokens, scanner generator (lex, flex)
Syntax Analysis (Parser): LL(1) grammar and top-down parsing, operator grammar, LR(0), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)
Semantic Analysis: Syntax directed definition, evaluation and flow of attribute in a syntax tree, translation scheme, symbol tables.
Intermediate Code Generation: Translation of different language features, different types of intermediate forms, Type checking, **Run-time environment:** storage organization and allocation strategies parameter passing mechanism.
Code generation & optimization: Issues in code generation, basic blocks and flow graphs, optimization of basic blocks, peephole optimization, register allocation and assignment, sources of optimization, loops in flow graph.

Text-Book:

1. "Compilers: Principles, Techniques and Tools", Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, 2nd edition, Pearson Addison-Wesley, 2013.
2. "Engineering a Compiler", Keith D. Cooper and Linda Torczon, 2nd edition, Morgan Kaufmann, 2011.

References Book:

1. "Compiler Construction– Principles and Practice", Kenneth C. Louden, 1st edition, PWS Publishing, 1997.
2. "Modern Compiler Implementation C", Andrew W. Appel, 1st edition, Cambridge University Press, 2004.

COURSE OUTCOMES

On completion of the course the student should be able to

CSU621.1 Develop the lexical analyzer for a given grammar specification.

CSU621.2 Design top-down and bottom-up parsers for a given parser specification.

CSU621.3 Develop syntax directed translation schemes.

CSU621.4 Design algorithms to generate code for a target machine.

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CSU622 SOFTWARE ENGINEERING

Teaching Scheme : 03T Total 03 Credits : 03
Evaluation Scheme: 30MSE+10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives

I. To develop an ability to look at the Computer Science discipline from Software Engineering Systems perspective.

II. To develop understanding of generic processes of software development and learn different techniques and methodologies used in development of large software systems.

III. To develop analytical ability to employ various strategies in selecting from various models of different stages of software development.

IV. To develop ability to understand role of teamwork in software development and ability to effectively communicate in written forms at various stages of the developmental process.

V. To develop ability to pursue life-long learning as required for software developers for different skills at conceptual, strategic, and operational level.

Introduction to software engineering: Scope and necessity of software engineering-Evolution of software design techniques-Recent challenges in software industry

Software life cycle model: Need for software life cycle model-Different life cycle models Waterfall model-Iterative waterfall model Prototyping model-Evolutionary model-Spiral model-Agile development methodologies-Rational unified process (RUP) - Extreme Programming (XP)

Requirement analysis and specification: Requirements engineering-Types of system requirements-Role of system analyst-Software requirement specification-Formal requirement specification

System Design: System modelling- Unified modelling language (UML)-Design Challenges Design Practices- Top-down and bottom-up design- Experimental prototyping Collaborative design Basic concepts in user interface design: Characteristics of a user interface-Types of user interfaces-Component based graphical user interface design

Software Testing and Quality Management: Role of testing-Testing strategies-Unit tests-Integration testing-Top down integration-Bottom up integration Validation testing-Alpha testing-Beta testing Other forms of high-level testing-Stress testing Code inspections-Manual testing-Automated testing-Breaking tests-Regression testing Examples of testing frame works (Tinderbox, JUnit)

Quality concepts, quality assurance, software reviews, statistical quality assurance.

Software configuration management and advance topics : Elements of configuration management system, process configuration for web engineering, component-based development, clean room software engineering, formal methods, software reengineering, Software Maintenance.

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Text Books:

1. “Software Engineering: A Practitioner's Approach”, Roger S Pressman, McGraw-Hill Higher Education, 7th Edition.
2. “Software Engineering”, Ian Sommerville, Pearson Education, 9th Edition.

References:

1. “A concise introduction to software engineering”, P. Jalote, Springer Verlag, 2008.
2. “An integrated approach to software engineering”, third edition By P. Jalote Springer Verlag, 2005.

Course Outcomes:

After completion of this course student will be able to

CSU622.1 Look at the large scale software development from a broader perspective, and function in multidisciplinary teams.

CSU622.2 Apply knowledge gained in the course to practical software development situations in methodical way.

CSU622.3 Design software systems to meet desired needs with realistic constraints.

CSU622.4 Communicate effectively in software development activities.

CSU622.5 Get an idea about contemporary issues in Software development and engage in life-long learning, understand professional and ethical responsibility.

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PROGRAM ELECTIVE-II

CSU 623 (A) ADVANCED ALGORITHMS

Teaching Scheme: 03L **Total: 03** **Credit: 03**

Evaluation Scheme: 30MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE Duration: 2 Hrs. 30 min.

COURSE OBJECTIVE

I. To introduce students to the advanced methods of designing and analysing algorithms

II. The student should be able to choose appropriate algorithms and use it for a specific problem

III. To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems

IV. To understand different classes of problems concerning their computation difficulties.

Graph: Definitions and Elementary Algorithms: depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition

Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

Text-Book:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.

Reference Books:

1. "Algorithm Design" by Kleinberg and Tardos

COURSE OUTCOMES

After completion of course, students would be able to:

CSU623 (A).1 Analyze the complexity/performance of different algorithms.

CSU623 (A).2 Determine the appropriate data structure for solving a particular set of problems.

CSU623 (A).3 Categorize the different problems in various classes according to their complexity.

CSU623 (A).4 Have an insight of recent activities in the field of the advanced data structure.

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PROGRAM ELECTIVE-II
CSU623 (B) DISTRIBUTED SYSTEMS

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2Hrs. 30 min.

Course Objectives

I. To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems
II. To learn the principles, architectures, algorithms and programming models used in distributed systems
III. To learn the distributed object and databases

Basic concepts. Models of computation: shared memory and message passing systems, synchronous and asynchronous systems. Logical time and event ordering. Global state and snapshot algorithms, mutual exclusion, clock synchronization, leader election, deadlock detection, termination detection, spanning tree construction.
Programming models: Request-reply protocols, remote procedure calls, distributed shared memory.
Fault tolerance and recovery: basic concepts, fault models, agreement problems and its applications, commit protocols, voting protocols, checkpointing and recovery, reliable communication.
Distributed File Systems: File service architecture, Case study: Sun Network File System, Case study: The Andrew File System, Enhancements and further developments
Security and Authentication: basic concepts, Kerberos. Resource sharing and load balancing.
Special topics: distributed objects, distributed databases, directory services, web services.

Text-Book :

1. "Distributed Systems Concepts and Design", George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair,5th ed, Addison-Wesley,2012
2. "Distributed Operating Systems", Andrew S. Tanenbaum, ACM Press.

References Book:

1. "Advanced Concepts in Operating Systems", Mukesh Singhal and Niranjan Shivaratri, McGraw-Hill.
2. "Distributed Algorithms", Nancy Lynch, Morgan Kaufmann.
3. "Distributed Systems", Jie Wu, CRC Press.
4. "Distributed Computing: Fundamentals, Simulations and Advanced Topics", Hagit Attiya, Jennifer Welch, McGraw-Hill.
5. "Distributed Systems", Sape Mullender (ed.), Addison-Wesley.

COURSE OUTCOMES

On completion of the course the student should be able to

CSU623 (B).1 Apply knowledge of distributed systems techniques and methodologies.
CSU623 (B).2 Explain the design and development of distributed systems and distributed systems applications.
CSU623 (B).3 Use the application of fundamental Computer Science methods and algorithms in the development of distributed systems and distributed systems applications.
CSU623 (B).4 Understand the importance of security in distributed systems

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PROGRAM ELECTIVE-II

CSU623 (C) MACHINE LEARNING

Teaching Scheme : 03T Total 03 Credits : 03
Evaluation Scheme: 30MSE +10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Required Knowledge: Calculus & Linear Algebra; Programming language

Course Objectives

I. To explore supervised, unsupervised and reinforcement learning paradigms of machine learning.
II. To design and implement machine learning solutions to classification, regression, and clustering problems.
III. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
IV. To learn to apply machine learning algorithms on real world problems.

Introduction to Machine Learning: The concept learning task. General-to-specific ordering of hypotheses. Version spaces. Inductive bias. Decision Tree Learning. Rule Learning: Propositional and First-Order, Over-fitting, Cross-Validation. Experimental Evaluation of Learning Algorithms Instance-Based Learning: k-Nearest neighbour algorithm, Radial basis functions. Case-based learning. Computational Learning Theory: probably approximately correct (PAC) learning. Sample complexity. Computational complexity of training.

Supervised Learning: Linear and Logistic Regression, Assessing performance of Regression- Error measures, Over-fitting- Catalysts for Over-fitting, Case study of Polynomial Regression. Gradient Descent, Support Vector Machines, Decision Trees, ML and MAP Estimates, K-Nearest Neighbour, Naive Bayes.
Binary Classification- Assessing Classification performance, Multiclass Classification.

Unsupervised learning algorithms: K-Means clustering, Expectation Maximization, Gaussian Mixture Models. PAC Learnability, Learning with Partially Observable Data (EM). Dimensionality Reduction and Principal Component Analysis (PCA). Bias Variance Trade-off. Model Selection and Feature Selection. Regularization. Learning Theory. Introduction to Markov Decision Processes.
Reinforcement Learning: Ensemble learning- Boosting, Bagging, Random forests and some application areas of machine learning e.g. applications on the web mining, Image recognition, text and speech recognition.

Text Book:

1. "Machine Learning", Tom Mitchell, McGraw-Hill, 1997.
2. "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Peter Flach, Cambridge University Press, Edition 2012.
3. "Introduction to Statistical Machine Learning with Applications in R", Hastie, Tibshirani, Friedman, Springer, 2nd Edition-2012.

Reference Books

1. Ethem Alpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013.

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2. Parag Kulkarni: Reinforcement and Systematic Machine Learning for Decision Making, Wiley IEEE Press, Edition July 2012.
3. NPTL: https://onlinecourses.nptel.ac.in

Course Outcomes

After this completion of this course student will be able to

CSU623(C).1 Understand fundamental issues and challenges of machine learning, data model selection and model complexity.

CSU623(C).2 Analyze the strengths and weaknesses of many popular machine learning approaches.

CSU623(C).3 Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

CSU623(C).4 Design and implement various machine learning algorithm in a range of real world applications.

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Program Elective II
CSU 623 (D) - Computer Graphics

Teaching Scheme: 03 T Total-03 Credit: 03
Evaluation Scheme: 30MSE+10TA + 60 ESE Total Marks:100
Duration of ESE: 2:30 hrs

Course Objective

- **I.** To provide overview of computer graphics.
- **II.** To understand the mathematical concepts and algorithms used in computer graphics in two and three dimensions.
- **III.** To learn the graphics programming experience with WebGL.
- **IV.** To discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

Introduction: Display of entities, Geometric computation and representation, Graphics Environments; Working Principles of display devices: refreshing raster scan devices, vector devices, Cathode Ray Tube Terminals, Plotters; Display of colors: Look Up Tables, display of gray shades, Half toning, Graphics Pipeline.
Display and drawing of graphics primitives: point, line, polygon, circle, curves and text; Coordinate Conventions: world coordinates, device coordinates, normalized device coordinates, view-port and window,
Computations on polygons: point inclusion problem, polygon filling, polygon intersection, clipping, polygonization of a point set, convex hull computation, triangulation of polygons;
Transformations in 2D and 3D: translation, rotation, scaling, reflection, Projection: perspective and parallel projections, isometric projection, Transformation matrices;
Volume and Surface Representation: polygonal meshes, parametric curves and surfaces, Surfaces and Volumes by rotation of curves and surfaces, Hidden surface and line elimination**:** Elimination of back surfaces, painters' algorithms,
Rendering and Visualization: Shading model, Constant, Ray tracing algorithm, Radiosity Computation; fundamental concepts of Computer Animation and WebGL

Text Book

1. "Computer Graphics: Principles and Practice", 3rd ed. J. Hughes, A. Van Dam, et. al. Addison - Wesley, 2013.
2. "Computer Graphics with OpenGL", 4th ed. (or 3rd ed.), D. Hearn and M.P. Baker, Prentice-Hall, 2010.

References

1. "Fundamentals of Computer Graphics", 4th ed., P. Shirley et al.,A.K. Peters 2015.
2. "The OpenGL Programming Guide", Neider, Davis, Woo, Addison-Wesley.
3. https://nptel.ac.in/courses/106/106/106106090/

Course Outcomes

CSU623 (D).1 Describe the graphics environment and graphics devices.
CSU623 (D).2 Implements various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
CSU623 (D).3 Describes the importance of viewing and projections.
CSU623 (D).4 Defines the fundamentals of animation and its related technologies.

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PROGRAM ELECTIVE III

CSU624 (A) PARALLEL AND DISTRIBUTED ALGORITHMS

Teaching Scheme: 03 L+00T Total - 03 Credits: 03

Evaluation Scheme: 30MSE +10 TA+ 60 ESE Total Marks: 100

Duration of ESE: 2hrs.30min.

Course Objectives:

I. To learn parallel and distributed algorithms development techniques for shared memory and message passing models.
II. To study the complexity and correctness models for parallel algorithms.
III. To provide students with contemporary knowledge in parallel and distributed computing.
IV. To focus on performance and flexibility issues related to systems design decisions.
V. To introduce a variety of methodologies and approaches for reasoning about concurrent and distributed algorithms.

Parallel Algorithms: Parallel Programming Models: Shared-memory model (PRAM, MIMD, SIMD), network model (line, ring, mesh, hypercube), performance measurement of parallel algorithms.
Algorithm Design Techniques for PRAM Models: Balancing, divide and conquer, parallel prefix computation, pointer jumping, symmetry breaking, pipelining, accelerated cascading. Algorithms for PRAM Models: List ranking, sorting and searching, tree algorithms, graph algorithms, string algorithms.

Algorithms for Network Models: Matrix algorithms, sorting, graph algorithms, routing, Relationship with PRAM models. Parallel Complexity: Lower bounds for PRAM models, the complexity class NC, Pcompleteness.
Distributed Algorithms Basic concepts and Models of computation: shared memory and message passing systems, synchronous and asynchronous systems. Logical time and event ordering. Global state and snapshot algorithms, clock synchronization.
Distributed Operating Systems: Mutual exclusion, deadlock detection. Classical Algorithms: Leader election, termination detection, distributed graph algorithms.
Fault tolerance and recovery: basic concepts, fault models, agreement problems and its applications, commit protocols, voting protocols, check pointing and recovery, reliable communication. Security and Authentication: basic concepts, Kerberos. Resource sharing and load balancing.

Text books:

1. "An Introduction to Parallel Algorithms", Joseph F Jájá, Addison-Wesley, 1992.
2. "Advanced Concepts in Operating Systems", Mukesh Singhal and Niranjan Shivaratri, McGraw-Hill.

Reference books:

1. Michael J Quinn, Parallel Computing: Theory and Practice, second edition, McGraw Hill, 1994/2002.
2. Michael J Quinn, Parallel Programming in C with MPI and OpenMP, first edition, McGraw Hill, 2004/2003. 39
3. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, Introduction to Parallel Computing, second edition, Addison-Wesley/Pearson, 1994/2003.
4. Nancy Lynch, Distributed Algorithms, Morgan Kaufmann.
5. Andrew S. Tanenbaum, Distributed Operating Systems, ACM Press.

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Course Outcomes:

CSU 624 (A).1. Design and analyze the parallel algorithms for real world problems and implement them on available parallel computer systems.

CSU 624 (A).2. Analyze the concepts and issues related to distributed systems.

CSU 624 (A).3. Design and develop the programs for distributed environment.

CSU 624 (A).4. Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.

CSU 624 (A).5. Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems.

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Program Elective III

CSU624 (B) EMBEDDED SYSTEM

Teaching Scheme: 03T **Total: 03** **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

ESE Duration: 2Hrs. 30 min.

Course Objectives

I. Develop an understanding of the technologies behind the embedded computing systems.
II. To introduce students to the design issues of embedded systems.
III. Enable students to analyse and develop software programs for embedded systems

Introduction to embedded systems: Processor in the system, Hardware units required in the exemplary cases, Software embedded into a system, Final Machine implementable software for a product, Software in Processor specific assembly language and high level language, Device drivers, device management using an operating systems, Software design for scheduling multiple tasks and devices using RTOS, Embedded SoC in VLSI circuits.

Structural units of the processor: Allocation of memory to program segment and blocks, memory map of the system, Memory blocks for different data sets and structures, Virtual Devices, Device drivers for parallel port, serial and timing devices, Context and periods for context switching, deadline and interrupt latency.

Embedded programming in assembly language and C: Function pointers, Function queues and ISR queues, Queues for implementing protocol for a network, Queuing of functions on interrupts, Use of FIFO queues, Stacks, Lists and Ordered Lists.

Modeling process: Use of dataflow & control data flow graphs, Programming model for event controlled or response time constraint, Real time programs, Inter process Communication and Synchronization, Multiple processes in an application, Sharing data by multiple tasks, use of finite states machine model & Petri net Model, Use of Semaphores for a task or for Critical section of code, Mutex & P & V, Priority inversion problems & deadlock situations IPC issues, Use of Semaphore flags or Mutex as resource key, use of message queues, mailboxes, pipes, virtual sockets, RPCs.

Introduction to RTOS: RTOS Services, Schedule management for multiple tasks in Real Time, Handling of interrupt source call, RTOS task scheduling models, Cooperative Round Robin Scheduling using a Circular Queue of ready tasks and using ordered list as per precedence constraints, cycling scheduling in Time Sharing, fixed Real Time scheduling, Precedence assignment in Scheduling algorithms, fifteen-point strategy for Synchronization, Embedded Linux Kernel. Advances in Embedded System.

Text Book:

1. Embedded Systems, Architecture, Programming & Design, Rajkamal, 2nd edition, Tata McGraw Hill, 2007

Reference Books:

1. "Real Time Systems", Jane W. S. Liu, 1st Edition, Pearson Education, 2004.
2. "Embedded System Design: A Unified Hardware/Software Introduction", by Frank Vahid, Tony Givargis, 1st Edition, John Wiley & Sons publication, 2002

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COURSE OUTCOMES

On completion of the course the student should be able to

CSU624 (B).1 Understand hardware and software design requirements of embedded systems.

CSU624 (B).2 Analyze the embedded system's specification and develop software programs.

CSU624 (B).3 Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.

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Program Elective III
CSU624 (C) Data Mining

Teaching Scheme : 03T Total 03 Credits : 03
Evaluation Scheme: 30MSE+10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives:

I. To introduce the basic concepts of Data Mining techniques.

II. Examine the types of the data to be mined and apply pre-processing methods on raw data.

III. Apply basic classification, clustering and outlier analysis on a set of data.

Required knowledge: CSU 521 Data base Management System

Introduction to data mining: Motivation and significance of data mining, data mining functionalities, interestingness measures, Data Reduction – Data Discretization and Concept Hierarchy Generation. Classification of data mining system, major issues in data mining.

Mining frequent patterns, associations and correlations: Basic concepts, efficient and scalable frequent item set mining algorithms, mining various kinds of association rules – multilevel and multidimensional, association rule mining versus correlation analysis, constraint based association mining.

Classification and prediction: Definition, decision tree induction, Bayesian classification, and rule based classification, classification by back propagation and support vector machines, associative classification, lazy learners, prediction, accuracy and error measures.

Cluster analysis: Definition, clustering algorithms - partitioning, hierarchical, density based, grid based and model based; Clustering high dimensional data, constraint based cluster analysis, outlier analysis – density based and distance based.

Data mining on complex data and applications: Algorithms for mining of spatial data, multimedia data, text data; Data mining applications, social impacts of data mining, trends in data mining.

Text Books:

1. “Data Mining - Concepts and Techniques”, Han, J. and Kamber, M., 3rd Ed., Morgan Kaufmann Series. 2011

2. “Data Mining - Methods and Techniques”, Ali, A. B. M. S. and Wasimi, S. A., Cengage Publishers. 2009

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Reference Books:

1. "Introduction to Data Mining", Tan, P.N., Steinbach, M. and Kumar, V., Addison Wesley – Pearson. 2008
2. "Data Mining Techniques", Pujari, A. K., 4th Ed., Sangam Books. 2008

Course Outcomes:

At the end of the course the student will be able to:

CSU624 (C).1 Analyze and evaluate performance of algorithms for Association Rules.

CSU624 (C).2 Analyze Classification and Clustering algorithms.

CSU624 (C).3 Apply the techniques of clustering, classification, association finding.

CSU624 (C).4 Apply techniques for feature selection and visualization to real world data.

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PROGRAME ELECTIVE-III
CSU624 (D) CLOUD COMPUTING

Teaching Scheme: 03 L+00T Total - 03 Credits: 03
Evaluation Scheme: 30MSE +10 TA+ 60 ESE Total Marks: 100
Duration of ESE: 2hrs.30min.

Course Objective:

I. To understand the basics of Cloud Computing.
II. To understand the architecture and concept of different Cloud Computing model.
III. To understand the movement from a traditional network infrastructure to a Cloud solution.
IV. To Design/Develop/Deploy cloud applications using Amazon Web Services (AWS).

Cloud Computing Basics: Cloud Computing overview, Applications, Internets and the Cloud, First moves in the Cloud, Benefits, Limitations and Security Concerns in the Cloud Computing.
Cloud Computing Technology: Hardware and Infrastructure: Clients, Security, Network, Services. Accessing the Cloud: Platforms, Web Applications, Web APIs, Web Browsers.
Cloud Storage and Standards: Cloud Storage Overview, Cloud Storage Providers. Standards: Application, Client, Infrastructure, Service.
Cloud Computing at Work: Software as a Service: Overview, Driving Forces, Company Offerings, And Industries. Developing Applications: Google, Microsoft, Intuit Quick Base, Cast Iron Cloud, and Bungee Connect, Development.
Organizations and Cloud Computing: Cloud Computing with the Titans: Google, EMC, NetApp, Microsoft, Amazon, IBM, Partnerships, The Business case for going to the Cloud.
Programming Models: Distributed Programming for the Cloud Data-Parallel Analytics with Hadoop MapReduce (YARN) Iterative Data-Parallel Analytics with Apache Spark Graph-Parallel Analytics with GraphLab 2.0 (PowerGraph)

Text Books:

1. Velte Anthony T., Velte Toby J. and Elsenpeter Robert, "Cloud Computing: A Practical Approach", McGraw Hill, Indian edition, 2010
2. Buyya Rajkumar, Broberg James and Goscinski Anderzej, "Cloud Computing: Principles and Paradigms", Wiley Publication, 2011.

Reference Books:

1. "Cloud Computing: Bible", Sosinsky Barrie, Wiley Publication, 2011.
2. "Distributed and Cloud Computing",Hwang K., Dongarra J., Fox G.C., Morgan-Kaufman.

Course Outcomes:

CSU624 (D).1 Apply knowledge to gain insight about basic technology behind the Cloud.

CSU624 (D).2 Apply to comprehend the Cloud computing applications.

CSU624 (D).3 Identify the appropriate cloud services for a given application.

CSU624 (D).4 Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS

CSU624 (D).5 Analyze various cloud programming models and apply them to solve problems

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OPEN ELECTIVE-I

CSU 633 (A) Web Designing

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2 Hours 30 Minutes

Course Objectives

I. Understand the process of Web Development.
II. To develop the skill & knowledge of Web page design.
III. To use variety of strategies and tools to create websites.
IV. Develop the skills to create fully functional and responsive web sites.

Fundamentals of Web Development

Introduction to Web Development, Domain Names & Hosting, Client and Server Programming Languages, Static & Dynamic Web Contents, Responsive Web Designing, Careers in Web Technologies

HTML, DHTML, XHTML and HTML5

Structure of HTML, Basic HTML Tags, Advanced HTML Tags, Difference between HTML & DHTML & XHTML, DHTML and XHTML Basic tags, Introduction to Doc Types, Creating HTML Pages, Working with HTML5.

Cascading Style Sheets

Introduction to CSS, Types of style sheets, Types of CSS Selectors, Complete CSS properties, Converting Table layout to CSS, Custom CSS Layout Design, Creating simple and dropdown menus, Creating Appealing forms using CSS

Java Script

Introduction to Java Scripting, Types of Java Scripts, Variables, operators, loops, Objects, Events and DOM, Common java script functions, Java Script Validations, Implementing Menus and Galleries etc., Introduction to Ajax, Real time Ajax Examples.

How to Create Website

Client Requirements/Specifications, Creating a concept and layout, Choosing a Colour Scheme, Choosing Stock Photography, Texture and Typography, Design a Professional Layout, Conversation of PSD to CSS, Implementing JavaScript.

Text-Book:

1. Learning Web Design- A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics by Jennifer Niederst Robbins, 4th Edition, O'Reilly
2. Web Design with HTML and CSS Digital Classroom, by Jeremy Osborn, Jennifer Smith, and the AGI Training Team, Wiley Publishing, Inc.

References Book:

1. HTML, XHTML, and CSS Bible by Steven M. Schafer, Fifth Edition, Wiley Publishing, Inc.
2. JavaScript for impatient programmers by Axel Rauschmayer

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COURSE OUTCOMES

On completion of the course the student should be able to

CSU 633 (A).1- Use different languages to develop the web pages

CSU 633 (A).2- Analyze the requirements from web site owner and deliver to their satisfaction

CSU 633 (A).3- Play a role as UI and UX designer

CSU 633 (A).4- Create fully functional, usable, interactive, user friendly and responsive Web Sites.

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OPEN ELECTIVE-I
CSU 633 (B) Data Structures

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2 Hours 30 Minutes

Course Objectives

I. To impart the knowledge of data structures and algorithms.
II. To analyze the algorithm with respect to time and space which will prove the efficiency of algorithm.
III. To assess how the choice of data structures and algorithm design methods impacts the performance of programs
IV. To convert algorithms into efficient programs

Basic of Data Structure and Algorithm

- Understanding the concept of Problem Solving, Design of Algorithms and Data Structures.
- Basic Terminologies: Elementary Data Organizations, Data Structures Operations and Types, Abstract Data Type (ADT)
- Writing Algorithms, Mathematical Notations and Functions, Algorithmic Notation
- Introduction to Searching Algorithms: Linear and Binary Search, Analysis of an Algorithm: Complexity and Rate of Growth, Asymptotic Notations, Time-Space Trade-Off
- Introduction to Sorting Algorithms: Bubble, Selection, Insertion, Quick, Merge, Radix

Note: In this unit all the algorithms are implemented through a basic data structure called Array.

Linked List

- Introduction to Linked List, Types of Linked List.
- Representation of Linked List in Memory
- Algorithms of several operation on Linked List and there analysis
- String Processing: Storing Strings, String Operations, Word/Text Processing, String Pattern Matching Algorithms

Unit-III: Stack and Queue

- Introduction to Stack, Representation of Stack in Memory using Array and Linked List
- Arithmetic Expression, Polish Notation, Application of Stack
- Tower of Hanoi Problem, Recursion
- Introduction to Queue, Representation of Queue in Memory using Array and Linked List,
- Types of Queues, Application of Queues

Unit-IV: Tree

- Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree
- Tree operations on each of the trees and their algorithms with complexity analysis
- Applications of Binary Trees
- Heap Sort

Graph

- Graph: Basic Terminologies and Representations
- Graph search and traversal algorithms and complexity analysis.

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- Minimum Spanning Tree Algorithms (Kruskal and Prim), Single Source Shortest Path (Dijkstra's) and Shortest Path Algorithms (Warshalls)

Text-Book:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill
2. Computer Algorithms, E. Horowitz et al., Computer Science Press

References Book:

1. Data Structures with C by Seymour Lipschutz, Mc Graw Hill Education

COURSE OUTCOMES

On completion of the course the student should be able to

CSU 633 (B).1- Understand basic terminology of data organization with the available data structures and their behavior.

CSU 633 (B).2- Analyze, understand and implement appropriate data structure for a given specific problem.

CSU 633 (B).3- Perform quantitative analysis of algorithm.

CSU 633 (B).4- Demonstrate ability to devise an efficient algorithm and transform into efficient code.

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CSU626 COMPILER DESIGN LABORATORY

Teaching Scheme: 04 P **Total: 04** **Credits: 02**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

The aim is to write a compiler for a small language.

Familiarity with compiled codes (assembly language) of RISC and CISC machines, writing a scanner, writing predictive parser for a small language, small experiment with scanner (lex/flex) and parser (yacc/bison) generator (such as translation of regular expression to NFA or the construction or parse tree), writing scanner-parse specification for a small language, translation of the language to an intermediate form (e.g. three-address code), generation of target code (in assembly language). Code improvement (optional).

Note:-

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge or skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions.

References

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley.
2. Keith D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier.
3. Andrew W. Appel, Modern Compiler Implementation in C/Java, Cambridge University Press.
4. Allen I. Holob, Compiler Design in C, Prentice-Hall.
5. Steven S. Muchnik, Advanced Compiler Design and Implementation, Elsevier.
6. Randy Allen and Ken Kennedy, Optimizing Compilers for Modern Architectures, Elsevier.
7. Michael L. Scott, Programming Language Pragmatics, Elsevier.

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CSU627 MINOR PROJECT

Teaching Scheme: 04 P **Total: 04** **Credits: 02**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
ESE Duration: 3Hrs.

Course Objectives

I. Apply knowledge of Computer Science and Engineering to solve an identified problem
II. Use software development life cycle activities in the project development
III. Develop communication skills, technical writing skills
IV. Develop ability to work in a team.

The project will consist of the work on the topic selected for the project .The project must be done in a group not exceeding three students. The candidates are expected to select the project topic, do the requirements analysis, and carry out the necessary design procedure for the completion of project.

Guidelines for completing the Minor Project:

Weekly report of students work after finalization of topic of project should be submitted to the faculty during designated hours meant for Minor Project.
It should have following stages:
Stage 1: Finalization of Project Groups and Project Topic.
Stage 2: Presentation on selected topic.
Stage 3: Development of Project
Stage 4: Pre submission changes/improvements suggested by faculty
Stage 5: Final submission of project with Demo, Presentation, Viva and Report.

Course Outcomes

CSU 627.1 Apply the software development cycle with emphasis on different processes - requirements, design, and implementation phases for the development of the identified project work.

CSU 627.2 Work as a team and to focus on getting project done within time with each student being held accountable for their part of the project.

CSU 627.3 Present technical report of project work clearly defining work objectives, process to achieve objectives, development methodology, objectives reached, contribution, implications and findings, visualize results and conclusions.

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GOVT. COLLEGE OF ENGINEERING AMRAVATI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROPOSED CURRICULUM

Of

FINAL YEAR

B. TECH. (Computer Science and Engineering)

2022- 2023

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Department of COMPUTER SCIENCE & ENGINEERING

Equivalence Scheme

Programme Name: - Computer Science & Engineering

Sr. No.	Course code with Name of course(old)	Credit	Course code with Name of course (new)	Credit
1	CSU701 System Software	3	CSU721 Compiler Design	3
2	CSU702 Microprocessor and Interfacing	3	No Equivalence	
3	**CSU703 Elective –I:** A) Advanced Computer Architecture	3	No Equivalence	
	B) Embedded System		CSU624(B) Embedded System	3
	C) Multimedia Technology		No Equivalence	
	D) Internet Technology		No Equivalence	
	E) Artificial Intelligence		CSU525(C) Artificial Intelligence	3
4	**CSU704 Interdisciplinary Elective** A) Nanotechnology	3	No Equivalence	
	B) Software Engineering		CSU622 Software Engineering	3
	C) Network Security		CSU725 Introduction to Network Security	3
5	CSU705 System Software Lab	1	CSU626 CompilerDesign Lab	2
6	CSU706 Microprocessor and Interfacing Lab	1	No Equivalence	
7	CSU707 Elective –I Lab	1	No Equivalence	
8	CSU708 Project Phase I	2	No Equivalence	
9	CSU709 Seminar	2	CSU726 Seminar	1
10	CSU710 Industrial Training / Visit	1	No Equivalence	

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11	CSU711 Industrial Lecture II	1	No Equivalence	
12	CSU712 Self Study III	2	No Equivalence	
13	CSU801 Operation Research and Management	3	No Equivalence	
14	CSU802 Digital Signal Processing	3	CSU721 Digital Signal Processing	3
15	**CSU803 Elective -II** A) Modeling and Simulation	3	No Equivalence	
	B) Parallel Computing	3	No Equivalence	
	C) Advanced Database Management System	3	No Equivalence	
	D)Artificial Neural Network	3	No Equivalence	
	E) Bioinformatics	3	No Equivalence	
16	**CSU804 Elective-III** A) Distributed Operating Systems		No Equivalence	
	B) Natural Language Processing		CSU821 Program Elective –V (C) Speech and Natural Language Processing	3
	C) Robotics		No Equivalence	
	D) Advanced Web Technology		No Equivalence	
	E) Computer Graphics		Program Elective-II CSU623(D) Computer Graphics	3
17	CSU805 Operation Research and Management Lab		No Equivalence	
18	CSU806 Digital Signal Processing Lab		No Equivalence	
19	CSU807 Elective –II Lab		No Equivalence	
20	CSU808 Project phase - II		No Equivalence	
21	No Equivalence		CSU722 Cyber Security	3
22	No Equivalence		CSU724 Program Elective-I	3

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Sr. No.	Course code with Name of course(old)	Credit	Course code with Name of course (new)	Credit
23	No Equivalence		CSU725 Open Elective-II	3
			(B) Introduction to Database	
25	No Equivalence		CSU821 Program Elective-V	3
			(A)Computational Geometry	
			(B)Advanced Operating Systems	
			(D) Internet of Things	
26	No Equivalence		**Program Elective-VI (CSU822)**	3
			(A)Queuing Theory and Modelling	
			(B)Fault Tolerant Computing	
			(C)Data Analytics	
			(D) Image Processing	

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CSU721 DIGITAL SIGNAL PROCESSING

Teaching Scheme: 03 T **Total: 03** **Credits: 03**
Evaluation Scheme: 30MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. To study about discrete time systems.
II. To learn about DSP algorithms for convolution, correlation, DFT, FFT etc.
III. To make students aware about the meaning and implications of the properties of systems and signals.
IV. To make students familiar with the most important methods in DSP, including digital filter design.

Discrete Time Signals: Introduction to DSP, Advantages, basic elements of DSP system, Elementary discrete-time sequences.

Discrete Time Systems: Description, representation, classification (linear versus non linear, time-invariant versus time variant, static versus dynamic, casual versus non causal , stable versus unstable)

LTI systems: The convolution sum, properties of convolution, Analysis of causal LTI systems, stability of LTI systems, step response of LTI systems, difference equation, solution of difference equations, Impulse response of LTI recursive system, Correlation of discrete time signals and types.

Fourier Transforms: Definition & properties of Fourier transform, Finite duration sequences and the discrete Fourier transform (DFT), properties, circular convolution, Fast algorithms for the computation of DFT: radix-2 algorithms, Bit Reversal Algorithm.

Z- Transform: Definition of Z- Transform, properties, rational Z-Transforms, evaluation of the inverse Z- Transforms, analysis of linear time invariant systems in Z-domain, transient and steady-state responses, causality, stability, pole-zero cancellation, relation with Fourier transform.

Digital Filters: Classification (LP, HP, BP, FIR and IIR filters), filter specifications, Impulse invariant transformation and bilinear transformation, Commonly used Analog filters and IIR Filter design example, Structures for realization of Discrete-Time systems.

Realization of FIR and IIR Systems: Direct Form, Cascade Form, Signal flow graph and Transposed structures, Cascade form, Lattice and Lattice-ladder.

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Text Book:

1. Digital Signal Processing: Principles Algorithms and Applications, J G Proakis and D G Manolakis, 3rd Edition, Pearson Education Pvt .Ltd, 1996.

Reference Books:

1. Digital Signal Processing: A Computer-Based Approach by S K Mitra, 3rd Edition Tata McGraw Hill Publish Co. Ltd., 2001.
2. Digital Signal Processing a Practical Approach, E C Ifeacthor and B W Jervis, 1st Edition, Pearson Education, 2002.
3. Discrete Time Signal Processing, A V Oppenheim, R W Schafer with J RBuck, 2nd Edition (PHI), 2005.

Course Outcomes:

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

CSU 721.1 Use concepts of trigonometry, complex algebra, Fourier transform, z-transform to analyse the operations on signals and acquire knowledge about systems.

CSU721.2 Design, implementation, analysis and comparison of digital filters for processing of discrete time signals.

CSU721.3 Integrate computer-based tools for engineering applications.

CSU721.4 Employ signal processing strategies at multidisciplinary team activities.

CSU721.5Assess the techniques, skills, and modern engineering tools necessary for analysisof different electrical signals and filtering out noise signals in engineering practice. Also develop creative and innovative designs that achieve desired performance criteriawithin specified objectives and constraints, understand the need for lifelong learning and continuing professional education.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU721.1	3	3	2	1	1	0	0	0	0	0	0	1	3	1	2
CSU721.2	3	2	3	1	3	0	0	0	0	0	0	1	3	1	3
CSU721.3	3	3	2	1	1	0	0	0	0	0	0	1	3	1	2
CSU721.4	2	2	2	1	1	0	0	1	3	1	0	1	2	1	1
CSU721.5	3	2	3	1	1	0	0	0	0	0	0	3	3	3	1

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CSU722 CYBER SECURITY

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objective

- **I.** To Understand key terms and concepts in Cryptography
- **II.** Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization
- **III.** Practice with an expertise in academics to design and implement security solutions
- **IV.** Develop cyber security strategies and policies

Introduction: Basic objectives of cryptography, secret-key and public-key cryptography, one-way and trapdoor one-way functions, cryptanalysis, attack models, classical cryptography.

Block ciphers: Modes of operation, DES and its variants, RCS, IDEA, SAFER, FEAL, BlowFish, AES, linear and differential cryptanalysis.

Stream ciphers: Stream ciphers based on linear feedback shift registers, SEAL, unconditional security.

Message digest: Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions.

Public-key parameters: Modular arithmetic, gcd, primality testing, Chinese remainder theorem, modular square roots, finite fields. Design and Implementation of Security solution .

Public-key encryption: RSA, Rabin and EIGamal schemes, side channel attacks.

Digital signatures: RSA, DSA and NR signature schemes, blind and undeniable signatures.

Text Books

1. Handbook of Applied Cryptography, Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, CRC Press.
2. Cryptography and Network Security: Principles and Practice, William Stallings, Prentice Hall of India.

References

1. A course in number theory and cryptography, Neal Koblitz, Springer.
2. Introduction to Cryptography, Johannes A. Buchmann, Undergraduate Text in Mathematics, Springer.
3. Cryptography Theory and Practice, Doug Stinson, CRC Press.
4. Public-Key Cryptography: Theory and Practice, Das and C. E. Veni Madhavan, Pearson Education

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

CSU722.1 Analyze and Evaluate the cyber security needs of an organization
CSU 722.2 Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
CSU 722.3 Design and develop a security architecture for an organization
CSU 722.4 Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation
CSU722.5 Synthesize the Application by using encryption algorithm

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU722.1	3	2	0	2	0	0	1	0	0	0	0	0	3	0	0
CSU722.2	3	2	0	1	0	0	2	0	0	0	0	0	3	0	0
CSU722.3	3	2	2	0	2	1	0	0	0	0	0	2	2	2	0
CSU722.4	1	1	3	2	2	0	0	2	1	0	0	0	0	2	3
CSU722.5	3	2	3	1	3	0	0	0	0	0	0	1	3	1	3

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CSU 723 SOFTWARE PROJECT MANAGEMENT

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course objective:

I. To understand the Software Project Planning and Evaluation techniques.

II. To plan and manage projects at each stage of the software development life cycle (SDLC).

III. To learn about the activity planning and risk management principles.

IV. To manage software projects and control software deliverables.

V. To develop skills to manage the various phases involved in project management and people management.

VI. To deliver successful software projects that support organization‘s strategic goals.

PROJECT EVALUATION AND PROJECT PLANNING:

Importance of Software Project Management Activities Methodologies Categorization of Software Projects Setting objectives Management Principles Management Control Project portfolio Management Cost-benefit evaluation technology Risk evaluation Strategic program Management Stepwise Project Planning.

PROJECT LIFE CYCLE AND EFFORT ESTIMATION:

Software process and Process Models Choice of Process models Rapid Application development Agile methods Dynamic System Development Method Extreme Programming Managing interactive processes Basics of Software estimation Effort and Cost estimation techniques COSMIC Full function points COCOMO II a Parametric Productivity Model.

ACTIVITY PLANNING AND RISK MANAGEMENT:

Objectives of Activity planning Project schedules Activities Sequencing and scheduling Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

PROJECT MANAGEMENT AND CONTROL:

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

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STAFFING IN SOFTWARE PROJECTS:

Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TEXT BOOK:

1. Software Project Management, Bob Hughes, Mike Cotterell and Rajib Mall, Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Effective Software Project Management, Robert K. Wysocki, Wiley Publication, 2011.
2. Software Project Management, Walker Royce, Addison-Wesley, 1998.
3. Managing Global Software Projects, Gopalaswamy Ramesh, McGraw Hill Education (India), Fourteenth Reprint 2013.

Program Outcomes:

On completion of course, the students will be able to

CSU723.1 Understand Project Management principles while developing software.
CSU723.2 Gain extensive knowledge about the basic project management concepts, framework and the process models.
CSU723.3 Obtain adequate knowledge about software process models and software effort estimation techniques.
CSU723.4 Estimate the risks involved in various project activities.
CSU723.5 Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU723.1	3	2	1	1	2	0	2	0	0	1	0	0	2	2	0
CSU723.2	3	2	1	1	2	0	2	0	0	1	0	0	2	2	0
CSU723.3	3	2	1	3	2	0	2	0	0	1	0	0	2	2	1
CSU723.4	3	2	1	1	2	0	2	0	0	1	0	0	2	2	0
CSU723.5	3	2	1	1	2	0	2	0	0	1	0	0	2	2	1

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CSU724 PROGRAM ELECTIVE-IV
A) COMPUTATIONALCOMPLEXITY

Teaching Scheme: 03T + 00TU Total: 03 Credits: 03
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE Total Marks: 100
ESE Duration: 2Hrs. 30 min.

Course Objectives

I. Capability to communicate conclusions, knowledge and rationale for carrying these to both skilled and unskilled public in a clear and unambiguous way.
II. Capability to apply the scientific method to study and analyse of phenomena and systems in any area of Computer Science.
III. Capacity for mathematical modelling, calculation and experimental designing in technology particularly of research and innovation.
IV. Capacity for abstraction to create and use models that reflect real situations.

Introduction. Easy and hard problems. Algorithms and complexity. **Turing machines**. Models of computation. Multi-tape deterministic and non-deterministic Turing machines. Decision problems. **The Halting Problem and Undecidable Languages**. Counting and diagonalisation. Tape reduction. Universal Turing machine. Undecidability of halting. Reductions. Rice's theorem.

Deterministic Complexity Classes. DTIME[t]. Linear Speed-up Theorem. PTime. Polynomial reducibility. Polytime algorithms: 2-satisfiability, 2-colourability.

NP and NP-completeness. Non-deterministic Turing machines. NTIME[t]. NP. Polynomial time verification. NP-completeness. Cook-Levin Theorem. Polynomial transformations: 3-satisfiability, clique, colourability, Hamilton cycle, partition problems. Pseudo-polynomial time. Strong NP-completeness. Knapsack. NP-hardness.

Space complexity and hierarchy theorems. DSPACE[s]. Linear Space Compression Theorem. PSPACE, NPSPACE. PSPACE = NPSPACE. PSPACE-completeness. Quantified Boolean Formula problem is PSPACE-complete. L, NL and NL-completeness. NL=coNL. Hierarchy theorems.

Optimization and approximation. Combinatorial optimisation problems. Relative error. Bin-packing problem. Polynomial and fully polynomial approximation schemes. Vertex cover, travelling salesman problem, minimum partition. **Randomized Complexity.** The classes BPP, RP, ZPP. Interactive proof systems: IP = PSPACE.

Text Book

1. Introduction to the Theory of Computation, M Sipser second edition - Thomson Course Technology, 2005.
2. Computational Complexity, Arora, Barak Cambridge University Press, 2009.

Reference Book

1. Complexity Theory, I Wegener. Springer, 2005.
2. Introduction to Algorithms, T H Cormen, S Clifford, C E Leiserson and R L Rivest. MIT Press, Second edition, 2001.
3. Computational Complexity, Oded Goldreich. Cambridge University press, 2001
4. Approximation Algorithms, Vijay V. Vazirani. Springer, Second edition, 2003.

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Course Outcome

On completion of course, the students will be able to

CSU724 (A).1 Classify decision problems into appropriate complexity classes, including P, NP, PSPACE and complexity classes based on randomized machine models.

CSU724 (A).2 State precisely what it means to reduce one problem to another, and construct reductions for simple examples.

CSU724 (A).3 Classify optimization problems into appropriate approximation complexity classes.

CSU724 (A).4 Use the concept of interactive proofs in the analysis of optimization problems.

CSU724 (A).5 Define the recurring methods used to prove the relationship between complexity classes.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU724 (A).1	3	3	2	2	0	0	0	0	0	1	0	1	3	1	0
CSU724 (A).2	3	3	2	0	2	0	0	0	0	1	0	1	2	1	0
CSU724 (A).3	3	3	2	2	0	0	0	0	0	1	0	1	3	1	0
CSU724 (A).4	3	3	2	0	2	0	0	0	0	1	0	1	2	1	0
CSU724 (A).5	3	2	0	2	0	0	0	0	0	1	0	1	2	1	0

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CSU 724 PROGRAM ELECTIVE-IV
B) LOW POWER VLSI CIRCUITS AND SYSTEMS

Teaching Scheme: 03T **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**
ESE Duration: 2 Hours 30 Minutes

Course Objectives

I. Addresses a profound analysis on the development of the CMOS & Bi-CMOS digital circuits for a low voltage low power environment.
II. To study the concepts of device behaviour and modelling.
III. To study the concepts of low voltage, low power logic circuits.

INTRODUCTION TO CMOS LOGIC: The Inverter, The NAND Gate, CMOS Logic Gates, NOR Gate, Compound Gates, Pass Transistors and Transmission Gates, Tristates, Multiplexers, Sequential Circuits, **CMOS Fabrication Layout:** Inverter Cross Section, Fabrication Process, Layout Design Rules, Gate Layouts, Stick Diagrams

MOS TRANSISTOR THEORY: Simple MOS Capacitance Models, Detailed MOS Gate Capacitance Model, Detailed MOS Diffusion Capacitance Model, **Nonideal I-V Effect:** Mobility Degradation and Velocity Saturation, Channel Length Modulation, Threshold Voltage Effects, Leakage, Temperature Dependence, Geometry Dependence.

CMOS PROCESSING TECHNOLOGY: Wafer Formation, Photolithography, Well and Channel Formation, Silicon Dioxide, Isolation, Gate Oxide, Gate and Source/Drain Formation, Contacts and Metallization, Passivation, Metrology, **Layout Design Rules:** Design Rule Background, Scribe Line and Other Structure, MOSIS Scalable CMOS Design Rules, Micron Design Rules.

POWER: Definition, Examples, Sources of Power Dissipation, **Dynamic Power:** Activity Factor, Capacitance, Voltage, Frequency, Short-Circuit Current, Static Power Sources, Power Gating, Multiple Threshold Voltages and Oxide Thicknesses, Variable Threshold Voltages, Input Vector Control, **Energy Delay Optimization:** Minimum Energy, Minimum Energy-Delay Product, Minimum Energy Under a Delay Constraint, **Low Power Architectures:** Microarchitecture, Parallelism and pipelining, Power Management Modes.

COMBINATIONAL CIRCUIT DESIGN: Satic CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits. Circuit Pitfalls: Threshold Drops, Ratio Failures, Leakage, Charge Sharing, Power Supply Noise, Hot Spots. Silicon-On-Insulator Circuit Design: Floating Body Voltage, SOI Advantages, SOI Disadvantages, Implications for Circuit Styles.

SEQUENTIAL CIRCUIT DESIGN: Sequential Methods, Max-Delay Constraints, Min-Delay Constraints, Time Borrowing, Clock Skew, Conventional CMOS Latches, Conventional CMOS Flip-Flops, Pulsed Latches, Resettable Latches and Flip-Flops, Enabled Latches and Flip-Flops, Incorporating Logic into Latches, Klass Semi dynamic Flip-Flop, Differential Flip-Flop, Dual Edge-Triggered Flip-Flop, Radiation-Hardened Flip-Flop, True Single-Phase-Clock Latches and Flip Flops.

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Text Book:

1. CMOS VLSI Design A circuit and System Perspective, Neil H. E. Weste, David Money Harris Forth Edition, Pearson Education, 2011.

Reference Books:

1. Digital Integrated Circuits, J.Rabaey, PH. N.J 1996, 2nd Edition.

2. CMOS Digital ICs, Sung-mokang and yusufleblebici, TMH, 3rdedition, 2003.

3. VLSI DSP Systems, Parhi, John Wiley & sons, 2003 Reprint.

4. IEEE Trans Electron Devices, IEEE J.Solid State Circuits, and other National and International Conferences and Symposia.

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

CSU724 (B).1 Capability to recognize advanced issues in VLSI systems, specific to the deep-submicron silicon technologies.
CSU724 (B).2 Understand deep sub-micron CMOS technology and digital CMOS design styles.
CSU724 (B).3 Design chips used for battery-powered systems and high performance circuits.
CSU724 (B).4 Utilize logic simulation methods to design Low Power VLSI circuits.
CSU724 (B).5 Implement practical and state of the art Low Power VLSI design, suitable for real life and Industry applications.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU724 (B).1	3	2	1	2	2	0	0	0	0	0	0	1	3	1	1
CSU724 (B).2	3	2	1	2	2	0	0	0	0	0	0	1	3	1	1
CSU724 (B).3	3	2	3	2	3	0	0	0	0	0	0	1	3	1	3
CSU724 (B).4	3	2	3	2	3	0	0	1	0	0	0	1	3	1	3
CSU724 (B).5	3	3	2	2	3	0	1	0	0	0	0	1	3	1	3

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CSU724 PROGRAM ELECTIVE-IV
C) SOFT COMPUTING

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course objective:

I. To gain a historical perspective of Soft Computing and its foundations.
II. To become familiar with basic principles of Evolutionary algorithms.
III. To provide the mathematical background for carrying out the optimization associated with neural network learning.
IV. To develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project.

Introduction to Soft Computing: Concept of computing systems. "Soft" computing versus "Hard" computing Characteristics of Soft computing Some applications of Soft computing techniques.

Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques Basic GA framework and different GA architectures. GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs..

Artificial Neural Networks: Biological neurons and its working. Simulation of biologicalneurons to problem solving. Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function NetworksReinforcement Learning, Unsupervised Learning Neural Networks, Applications of ANNs to solve some real life problems.

Recent Trends: Advances in Neural networks and genetic algorithm, Study of neural network toolbox, Simple implementation of Artificial Neural Network, Recurrent Neural Network, Convolutional Neural Network.

Text Book

1. Neural Networks, Fuzzy Logis and Genetic Algorithms : Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.

Reference Book

1. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
2. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.
3. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.
4. Soft Computing, D. K. Pratihar, Narosa, 2008.
5. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.
6. Neural Networks and Learning Machines, (3rd Edn.), Simon Haykin, PHI Learning, 2011

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Course outcomes:

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

CSU 724(C) 1. Demonstrate fundamental understanding of Evolutionary algorithms, ANN andits foundations.

CSU 724(C) 2. Apply basic principles of soft computing and its applications.

CSU 724(C) 3 Solving single-objective optimization problems using GAs.

CSU 724(C) 4 Determine the application of ANN and Implementation of various ANNClassifier

CSU 724(C) 5 Differentiate between Genetic Algorithm (GA) And Artificial Neural Network Algorithms

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU724 (C).1	3	2	0	1	0	0	0	0	0	0	1	0	3	0	0
CSU72(C).2	3	2	0	1	0	0	0	0	0	0	0	0	3	0	0
CSU722 (C).3	3	2	0	2	0	1	0	0	0	0	0	0	2	3	0
CSU722(C).4	2	2	3	1	3	0	0	0	2	0	1	0	0	3	3
CSU722(C).5	3	3	2	2	0	0	0	0	0	1	0	1	3	1	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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CSU 724 PROGRAM ELECTIVE-IV
D) HUMAN COMPUTER INTERACTION

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. Provide an overview of the concepts relating to the design of human-computer interfaces in ways making computer-based systems comprehensive, friendly and usable.
II. Identify the impact of usable interfaces in the acceptance and performance utilization of information systems.
III. Analyse Human-Computer Interaction principle and designs in Information Systems.
IV. Study various HCI designs to gain knowledge on user-centric interfaces.

Introduction: The human, the computer, The interaction, Paradigms, Usability of Interactive systems, Guidelines, principles and theories

Design Process: Interaction design basics, HCI in software process, Design rules, Implementation support, Evaluation techniques, Universal design, User support.

Models and Theories: Cognitive models, socio-organizational issues and stakeholder requirements, communication and collaboration models, task analysis, dialogue notation and design, models of the system, modelling rich interaction.

Interaction Style: Direct manipulation and virtual environments, Menu selection, Form filling and dialogue boxes, Command and natural languages, Interaction devices, Collaboration and social media participation.

Design Issues: Quality of service, balancing function and fashion, User Documentation and Online Help, Information Search, Information Visualization.

Outside Box: Group ware, Ubiquitous computing and augmented realities, Hypertext, Multimedia and worldwide web.

Text Books:

1. Human Computer Interaction, Alan Dix, Janet Finlay, ISBN: 978813171035, Pearson Education 2004.
2. Designing the User Interface-Strategies for Human Computing Interaction, Ben Shneiderman, ISBN: 9788131732557, Pearson Education 2010.

Reference Books:

1. Usability Engineering: Scenario-Based Development of Human Computer Interaction, Rosson. M. and Carroll J. 2002.
2. The Essential of Interaction Design, Cooper, et al, Wiley Publishing, 2007.
3. Usability Engineering, Nielson J. Morgan Kaufmann, San Francisco, ISBN: 0-12-518406-9, 1993.
4. The Resonant Interface: HCI Foundation for Interaction Design, Heim S., Addison-Wesley, 2007.

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Course outcomes:

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

CSU724 (D).1 Analyse Human-Computer Interaction principle and designs in Information Systems.
CSU724 (D).2 Compare various HCI designs to gain knowledge on user-centric interfaces.
CSU724 (D).3 Evaluate the Internet sites considering; usability and user appreciation designs.
CSU724 (D).4 Design effective HCI for individuals and persons with disabilities.
CSU724 (D).5 Develop meaningful user interface.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU724 (D).1	3	2	2	1	3	0	0	0	0	0	0	1	1	1	0
CSU724(D).2	3	2	2	1	3	0	0	0	0	0	0	1	2	2	1
CSU724 (D).3	3	3	3	1	3	0	0	0	0	0	0	1	2	1	1
CSU724 (D).4	3	2	2	1	3	0	0	0	0	0	0	1	3	2	1
CSU724 (D).5	3	2	2	1	3	0	0	0	0	0	0	1	2	2	1

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CSU 733 OPEN ELECTIVE-II
A) INTRODUCTION TO COMPUTER NETWORK

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. To understand the network security, services, attacks, mechanisms, types of attacks.
II. To comprehend and apply authentication services, authentication algorithms.
III. To comprehend and apply network layer security protocols, Transport layer security protocols, Web security protocols.

Introduction to Data communication: Components**,** Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media.

LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.
TCP/IP Model

Introduction to the Internet Protocol: IP Addressing, IP Address Classes, Reserved IP Addresses, Public and Private IP Addresses, IPv4 and IPv6 Security, Addresses.

Introduction: Attack, Services and Mechanism, Model for Internetwork Security Cryptography : Notion of Plain Text, Encryption, Key, Cipher Text, Decryption and Cryptanalysis, Public Key Encryption, Digital Signatures and Authentication

Overview of Network Security: Security services, Security Issues in TCP/IP suite, Sniffing, spoofing, buffer overflow, ARP poisoning, ICMP Exploits, DNS security, IP address spoofing, UDP exploits, TCP exploits.

Digital Signatures and Authentication: Requirements, Authentication functions, Message Authentication Codes, Security of Hash Functions and MACs, MD5 message Digest algorithm.

IP Security: Overview and Architecture, Secure E-mail and S/MIME, Domain Keys Identified Mail, Secure Socket Layers (SSL) and Transport Layer Security (TLS), HTTPS

Text Books:
1. Computer Networking: A top down Approach Featuring the internet, Jim Kurose, Keith Ross, 6th Edition, Addison Wesley, July2002.
2. Cryptography and Network Security: Principles and Practice, Stallings W., Seventh Edition, Pearson, 2017.

Reference Book:
1. Cryptography and Network Security, Kahate Atul, Tata McGraw-Hill, Third Edition, 2013.
2. Computer Networks, A.S. Tanenbaum, 4th Edition, PHI Publication, 2002.

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

CSU733 (A).1 Ability to determine appropriate mechanisms for protecting the network.
CSU733 (A).2 Ability to design and develop security solutions for a given application or system.
CSU733 (A).3 Ability to develop a secure network stack.
CSU733 (A).4 Ability to determine security and authentications.
CSU733 (A).5 Ability to analyse models for internet work security.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU733 (A).1	2	2	0	0	1	0	0	2	0	0	0	0	0	0	0
CSU733 (A).2	1	3	2	0	1	0	0	2	0	0	0	2	1	0	0
CSU733 (A).3	2	1	1	2	1	2	2	0	0	2	2	2	1	2	1

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CSU 733 OPEN ELECTIVE-II
B) INTRODUCTION TO DATABASE

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. To understand the basic concepts of DBMS

II. To learn data models, conceptualize and depict a database system using ER diagram.

III. To understand the different database models and language queries to access databases

IV. To understand the normalization forms in building an effective database tables

Introduction: Database System Applications, Purpose of Database System, Views of data, data models, Database Languages, database architecture and components of DBMS, Database System Applications, Database Users and Administrators, Database System Structure, History of Database Systems. Entity-Relationship Model, Basic Concepts, Design Issues, Entity-Relationship Diagram, ER Model, notations, examples.

Relational Model: Relational Data Model, Concept of relations, schema-instance distinction, referential integrity constraints, keys, referential integrity and foreign keys, relational algebra operators, Extended Relational-Algebra Operations

SQL: Introduction, data definition in SQL, table, key and foreign key definitions, update behaviours. Querying in SQL, notion of aggregation, aggregation functions group by and having clauses, embedded SQL. Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization, Authorization in SQL, Encryption and Authentication.

Transactions: Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.

Current Issues: Rules, Knowledge Bases, Active and Deductive Databases, Multimedia Databases Multimedia Data Structures, Multimedia Query languages, Spatial Databases.

Text Book

1. Database System Concepts, Silberschatz, Abraham, Korth, Henry F., and Sudharshan, S., 6th Edition, Tata McGraw Hill, 2017.

Reference Books

1. Fundamentals of Database Systems, Elmasri, R. and Navathe, S. B. 5th Edition, Pearson/Addison Wesley, 2017.
2. Database Systems: A Practical Approach to Design, Implementation, and Management, Connolly, Thomas and Begg, Carlolyn, 5th Edition, Addison-Wesley, 2014.

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Course Outcomes

CSU733 (B).1 Ability to comprehend the complex query processing techniques.

CSU733 (B).2 Ability to design and implement multimedia databases and writing query structure. Ability to install, configure and interact with a relational database management system.

CSU733 (B).3 Ability to master the basics of SQL and construct queries using SQL.

CSU733 (B).4 Ability to develop skill set in file organization, Query Optimization, Transaction management, and database administration techniques.

CSU733 (B).5 Ability to understand concepts of transaction processing.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU733 (B).1	2	2	0	0	1	0	0	2	0	0	0	0	0	0	0
CSU733 (B).2	1	3	2	0	1	0	0	2	0	0	0	2	1	0	1
CSU733 (B).3	2	1	1	2	1	2	2	0	0	2	2	2	1	2	1
CSU733 (B).4	1	1	0	0	2	0	2	0	2	1	2	2	2	2	3
CSU733 (B).5	1	1	0	0	2	0	2	0	1	1	2	2	1	2	3

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CSU 726 SEMINAR

Teaching Scheme: 02P **Total – 02** **Credits: 01**
Evaluation Scheme: 50 ICA **Total Marks: 50**

Course Objectives:

I. Establish motivation for any topic of interest not covered in curriculum and develop a thought process for technical presentation.
II. Organize a detailed literature survey and build a document with respect to technical publications.
III. Learn effective presentation and improve soft skills.
IV. Make use of new and recent technology for creating technical reports.

The seminar is to be undertaken by single student

1. Student shall select a topic for seminar which is not covered in curriculum

2. Topics shall be registered within a month after beginning of VII Semester and shall be approved by the concerned guide and Program Head

3. Students should know the functional and technical details of selected topic after carrying out the conceptual study.

4. Before the end of semester, student shall deliver a seminar and submit the seminar report in following format:

– Introduction

– Literature Survey

– Concept

– Functional and Technical Details

– Future scope

– Applications

Course Outcomes:

After completing this course, Students shall be able:

CSU726.1 To study research papers for understanding of a new field, in the absence of a textbook, to summaries and review them.

CSU726.2 To identify promising new directions of various cutting edge technologies

CSU726.3 To impart skills in preparing detailed report describing the topic and results

CSU726.4 To effectively communicate by making an oral presentation before an evaluation committee.

CSU726.5 To develop the interpersonal skills for presentation of topic.

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CO-PO-PSO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU726.1	3	1	3	0	0	0	0	0	3	0	2	0	3	2	1
CSU726.2	2	3	2	3	0	0	0	0	2	0	3	0	1	3	0
CSU726.3	2	2	3	2	0	0	0	0	2	0	2	0	2	2	2
CSU726.4	2	2	3	2	0	0	0	0	2	0	2	0	2	3	3
CSU726.5	2	2	3	2	0	0	0	0	2	0	2	0	2	2	2

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CSU 821 PROGRAM ELECTIVE-V
A) COMPUTATIONALGEOMETRY

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objective

I. Learn the several kinds of problems in Computational Geometry, as well as their applications.
II. Learn the capacity of combining geometric tools with the appropriated data structures and algorithmic paradigms.
III. Ability to solve basic problems that appear in computational geometry.
IV. Ability to implement the solutions proposed in the class, as well as those that can be found in the basic references of the course.
V. Ability to recognize the geometric problems behind the applications, and to propose adequate algorithmic tools to solve them.

Polygon Triangulation: Triangulation Theory, Area of Polygon, Segment intersection, Segment-triangle intersection. **Polygon Partitioning**: Monotone Partitioning, rapezoidalization, Partition into Monotone Mountains, Linear-Time Triangulation, Convex Partitioning.

Convex Hulls in Two Dimensions: Definitions of Convexity and Convex Hulls, Naive Algorithms for Extreme Points, Gift Wrapping, QuickHull, Graham's Algorithm, Lower Bound, Incremental Algorithm, Divide and Conquer

Convex Hulls in Three Dimensions: Polyhedra and data structures, Gift wrapping, Preparata-Hong algorithm, Incremental algorithm, Randomized incremental algorithm

Voronoi Diagrams: Definitions and Basic Properties, Delaunay Triangulations, Algorithms, Applications in Detail, Medial Axis, Connection to Convex Hulls, Connection to Arrangements

Arrangements: Combinatorics of Arrangements, Incremental Algorithm, Three and Higher Dimensions, Duality, Higher-Order Voronoi Diagrams, Applications
Search and Intersection: Segment-Segment Intersection, Segment- Triangle Intersection, Point in Polygon, Point in Polyhedron, Intersection of Convex Polygons, Intersection of Segments, Intersection of Non convex Polygons, Extreme Point of Convex Polygon, Extremal Polytope Queries, Planar Point Location
Motion Planning: Shortest Paths, Moving a Disk, Translating a Convex Polygon, Moving a Ladder, Robot Arm Motion, Separability.

Text Book

1. Computational Geometry: Algorithms and Applications, M. de Berg, M. van Kreveld, M. Overmars, O. Schwarzkopf, 2nd Edition, Springer-Verlag. 2000
2. Computational Geometry in C, J. O'Rourke, 2nd edition, Cambridge Univ. Press, 1998.

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Reference Book

1. Mathematical Illustrations: A Manual of Geometry and PostScript, B. Casselman, Springer-Verlag,.(http://www.math.ubc.ca/~cass/graphics/manual) 2005
2. Computational Geometry: An Introduction Through Randomized Algorithms,K. Mulmuley, Prentice Hall. 1994

Course Outcomes

On the completion of course, the student will be able to:
CSU821 (A).1 Analyze randomized algorithms for small domain problems.
CSU821 (A).2 Use line-point duality to develop efficient algorithms.
CSU821 (A).3 Apply geometric techniques to real-world problems in graphics.
CSU821 (A).4 Solve linear programs geometrically.
CSU821 (A).5 Assess theoretical and practical problems that involve geometry and will adapt efficient methods to solve them.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU821 (A).1	3	3	2	2	0	0	0	0	0	1	0	1	3	1	0
CSU821 (A).2	3	3	2	0	2	0	0	0	0	1	0	1	2	1	0
CSU821 (A).3	3	3	2	2	0	0	0	0	0	1	0	1	3	1	0
CSU821 (A).4	3	3	2	0	2	0	0	0	0	1	0	1	2	1	0
CSU821 (A).5	3	3	2	2	0	0	0	0	0	1	0	1	3	1	0

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CSU 821 PROGRAM ELECTIVE-V
B) ADVANCED OPERATINGSYSTEMS

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. To study, learn, and understand the main concepts of advanced operating systems
II. To understand the concept of distributed operating system
III. To compare the traditional operating system and Advance operating system.
IV. To understand the different case studies of Advance operating system

Theory and implementation aspects of distributed operating systems. Process Synchronization, Remote Procedure call,

Inter-process communication and co-ordination in large distributed systems. Distributed resource management. Message- and Stream-Oriented communication, Processes and threads, Code migration and distributed scheduling, Naming.

Clock Synchronization, Distributed mutual exclusion and distributed deadlocks, Distributed transaction Distributed file systems (NFS, AFS & coda)

Fundamentals of real time operating systems. Information management in distributed systems: security, integrity and concurrency problems. Fault tolerance issues.

OS issues related to the Internet, intranets, pervasive computing, embedded systems, mobile systems and wireless networks.

Case studies of contemporary operating systems, DCOM and JINI

Textbook

1. Distributed Systems: Principles and Paradigms, Andrew S. Tanenbaum and Maarten van Steen. Prentice Hall, 2nd Edition, 2007
2. Advanced Operating Systems and Kernel Applications, Techniques and Technologies Wiseman, Yair Information Science Publishing, 2009

References

1. Distributed Operating Systems & Algorithms, Randy Chow and Theodore Johnson. Addison-Wesley, 1997

Course Outcome

On completion of the course student should be able to
CSU821 (B).1 Analyse the general aspect of distributed operating system.
CSU821 (B).2 Understand and analysed the interposes communication and clock synchronization
CSU821 (B). 3 Identify, formulate and solve integrative operating system problem
CSU821 (B).4 Analyse the difference between DCOM and JINI
CSU821 (B).5 Understand and analysed the different AOS related issues.

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CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU821 (B).1	3	2	0	1	0	0	3	0	0	0	0	0	3	0	0
CSU821 (B).2	3	2	0	1	0	0	3	0	0	0	0	0	3	1	0
CSU821 (B).3	3	2	1	0	1	0	2	0	0	0	0	0	3	0	0
CSU821 (B).4	3	2	1	0	1	0	2	0	0	0	0	0	3	0	0
CSU821 (B).5	3	2	0	1	0	0	3	0	0	0	0	0	3	1	0

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CSU 821 PROGRAM ELECTIVE-V
C) SPEECH AND NATURALLANGUAGE PROCESSING

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives

I. To introduce students to the fundamental concepts and techniques of speech and natural language processing (NLP).
II. To gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
III. To examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.

Speech and Natural Language Processing: Introduction; Brief Review of Regular Expressions and Automata; Finite State Transducers; Word level Morphology and Computational Phonology; **Basic Text to Speech:** Introduction to HMMs and Speech Recognition. Indian language case studies; Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning;
Semantic Analysis: Lexical Semantics; Word Sense; Disambiguation; Discourse understanding; Natural Language Generation; Techniques of Machine Translation; Indian Language case studies.

Text Book:

1. Daniel Jurafsky and James H. Martin, Speech and Language Processing, Prentice-Hall.
2. Natural Language Processing with Python by Steven Bird, Ewan Klein, Edward Lopper

Reference Books:

1. Foundations of Statistical Natural Language Processing, Chris Manning and Hinrich Schuetze, MIT Press.
2. Handbook of Natural Language Processing, Second Edition—Nitin Indurkhya, Fred J. Damerau, Fred J. Damerau

COURSE OUTCOMES

On completion of the course the student should be able to

CSU821.1 (C) Understand how key concepts from NLP are used to describe and analyze language.

CSU821.2 (C) Understand POS tagging and context free grammar for English language

CSU821.3 (C) Analyse semantics of English language for processing.

CSU821.4 (C) Analyse large volume text data generated from a range of real-world applications**.**

CSU821.5 (C) Understand the various techniques of Machine Translation

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CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU821 (C).1	3	2	1	1	1	0	0	0	0	0	0	1	3	1	0
CSU821 (C).2	3	3	1	2	1	0	0	0	0	0	0	1	3	0	1
CSU821 (C).3	3	2	2	2	1	0	0	0	0	0	0	1	3	0	1
CSU821 (C).4	3	2	2	2	1	0	0	0	0	0	0	1	3	0	1
CSU821 (C).5	3	2	2	2	1	0	0	0	0	0	0	1	3	0	1

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CSU 821 PROGRAM ELECTIVE-V
D) INTERNET OF THINGS

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objective

I. To understand about the fundamentals of Internet of Things and its building blocks along with their characteristics
II. To understand the recent application domains of IoT in everyday life
III. To understand the protocols and standards designed for IoT and the current research on it.
IV. To understand the other associated technologies like cloud and fog computing in the domain of IoT

Introduction to Internet of Things: Application areas of IoT, Characteristics of IoT, Things in IoT, IoT stack, Enabling technologies, IoT challenges, IoT levels, IoT and cyber physical system, IoT and WSN
Sensors, Microcontrollers, and Their Interfacing: Sensor interfacing, Types of sensors, Controlling sensors, Microcontrollers, ARM
Protocols for IoT: Messaging protocols, Transport protocols, IPv4, IPv6, URI
Cloud for IoT: IoT and cloud, Fog computing, Security in cloud, Edge Computing, Case study
Application Building with IoT: Various application of IoT : Food, Healthcare, Lavatory maintenance, Water quality, Warehouse, Retail, Driver Assistance, Collision impact
Arduino and Raspberry Pi: Arduino Architecture, Programming and Application
Raspberry Pi: Architecture, Programming and Application

Text Books:

1. Internet of Things, Vasudevan, Nagrajan and Sundaram, Wiley India
2. IoT Fundamentals, David Hence at el, Cisco Press

Reference Books:

1. IoT Based Projects, Rajesh Singh at el, BPB
2. Internet of Things with ARDUINO and BOLT, Ashwin Pajankar, BPB

Course Outcomes:

After completion of the course, student will be able to

CSU 821(D).1 Able to understand building blocks of Internet of Things and characteristics
CSU 821(D).2 Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
CSU 821(D).3 Use the IoT technologies in practical domains of society.
CSU 821(D).4 Gain knowledge about the state of the art methodologies in IoT application domains.

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CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU821 (D).1	3	3	1	0	1	0	0	0	0	0	0	0	3	1	0
CSU821 (D).2	3	3	1	2	1	0	0	0	0	0	0	0	3	2	1
CSU821 (D).3	3	3	1	0	1	0	0	0	0	0	0	0	3	1	0
CSU821 (D).4	3	3	2	2	3	0	0	0	0	0	0	1	3	2	0

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CSU 822 PROGRAM ELECTIVE-VI
A) QUEUING THEORYAND MODELLING

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives

I. To show how to use the theory of probability to describe and predict the behaviour of real systems (computer and telecommunications networks, others) that use fixed resources to handle random demands.
II. To understand the concept of queuing models and apply in engineering.
III. To understand the significance of advanced queuing models.

Introduction: (historical background, summary of technology and economics), Intuitive analysis of mathematical models, subtleties

Review of probability and stochastic processes: Random variable, birth-and-death processes, Statistical Equilibrium, Probability Generating function, Some Important Probability Distributions, simulation via inverse transform , Introduction to stochastic processes

One-dimensional birth-and-death processes : related queueing models, PASTA (Poisson Arrivals See Time Averages) , Erlang B and Erlang C models, finite-source models,

Multidimensional birth-and-death processes: Introduction, Product Solution, Generating Function, Macrostates, Indirect Solution of Equations, Numerical Solutions of State Equation by Iterations, The Equivalent Random Method, The Method of Phases

Imbedded Markov Chains Queuing Model: Introduction, Little's theorem**,** Equality of State Distribution at Arrival and Departure Epochs , Mean Queue Length and Mean Waiting Time in the M/G/1 queues, Riemann—stieltjes Integral, Laplas-stieltjes Transforms, Some Results from Renewal, The M/G/1 queues, related models

Simulation and Queuing Model: Introduction**,** Generation of Stochastic Variables, Simulation Programing Language, Statistical Question, Examples

Text Book:

1. Introduction to Queueing Theory, Robert B. Cooper, North Holland, 2nd Edition.

Reference Books:

1. Data Networks, D. and R. Gallager. 2nd Ed., Prentice Hall, 1992 (ISBN 0-13-200916-1 paperback)
2. Introduction to Probability Models, Ross, S.M., 10th edition, Academic Press ISBN 978-0-12-375686-2.
3. A First Course in Stochastic Models, Tijms, H.C., Wiley, 2003 (ISBN 0-471-49881-5 paperback).
4. Hlynka's Queueing Theory Page: http://web2.uwindsor.ca/math/hlynka/queue.html

COURSE OUTCOMES

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

CSU822 (A).1 Examine the relationship between mathematical models (precise formulas, but limited applicability) and their corresponding simulation models (imprecise experimental data, butgreater flexibility and realism)

CSU822 (A).2 Understand the fundamental concepts of probability

CSU822 (A).3 Provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering

CSU822 (A).4 Apply the concept of queuing model in Engineering

CSU822 (A).5 Understand the basic characteristic features of a queuing system and acquire skills inanalyzing queuing models.

CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU822 (A).1	3	3	3	2	2	0	0	0	0	1	0	1	3	1	2
CSU822 (A).2	3	3	3	2	2	0	0	0	0	0	0	1	3	1	2
CSU822 (A).3	3	2	1	1	3	0	0	0	0	0	0	1	3	1	3
CSU822 (A).4	3	2	1	1	2	0	0	0	0	1	0	1	3	2	3
CSU822 (A).5	3	2	1	2	2	0	0	0	0	0	0	1	3	1	2

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CSU 822 PROGRAM ELECTIVE-VI
B) FAULT TOLERANTCOMPUTING

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objective:

I. To understand the fault tolerant design principles
II. To identify the requirement of fault tolerant systems
III. To understand fault tolerant distributed systems and its requirement
IV. To design algorithms for fault tolerant systems

Introduction to Fault-Tolerance: Error, Faults and Failures; Reliability and Availability; Dependability Measures.

Hardware Fault-Tolerance: Canonical and Resilient Structures; Reliability Evaluation Techniques and Models; Processor-level Fault Tolerance; Byzantine Failures and Agreements.

Information Redundancy: Error Detection/Correction Codes (Hamming, Parity, Checksum, Berger, Cyclic, Arithmetic); Encoding/Decoding circuits; Resilient Disk Systems (RAID).

Fault-Tolerant Networks: Network Topologies and their Resilience; Fault-tolerant Routing.
Software Fault-Tolerance: Single-Version Fault Tolerance; N-Version Programming; Recovery Approach; Exception and Conditional (Assert) Handling; Reliability Models.
Checkpointing: Optimal Checkpointing; Checkpointing in Distributed and Shared-memory Systems.

Text Book:

1. Fault Tolerant Systems, I. Koren, Morgan Kauffman , 2007
2. Fault Tolerant Computer System Design,D. K. Pradhan, Prentice Hall, 1996.

Reference Book:

1. Probability and Statistics with Reliability, Queuing and Computer Science Applications, Kishor S. Trivedi, John Wiley & Sons Inc., 2016.

Course Outcomes:

CSU 822(B).1 Understand the risk of computer failures and their comparison with other equipment failures.
CSU 822(B).2 Know the different advantages and limits of fault avoidance and fault tolerance techniques.
CSU 822(B).3 Gain knowledge in sources of faults and their prevention and forecasting
CSU822 (B).4 Analyse fault-tolerant or non-fault-tolerant on the basis of dependability requirements.

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CO/PO Mappings:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU822 (B).1	3	3	1	0	1	0	0	0	0	0	0	0	3	1	0
CSU822 (B).2	3	3	1	2	1	0	0	0	0	0	0	0	3	2	1
CSU822 (B).3	3	3	1	0	1	0	0	0	0	0	0	0	3	1	0
CSU822 (B).4	3	3	2	2	3	0	0	0	0	0	0	1	3	2	0

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CSU 822 PROGRAM ELECTIVE-VI
C) DATA ANALYTICS

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. Explore the fundamental concepts of data analytics.
II. Understand descriptive, inferential and predictive data analytic techniques.
III. Find meaningful patterns in data.
IV. Understand prescriptive data analytic techniques.
V. Implement analytical algorithms.

Descriptive Statistics: Introduction to data analytics, Descriptive Statistics, Probability Distributions, and Inferential Statistics through hypothesis tests Permutation & Randomization Test.

Regression and ANOVA: Regression, ANOVA (Analysis of Variance).

Classification: An Overview of Classification, Logistic Regression, Generative Models for Classification, A Comparison of Classification Methods, Classification Methods.

Machine Learning: Introduction and Concepts, Differentiating algorithmic and model based frameworks, Regression, Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours.

Unsupervised Learning and Challenges for Big Data Analytics: Clustering, Associative Rule Mining Challenges for big data analytics.

Prescriptive analytics: Creating data for analytics through designed experiments**,** creating data for analytics through Active learning, creating data for analytics through Reinforcement learning.

Text Books:

1. The elements of statistical learning, Hastie, Trevor, et al, Vol. 2. No. 1. New York: Springer, 2009.
2. Applied statistics and probability for engineers, Montgomery, Douglas C., and George C. Runger, John Wiley & Sons, 2010

Reference Books:

1. Introduction to Statistical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, 2nd edition, 2021.
2. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series), Bart Baesens, John Wiley & Sons, 2014

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Course Outcomes:

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

CSU822 (C).1 Understand the essentials of data analytics and the corresponding terminologies.
CSU822 (C).2 Analyse the steps involved in the Analytics process.
CSU822 (C).3 Identify meaningful patters in data.
CSU822 (C).4 Understand use of descriptive, predictive and prescriptive analytics.
CSU822 (C).5 Design efficient algorithms for data analytics.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU822(C).1	3	3	2	2	0	3	1	2	3	2	2	2	0	3	3
CSU822(C).2	3	0	3	2	3	3	2	1	2	3	2	3	3	3	0
CSU822(C).3	0	3	3	2	2	2	1	3	2	3	3	0	0	0	3
CSU822(C).4	2	3	3	3	2	2	2	1	3	3	3	2	3	3	0
CSU822(C).5	3	3	3	3	3	3	3	2	3	3	2	2	3	3	3

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CSU 822 PROGRAM ELECTIVE-VI
D) IMAGE PROCESSING

Teaching Scheme: 03T **Total – 03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objective

I. To introduce the concepts of image processing and basic analytical methods to be used in image processing.
II. To familiarize students with image enhancement and restoration techniques, To explain different image compression techniques
III. To introduce segmentation and morphological processing techniques.

Introduction: Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Spatial Domain Filtering, sampling and quantization.

Spatial Domain Filtering: Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.

Image Restoration: Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Restoration from projections.

Image Compression: Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, LZW coding, Sub-image size selection, Run length coding, Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding

Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, basic morphologic algorithm

Image Segmentation: Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Iterative thresholding, Moving averages, Multivariable thresholding, Region based segmentation, Use of motion in segmentation

Text Book

1. Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education.

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References:

1. Digital Image Processing, R C Gonzalez & R E Woods, 3 rd /4 th Ed, PHI
2. Fundamentals of DIP, A. K. Jain, PHI
3. Digital Image Processing, Wiliam K Pratt, Wiley Student Publishers, 3ed.
4. Digital Image Processing using MATLAB, R C Ganzalez, R E Woods & S L Eddins, 2 nd Edition
5. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Prentice Hall. 2011
6. Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning
7. https://nptel.ac.in/courses/117/105/117105135/

Course Outcomes:

After the successful completion of the course the students will be able to:

CSU822 (D).1 Analyse the different types of digital images.

CSU822 (D).2 Perform image enhancement techniques in spatial and frequency domain.

CSU822 (D).3 Elucidate the mathematical modelling of image restoration and compression

CSU822 (D).4 Apply the concept of image segmentation.

CSU822 (D).5 Analyse object detection and recognition techniques

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU822(D).1	3	3	2	1	0	0	0	0	0	0	0	1	3	1	0
CSU822(D).2	3	3	3	1	3	0	0	0	0	0	0	1	3	2	1
CSU822(D).3	3	1	2	1	3	0	0	0	0	0	0	1	2	1	1
CSU822(D).4	3	2	1	1	3	0	0	0	0	0	0	1	3	1	0
CSU822(D).5	2	3	3	1	2	0	0	0	0	0	0	1	3	1	0

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CSU 823 PROJECT / INDUSTRY INTERSHIP PROJECT

Teaching Scheme: 24 P + 00 T Total: 024 Credits: 12
Evaluation Scheme: 200 ICA + 200 ESE Total Marks: 400
Duration of ESE: 02.30 Hrs.

Course Objectives:

I. To collect information on novel and latest development in core and allied area ofthe subject.
II. To encourage the process of independent thinking and working together in a group.
III. To implement innovative ideas for social benefit.
IV. To develop the ability to describe, interpret and analyse technical issues.
V. To help the students to critically evaluate their own work.

A) PROJECT

Student shall select a topic for Project as per guidelines of the institute in the fieldof Computer Science and Engineering.

1. Topics shall be registered within a 15 days after beginning of VIII Semester and shall be approved by the concerned guide and Program Head.
2. Students should know the functional and technical details of selected topic after carrying out the conceptual study.
3. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
4. Students shall submit the final project report in proper format as per guidelines given on the college website
5. For uniform and continuous evaluation, evaluation committee for each group shallbe formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.
6. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

B) INDUSTRY INTERSHIP PROJECT

I. The aim of Industry Internship Project is to closely work with industry to apply theoretical knowledge in a real-world context providing real industrial project enabling learning focused on the application knowledge. This gives a student an opportunity to make their first traces in the industrial reality and start building a personal network, an important prerequisite for a successful industry career.

II. The purpose of the INDUSTRY INTERSHIP PROJECT to solve real industrial problemsby following established engineering methods, working in teams, and effectively communicating with various stakeholders.

III. The students can work in group decided by the department as per availability of Faculty. The individual students can also undertake the Industry Institute Project subject to availability of Industry Mentor/Guide. Students/Group select the industry which is ready to provide INDUSTRY INTERSHIP PROJECT through oral/written communication. Once selected the student group has to visit the industry/stay as per need. The institute willnot provide any assistance in Travel and Stay. The

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student/ Group need to submit acceptance letter from Industry regarding allowing the student/groups for INDUSTRY INTERSHIP PROJECT stating the Project name or research area.

IV. Each group has an Industry Project Guide and Institute Project Guide. The meeting with Project guide is once within week/two week at Institute. These meetings typically includeassistance in finding solutions recent problems in the projects, technical support on appliedsoftware packages, and support with writing the final report. The project groups do multiple company visits where they meet the industrial contacts to formulate the problem,collect data and information, and gain necessary experiences from the industry.

V. Furthermore, INDUSTRY INTERSHIP PROJECT includes seminars aiming to give the students experience of communicating to a larger audience, working in teams, etc. The Project monitoring will be done by Institute Guide to know whether learning objective is achieved or not.

VI. The INDUSTRY INTERSHIP PROJECT undergone individual student/ Group will haveto submit following documents on the successful completion of Industry Institute Project

1. Authenticated attendance record from Industry internship project mentor/supervisor/Guide
2. Industry internship project signed by Industry Mentor/Guide
3. Industry internship project Completion Letter by Industry Mentor/ Guide
4. Project evaluation report signed by Industry Mentor/ Guide

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall beconducted on the Project report, by the panel of examiners consisting of Project Guide,Course Coordinator and Expert appointed by Program Head.

ESE: The End Semester Examination for Project shall consist of Demonstration if any, presentation and oral examinations based on the project report.

Course Outcomes:

On successful completion of the course students will be able to:

CSU823.1 Demonstrate a sound technical knowledge of their selected project topic.
CSU823.2 Undertake problem identification, formulation and solution.
CSU823.3 Design engineering solutions to complex problems utilising a systems approach.
CSU823.4 Conduct an engineering project.
CSU823.5 Demonstrate the knowledge, skills and attitudes of a professional engineer.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSU823.1	3	1	3	0	0	0	0	0	3	0	2	0	3	2	1
CSU823.2	2	3	2	3	0	0	0	0	2	0	3	0	1	3	0
CSU823.3	2	2	3	2	0	0	0	0	2	0	2	0	2	2	2
CSU823.4	2	2	3	2	0	0	0	0	2	0	2	0	2	3	3
CSU823.5	2	2	3	0	0	0	0	0	2	0	3	0	1	2	3

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