Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

Revision: SPIT-2-18

Bachelor of Technology (B.Tech)
in
Computer Engineering
(Program Code: UCE)

Second Year Engineering
(Sem. III and Sem. IV)
Effective from Academic Year 2018 -19

Board of Studies Approval: 14/12/2017

Academic Council Approval: 20/01/2018

Dr. D. R. Kalbande	*Dr. Surendra Rathod*	*Dr. Prachi Gharpure*
Head of Department	*Dr. Surendra Rathod*	*Principal*
	Dean Academics	

Principal
Sardar Patel Institute of Technology
Bhavans Andheri Campus
Munshi Nagar, Andheri (West),
Mumbai - 400 058.

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SEM III						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
BS31	Applied Mathematics I*	BS	3	1	-	4
CE31	Advanced Data Structures*	PC	3	-	-	3
CE32	Digital Logic Design and Analysis*	PC	3	-	-	3
CE33	Discrete Structures and Graph Theory	PC	3	2	-	4
CE34	Object Oriented Programming*	PC	3	-	--	3
CEL35	Linux Lab	PC	-	-	2	1
CEL31	Advanced Data Structures Lab	PC	-	-	2	1
CEL32	Digital Logic Design and Analysis Lab	PC	-	-	2	1
CEL34	Object Oriented Programming Lab	PC	-	-	2	1
BS32	Human Health Systems Approach	BS	2	-	-	2
SDX	SCOPE courses(Optional)	SD	--	--	--	--
ABL1	Building Automation, Fire Safety and Electronic Security (Noncredit)	ABL	--	--	--	--
CEP1	Introduction to CEP (Optional)	CEP	--	--	--	--
BC	Fundamentals of Mathematics (Noncredit) (only for direct second year students)	BC	2$	--	--	--
	Total		**17**	**3**	**08**	**23**

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$: Lateral entry students only/ **only for direct second year students** (Since it is non-credit course it will not be counted in total marks)

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SEM IV						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
BS41	Applied Mathematics II *	BS	3	1	-	4
CE41	Design and Analysis of Algorithms*	PC	3	-	-	3
CE42	Database Management Systems*	PC	3	-	-	3
CE43	Operating Systems*	PC	3	-	-	3
CE44	Computer Organization and Architecture*	PC	3	-	-	3
CEL41	Design and Analysis of Algorithms Lab	PC	-	-	2	1
CEL42	Database Management Systems Lab	PC	-	-	2	1
CEL43	Operating Systems Lab	PC	-	-	2	1
CEL44	Computer Organization and Architecture Lab	PC	-	-	2	1
CEL45	Web Technology Lab	PC	-	-	2	1
LA^	Liberal Arts (Non credit) LA1: Yoga Vidya LA2: Music Appreciation LA3: Dramatics	LA	1	--	--	--
SDX	SCOPE courses (Optional)	SD	--	--	--	--
ABL2	Occupational Safety and Legal Studies for Engineers (Noncredit)	ABL	--	--	--	--
CEP2	Problem solving module-I (Optional)	CEP	--	--	--	--
	Total		**16**	**1**	**10**	**21**

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Evaluation Scheme

B.Tech Computer Engineering (SEM III)					
Course Code	**Course Name**	**Marks**			
		ISE	**MSE**	**ESE**	**Total**
BS31	Applied Mathematics I*	20	20	60	100
CE31	Advanced Data Structures*	20	20	60	100
CE32	Digital Logic Design and Analysis*	20	20	60	100
CE33	Discrete Structures and Graph Theory	20	20	60	100
CE34	Object Oriented Programming*	20	20	60	100
CEL35	Linux Lab	40	--	--	40
CEL31	Advanced Data Structures Lab	40	--	20	60
CEL32	Digital Logic Design and Analysis Lab	40	--	--	40
CEL34	Object Oriented Programming Lab	40	--	20	60
BS32	Human Health Systems Approach	ISE1= 20	ISE2= 20	Attendance= 10	50
ABL1	Building Automation, Fire Safety and Electronic Security **(Noncredit)**	--	--	--	--
BC	Fundamentals of Mathematics**(Noncredit)** (only for direct second year students)	ISE1= 20	ISE2= 20	Attendance= 10	50&
	Total				**750**
B.Tech Computer Engineering (SEM IV)					
Course Code	**Course Name**	**Marks**			
		ISE	**MSE**	**ESE**	**Total**
BS41	Applied Mathematics II *	20	20	60	100
CE41	Design and Analysis of Algorithms*	20	20	60	100
CE42	Database Management Systems*	20	20	60	100
CE43	Operating Systems*	20	20	60	100
CE44	Computer Organization and Architecture*	20	20	60	100
CEL41	Design and Analysis of Algorithms Lab	40	--	20	60
CEL42	Database Management Systems Lab	40	--	--	40
CEL43	Operating Systems Lab	40	--	--	40
CEL44	Computer Organization and Architecture Lab	40	--	--	40
CEL45	Web Technology Lab	40	--	--	40
LA^	Liberal Arts**(Noncredit)** LA1: Yoga Vidya LA2: Music Appreciation LA3: Dramatics	ISE1= 20	ISE2= 20	Attendance= 10	50
ABL2	Occupational Safety & Legal Studies for Engineers**(Noncredit)**	--	--	--	--
	Total				**720**

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Semester III

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
BS31	Applied Mathematics-I	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Course Objectives:

- To familiarize learners with mathematical tools and methods to solve engineering problems.

Course Outcomes:

Pre-requisite course codes		BS11 (Engineering Mathematics I) BS21 (Engineering Mathematics II)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Check analyticity of function of complex variables
	CO2	Find Laplace and Inverse Laplace Transforms
	CO3	Apply Laplace and Laplace Inverse methods to solve differential equations with initial conditions
	CO4	Expand functions in terms of sine and cosine series on the given interval
	CO5	Evaluate Z-transform and Inverse Z-transform
	CO6	Formulate and solve Linear Programming Problem arising in engineering

Module No.	Module name	Unit No.	Topics	Ref	Hrs.
1	Complex Variables	1.1	Analytic functions, Cauchy Riemann equations in Cartesian coordinates and Polar coordinates.	1,2	03
		1.2	Harmonic functions, Analytic method and Milne Thomson methods to find f(z), Orthogonal trajectories.		04
2	Laplace & Inverse Laplace Transform	2.1	Definition of Laplace transform, Laplace transform of constant, trigonometric, exponential functions.		02
		2.2	Properties of Laplace transform: First shifting theorem, Laplace transform of $L\{t^n f(t)\}, L\{f(t)/t\}, L\{\frac{d^n}{dt^n} f(t)\}, L\{\int_0^t f(u)\,du\}, L\{f(at)\}$ without proof.	2,4	04
		2.3	Inverse Laplace transform with Partial fraction and Convolution theorem (without proof).		04
		2.4	Application to solving Differential Equations with		02

			given initial conditions.		
3	**Fourier series**	3.1	Introduction to Fourier Series, Dirichlet's conditions of convergences, Fourier series of periodic functions with period 2π and 2L.	1,2, 3	04
		3.2	Fourier series for even and odd functions		02
		3.3	Half range sine and cosine Fourier series, Parsevel's identities (without proof).		02
		3.4	Orthogonal and Orthonormal functions, Complex form of Fourier series.		02
4	**Z transform**	4.1	Z-transform of standard functions such as $Z(a^n)$, Z(cosak), Z(sin ak), etc.	1,2	01
		4.2	Properties of Z-transform :Linearity, Change of scale, Shifting property, Multiplication of K, Initial and final value, Convolution theorem (all without proof).		02
		4.3	Inverse Z transform: Method of Partial fraction.		02
5	**Mathematical Programming**	5.1	Introduction to Linear Programming problems and its formulation. Graphical method to solve LPP in two variables, Simplex method to solve LPP	2,3, 5	03
		5.2	Artificial variables, Big –M method (method of penalty). Revised and two phase simplex methods.		03
		5.3	Duality, Dual simplex method.		02
				Total	**42 hrs**

NOTE: ISE component will be evaluated through assignments conducted in the tutorial sessions (tutorials will be conducted class –wise)

References:

[1] Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley

[2] C. Ray Wylie & Louis Barrett, "Advanced Engg. Mathematics", 6thEdition, New York : McGraw-Hill, c1995.

[3] K. B. Datta, "Mathematical Methods of Science and Engineering", First edition, Cengage Learning India, 2011

[4] M. R. Spiegel, "Laplace Transforms", McGraw-Hill Education (1 January 1965)

[5] David G. Luenberger," Introduction to Linear and Nonlinear Programming", Addison-Wesley Publishing Company

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE31	Advanced Data Structures	3	--	--	3	--	--	3
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes	ES4- Programming Methodology and Data Structures	
After successful completion of the course student will be able to		
Course Outcomes	CO1	Implement various operations of non-linear data structures.
	CO2	Apply the concepts of Trees and Graphs to a given problem.
	CO3	Build various Heap Structures
	CO4	Illustrate the hashing and collision resolution techniques

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Linear and Non-linear Data Structures** Introduction to Data Structures, Review of Stack, Queue and Singly Linked List. Types of Linked Lists and it's applications: Circular Linked List, Doubly Linked List, Application of Linked List.	1,2	05
2		**Trees**		
	2.1	Binary Tree Terminology, Binary Search Tree and its operations, Binary Tree Traversal, Expression Tree	1,2	04
	2.2	AVL Trees- Properties of AVL trees, Rotations, Insertion, and Deletion	1,2	03
	2.3	B-Trees- Definition of B-trees, Basic operation of B-Trees, Deleting a key from B-Trees	1,2	04
	2.4	Introduction to B+ Trees	1,2	03
	2.5	Introduction to Multidimensional Trees, Segment trees, k-d trees, Point Quad trees	3	05
3		**Graph** Introduction To Graph, Representation of Graph- Adjacency Matrix, Adjacency List, Graph Traversal Technique	1,2	04

4	**4.1**	**Heap Structure** Introduction to Heap Structures, Min Heap, Max Heap, Construction of Heap	2	04
	4.2	Fibonacci heaps- Structure of Fibonacci heaps, Mergeable-heap, operations, Decreasing a key and deleting a node	2	06
5		**Hashing** Introduction to Hash Table, Hash functions, Collision Resolution Technique	1,2	04
			Total	**42**

References:

(1) Thomas H.Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, Massachusetts, 2009.

(2) Horowitz E, Sahni S andS.Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Galgotia Publications, New Delhi, 2010

(3) V. S. Subrahmanian , "Principles of Multimedia Database Systems", Morgan Kaufman Series in data Management Systems, Second Edition, USA, 2013.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE32	Digital Logic Design and Analysis	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes		ES11 (Basic Electrical and Electronics Engineering)
After successful completion of the course, student will be able to:		
Course Outcomes	CO1	Design of digital circuits using SOP &POS forms.
	CO2	Construct combinational circuits using given MSI devices.
	CO3	Apply the knowledge of flip-flops and MSI to design counters and Shift registers.
	CO4	Design state machines for given state diagrams after state reduction.
	CO5	Describe different types of programmable logic devices like PAL, PLA, CPLD and FPGA.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to Number System & Digital Logic:** Introduction to Number System,Basic gates, Universal gates, Sum of products and products of sum, minimization with Karnaugh Map (up to four variables) and realization. QuineMccluskey method.	1,2,3	16
	1.2	**Logic Families:** Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND, Interfacing CMOS to TTL and TTL to CMOS.	1,2,3	
	1.3	**Combinational Circuits using basic gates as well as MSI devices:** Half adder, Full adder, Half Subtractor, Full Subtractor, Multiplexer, De-multiplexer, Decoder, Comparator (Multiplexer and De-multiplexer gate level up to 4:1).	1,2,3	
2	2.1	**Sequential Logic:** Latches and Flip-Flops. Conversions of Flip-Flops, Timing Considerations and Metastability	1,2,3,4	05
3	3.1	**Counters:** Asynchronous, Synchronous Counters, Up Down Counters, Mod Counters.	1,2,4,5	11
	3.2	Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques and state assignment, Clocked synchronous state machine design.	1,24,5	
	3.3	MSI counters and applications.	1,2,4,5	
4	4.1	**Shift Registers:** Shift Registers, Ring Counters, Universal Shift Register, MSI Shift registers and their applications.	1,2,4,5	05
5	5.1	**Programming Logic Devices:** Concepts of Programmable Array Logic (PAL) and Programming Logic Array (PLA).	1,2,4,5	05

	5.2	Introduction to Complex Programmable Logic Device (CPLD) and Field Programmable Gate Array (FPGA) architectures.	1,2,4,5	
			Total	**42**

References:

[1] R. P. Jain, "*Modern Digital Electronics*", 4th Edition, Tata McGraw Hill, 2009.

[2] Morris Mano, "*Digital Design",* 5th edition, Pearson Education, 2013.

[3] William I. Fletcher, "*An Engineering Approach to Digital Design*", 1st Edition, PHI, 2009.

[4] John F. Wakerley, "*Digital Design Principles And Practices*", 3rd Edition Updated, Pearson Education, Singapore, 2002

[5] B. Holdsworth and R. C. Woods, "*Digital Logic Design*", 4thEdition, Newnes, 2002.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE33	Discrete Structure and Graph Theory	3	2	--	3	1	--	4
		Examination Scheme						
		Theory Marks						
		ISE			MSE	ESE	Total	
		20			20	60	100	

Pre-requisite Course Codes		(Basic Mathematics)
At the end of successful completion the course, students will be able to		
Course Outcomes	CO1	Cultivate clear thinking and problem solving ability
	CO2	Use various mathematical notations, apply various proof techniques to solve real world problems
	CO3	Learn and apply core ideas of Set Theory, Logic, Relations Functions, Recurrence Relations
	CO4	Use Graphs, Trees and their various types with their traversing techniques to solve practical examples.
	CO5	Understand the applications and make use of Algebraic Structures and Lattice to solve the problems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Set Theory – Finite and infinite set, Union, Intersection, Disjoint, and Difference of two sets. Power Set, Partition of Sets, Ordered Sets, De Morgan's Laws, Principle of Inclusion Exclusion	1,2, 3	2
	1.2	Logic – Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof, Mathematical Induction	1,2, 3	3
	1.3	Relations and Diagraphs – Product Sets and Partitions, Paths in relations and Diagraphs, Properties of Relations, Closure of Relation, Equivalence Relations, Operations on Relations, Warshall's Algorithm	1,2, 3	4
	1.4	Partially Ordered Sets, Extremal Elements of Partially Ordered Sets, Hasse Diagram	1,2, 3	2
2	2.1	Functions- Composition of Functions, Invertible Functions, Recursive Functions,	3	2
	2.2	Hashing, Pigeon hole Principle, Extended PHP	2,3	2
	2.3	Recurrence Relations – Introduction, Linear Recurrence Relations with constant coefficients, Homogeneous solutions, Particular Solutions, Total Solutions, Solution by the method of Generating functions, solving Recurrence Relations	3	4
3	3.1	Graph Theory Concepts and terminologies- Graphs as Model	2,4, 5	2
	3.2	Matrices, Isomorphism, Bipartite Graphs, Directed Graphs	2,4, 5	2

	3.3	Properties of trees, Minimal Spanning trees, Shortest Paths	2, 4	3
4	4.1	Graph: Connectivity, Coloring, Cycles – Transport Networks, Max Flows, Matching Problems, Maximum Bipartite Matching	2,4, 5	3
	4.2	Euler Paths- Circuits, Hamiltonian Paths- Circuits	2,4, 5	2
	4.3	Coloring Graphs, Chromatic Polynomial, Planer Graphs	2,4, 5	3
5	**5.1**	Algebraic Structures - Semigroup, Monoids, Groups, Rings, Integral Domain Rings	1,2, 3	3
	5.2	Isomorphism, Homomorphism, Auto morphism, Coding Theory	1,2, 3	3
	5.3	Lattice, Sub lattice, Isomorphic Lattices, Properties of Lattice, Special Types of Lattices	1,2, 3	2
			Total	42

References:

[1] Kenneth H. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill, 7th Edition / latest edition, ISBN 0-07-293033-0 HB.

[2] Bernard Kolman, Robert C. Busby, "Discrete Mathematical Structures", Pearson, Latest Edition

[3] C. L. Liu, D. P. Mohapatra, "Elements of Discrete Mathematics", Tata McGrawHill.

[4] Douglas West, "Graph Theory", Pearson, 2nd Edition

[5] NarsinghDeo, "Graph Theory with applications to Engineering and Computer Science ", Prentice Hall India

[6] ReinhardDiestel, "Graph Theory", Springer-Verlag-New York, 5 th Edition, ISBN 978-3-662-53621-6 eISBN 978-3-96134-005-7

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE34	Object Oriented Programming	3	-	--	3	-	--	3
		Examination Scheme						
		Theory Marks						
		ISE			MSE	ESE	Total	
		20			20	60	100	

Pre-requisite Course Codes		ES4: Programming Methodology and Data Structures
After successful completion of the course, student will be able to:		
Course Outcomes	CO1	Demonstrate object oriented programming paradigm.
	CO2	Solve problems using inheritance & package.
	CO3	Use file handling concepts in Java for data input and output.
	CO4	Apply concepts of multithreading and exception handling to create efficient program.
	CO5	Make use of string and collection classes.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**BASIC OF JAVA**	2	
	1.1	History & features, Difference between JDK,JRE,JVM, Unicode system, Advantages of OOP		4
	1.2	Object & Class, Constructor , Command line argument, Static Variable, Method & block		
	1.3	Branching & looping		
2		**OOP CONCEPTS**	1,2,4	
	2.1	Inheritance (IS – A), Aggregation & Composition (Has – A)		8
	2.2	Method overloading & overriding, Constructor overloading & overriding, this, super, final keyword		
	2.3	Runtime polymorphism, Static and Dynamic Binding		
3		**ABSTRACT CLASS, INTERFACE, PACKAGE**	1,2	
	3.1	Abstract class & interface, instanceof operator		5
	3.2	Package and access modifier		
	3.3	Object class, Nested class		
4		**STRING HANDLING**	1,2	
	4.1	Immutable string ,Methods of String class,		4
	4.2	String comparison, concatenation, substring, toString method		
	4.3	StringBuffer class, StringBuilder class, StringTokenizer class		
5		**EXCEPTION HANDLING**	1,2	
	5.1	What & why? Try & catch block, Multiple catch block, Nested try, Finally block		5
	5.2	Throw, Throws keywords, Exception propagation		
	5.3	Custom exception		
6		**MULTITHREADING**	1,2	

	6.1	Life cycle of a – thread, Create thread using, Thread & Runnable class		5
	6.2	Thread methods, schedule, sleep, join, Thread priority, Thread group, Perform multiple task using multiple thread		
	6.3	Thread synchronization		
7		**COLLECTION**	1,2	
	7.1	Collection framework, ArrayList, LinkedList		5
	7.2	HashMap, HashTable		
	7.3	Comparable & Comparator		
8		**INPUT & OUTPUT**	2	
	8.1	FileOutputStream&FileInputStream, BufferedOutputStream&BufferedIinputStream, FileWriter&FileReader		6
	8.2	Scanner, PrintStream, PrintWriter, CharArrayWriter		
	8.3	StreamTokenizer class		
			Total	**42**

References:

[1] Ralph Bravaco ,ShaiSimoson , "Java Programing From the Group Up" ,Tata McGraw-Hill.

[2] Herbert Schildt, "Java The Complete Reference", Tata McGraw-Hill.

[3] Jaime Nino, Frederick A. Hosch, "An introduction to Programming and Object Oriented Design using Java", Wiley Student Edition.

[4] C Xavier, "Java Programming A Practical Approach", Tata McGraw-Hill.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL31	Advanced Data Structures Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		20	60

Pre-requisite Course Codes	ES4- Programming Methodology and Data Structures CE31- Advanced Data Structures	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Implement various Linked List Operations.
	CO2	Implement various Operations of Trees and Graphs.
	CO3	Construct different Heap structures.
	CO4	Analyze different hashing and collision resolution techniques.
	CO5	Choose an appropriate data structure to solve a given problem.

Exp. No.	Experiment Details	Ref.	Marks
1	Implement a given scenario using Linked List.	1,2	5
2	Construct an expression tree using Binary Trees Concept	1,2	5
3	Develop an application to explore the uses of an AVL tree	1,2	5
4	Develop Search application using B-Tree.	1,2	5
5	Demonstrate an application using B+ Tree	1,2	5
6	Implement Operations of Heap Structures	2	5
7	Implement hash functions with different collision resolution techniques	1,2	5
8	Traverse a Graph using Graph Traversal Technique	1,2	5
		Total Marks	40

ESE Evaluation:
The ESE evaluation will take place through Practical Examination based on the Lab course at the end of semester. The distribution of marks is as follows.
Practical: (Any experiments based on the Lab course): 10 Marks
Oral: (Oral based on any experiments in the Lab course): 10 Marks

References:

(1) Thomas H.Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, Massachusetts, 2009.
(2) Horowitz E, Sahni S and S.Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Galgotia Publications, New Delhi, 2010

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL32	Digital Logic Design & Analysis Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes		**ES11** (Basic Electrical and Electronics Engineering) **CE32** (Digital Logic Design and Analysis)/**IT32** (Digital Logic Design and Analysis)
At the End of the course students will be able to		
Course Outcomes	CEL32.1	Construct and test logic circuits using logic gates to realize given function.
	CEL32.2	Construct and Test logic circuits using MSI ICs to realize given function.
	CEL32.3	Construct and test the design of combinational and sequential logic circuits by hardware implementation.
	CEL32.4	Construct and test design of counters/shift registers.

Exp. No.	Experiment Details	Ref.	Marks
1	To implement the combinational logic for given function using basic gates/MSI ICs and study NAND, NOR as universal gate.	1,2	**5**
2	To implement Binary to Grey, Grey to Binary Code conversion, BCD adder and BCD to Seven segment decoder using MSI ICs.	1,2	**5**
3	To implement 4-bit, 5-bit and 8 bit comparator using MSI ICs	1,2	**5**
4	To implement functions using multiplexer MSI ICs	1,2	**5**
5	To implement functions using demultiplexers/Decoder using MSI ICs.	1,2	**5**
6	To design and implement MSI circuits of flip-flops and conversion of one Flip flops to another one.	1,2	**5**
7	To configure MSI devices as asynchronous counter, synchronous counter	1,2	**5**
8	To configure universal shift register in various mode.	1,2	**5**
		Total Marks	**40**

References:

(1) For datasheet refer: http://www.datasheetcatalog.com.

(2) R. P. Jain and M. M. S. Anand ,"*Digital Electronics Practice Using Integrated Circuits,"* Tata McGraw Hill Education, 1983.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL34	Object Oriented Programming Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		20	60

Pre-requisite Course Codes		ES4: Programming Methodology and Data Structure CE34: Object Oriented Programming
After successful completion of the course, student will be able to:		
Course outcomes	CO1	Demonstrate object oriented programming concepts for a scenario.
	CO2	Apply static and dynamic binding.
	CO3	Apply concept of input, output and JDBC.
	CO4	Apply multi-threading and exception handling for a scenario.
	CO5	Design a java application using J2EE, Swing etc

Exp. No.	Experiment Details	Ref.	Marks
1	Program using conditional and control statements.	1,2,3,4	5
2	Program on Polymorphism.	1,2,3,4	5
3	Program on Inheritance, Aggregation, Composition	1,2,3,4	5
4	Program on Package, Nested Class, String, Collection	1,2,3,4	5
5	Program on Exception Handling	1,2,3,4	5
6	Program on Multithreading, I/O, JDBC	1,2,3,4	5
7	Mini project using Struts, J2EE, Swing etc	2,5,6	10
		Total Marks	40

ESE Evaluation:
The ESE evaluation will take place through Practical Examination based on the Lab course at the end of semester. The distribution of marks is as follows.
Practical: (Any experiments based on the Lab course): 10 Marks
Oral: (Oral based on any experiments in the Lab course): 10 Marks

References:

[1] Ralph Bravaco ,ShaiSimoson ,"Java Programing From the Group Up",Tata McGraw-Hill

[2] Herbert Schildt, "Java The Complete Reference", Tata McGraw-Hill.

[3] Jaime Nino, Frederick A. Hosch, 'An introduction to Programming and Object Oriented Design using Java', Wiley Student Edition.

[4] C Xavier, "Java Programming A Practical Approach",Tata McGraw-Hill.

[5] James Holmes "Struts: The Complete Reference" Tata McGraw-Hill.

[6] Jim Keogh, "J2EE: The Complete Reference" Tata McGraw-Hill.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL35	Linux Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes		ES24 (Programming Methodology and Data Structures)
At the End of the course students will be able to		
Course Outcomes	CO1	Demonstrate the knowledge of Linux File structure and installation process.
	CO2	Select and apply appropriate Linux command and utility to get desired output/results.
	CO3	Apply administrative skill for system and user management.
	CO4	Manipulate and manage file system, disk and software.
	CO5	Use Text processing Utility.
	CO6	Write Shell script and Shell Function.

Exp. No.	Experiment Details	Ref.	Marks
(3)	**Linux Installation and File System** **content:** - Introduction to OS (Unix, Linux, rpm, debian) - Installation of Linux(Ubuntu installation) - Linux File Structure	1, 5, 6	5
2.	**Managing Software (Binaries and Source)** **content:** - User root user account - Using Administrative Commands and Files - Using Different run-level - Managing software using apt-get - Getting a package using wget - Zip, Tar, Gunzip, Bzip	1, 5, 6	5
3.	**Linux Commands** **content:** - File Management Commands (ls, metacharacter, cat, wc, cp, mv, rm,) - Directories Command (cd, pwd, mkdir, rmdir, rm, mv) - Pipes and filter command(grep, sort, more) - Process Management Commands(ps, top, kill) - Linux Editors(vim, nano, gedit)	1, 4, 5, 6	5
4.	**User Administration** **content:** - Add and manage User - Add and manage Group - Setting Permission with ACL - Adding Directories for user to collaborate	1, 4, 6	5

	- File Permission Managing Commands (chmod, chown, chgrp)		
5.	**Shell Scripting** **content:** - Shell scripting(Bourne and C Shell, Shebang Construct, Basic Shell and Extended Shell) - Using Variables, Special Variables, Arrays in Shell Script - Using Basic Operators in Shell Script - Using Decision making Statements, Loops and Loop Control in Shell Script	1, 3	**5**
6.	**Shell Function and Cron** **content:** - Shell Functions - Using Substitution, Quoting mechanism, IO redirection in Shell Script - Cron and Shell Script	1, 3	**5**
7.	**Text Processing and Manipulation** **content:** - SED - AWK - GAWK	2	**5**
8.	**Managing Disk and File System** **content:** - Partitioning Disk - Mounting File system - Checking, creating and managing LVM (Logical Volume Manager)	1, 5	**5**
		Total Marks	**40**

References:

[1] Christopher Negus, "*Linux Bible*", Wiley Publication, 8th Edition.

[2] Dale Dougherty and Arnold Robbins, "sed&awk", O'Reilly Media, 2nd Edition.

[3] Cameron Newham," Learning the bash Shell", O'Reilly Media, 3rd Edition.

[4] Richard Petersen, "Linux: The Complete Reference",McGrawHill , 6th Edition.

[5] Matthew Helmke, "Ubuntu Unleashed", SAMS Pearson Education, 2015 Edition.

[6] Christine Bresnahan and Richard Blum, "Linux Essentials",Wiley/Sybex , 2nd Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
BS32	Human Health Systems Approach	2	--	--	2	--	--	2
		Examination Scheme						
		ISE1		ISE2	Attendance			Total
		20		20	10			50
Methodology for evaluating students for ISE1 and ISE2 shall be pre-declared by the course teacher.								

Pre-requisite Course Codes	--
After successful completion of the course, student will be able to understand	
Course Outcomes CO1	Physiology as integrated interdisciplinary Science
CO2	Physiological significance of balanced diet and exercise in health
CO3	Significance of cleanliness and hygiene in daily routine
CO4	Dynamics and homeostasis of human health

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Levels of Organizational Systems**		1	2
	1.1	Molecular, Cellular and Organ Systems		2
	1.2	Biological Molecules		
	1.3	Biochemistry, Biophysics, Molecular Biology and Bioengineering		
2	**Energy and Molecular Supply Chain Management**		1	7
	2.1	Digestive System: Nutrient supply and Balanced Diet		2
	2.2	Respiratory System and effects of Pollution		2
	2.3	Cardiovascular System, Blood Pressure, ECG and Blood Report		2
	2.4	Musculo-skeletal System and exercise Physiology		1
3	**Body FluidDynamics**		1	4
	3.1	Body fluids		2
	3.2	Kidneys as Filtration Units and their Physiological Functions		
	3.3	Urinary System		1
	3.4	Kidney and Urinary Stones, and Dialysis		1
4	**Control, Coordination and Regulatory Systems**		1	4
	4.1	Sense Organs		1
	4.2	Nervous systems		2
	4.3	Endocrine Systems (Pancreas and Diabetes, Thyroid and its functions)		1
5	**Defense Systems**		1	3
	5.1	Integumentary System		1
	5.2	Immune System		2
6	**Molecular Biology and Genetical Information**		2	6
	6.1	Hereditary Molecules: DNA RNA		2
	6.2	Horizontal flow of Genetic Information		2
	6.3	Vertical flow of Genetic Information		2
			Total	**26**

References:

[1] Text book of Anatomy and Physiology for Nurses and allied Health Sciences by InduKhurana&Arushi

[2] Simplified Course in Molecular Biology by V. K. Agarwal - S. Chand Publication

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Course Code	Course Name	Teaching Scheme			Credits Assigned			
		L	T	P	L	T	P	Total
BC	Fundamental of Mathematics	2	-	-	Non-Credits			
		Examination Scheme						
		ISE1		ISE2		Attendance		Total
		20		20		10		50

Student will be evaluated after completion of 50% syllabus for 20 Marks (ISE1) and at the end of course for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.

After successful completion of the course, student will be able to		
Course Outcomes	CO1	To find basic derivatives, Integration and limits.
	CO2	To find rank of a matrix and solve system of linear equations using rank.
	CO3	To find partial derivative of a function and apply it to extremise functions.
	CO4	To solve differential equations of first and higher order.
	CO5	To find roots & logarithm of a complex number.

Module No	Module name	Unit No.	Topics	Ref.	Hrs.
1.	Derivatives	1.1	Derivative of functions which are expressed in one of the following form a) product of functions, b) quotient of functions, c) derivatives of trigonometric function	1,2,5,6,7	1
		1.2	Application of Derivatives: Rolls theorem and Mean value theorem	1,2,5,6,7	1
2.	Integration	2.1	Indefinite integrals-methods of integration, substitution method.	1,2,5,6,7	1
		2.2	Evaluation of definite integral 1) bysubstitution, 2) integration by parts,	1,2,5,6,7	1
3.	Basic of Matrices	3.1	Rank of Matrix, Normal form	1,2,3,4,6	1
		3.2	Consistency and solution of simultaneous linear homogeneous and Non-homogeneous equations. Linear Dependence & independence vectors	1,2,3,4,6	1
4.	Partial Differentiation	4.1	Partial derivatives of first and higher order, Chain Rule & Composite function	1,2,3,4,7	1
		4.2	Euler's theorem on homogeneous functions with two and three independent variables	1,2,3,4,7	1
		4.3	Application of partial derivatives: Maxima and Minima of functions of two variables.	1,2,3,4,7	1

5.	Differential Equations of first & higher order	5.1	Exact Differential Equation,	1,2,3,4,	3
		5.2	Linear Differential Equation with constant coefficient- complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax},sin(ax+b)		
		5.3	cos(ax+b),x^m, $e^{ax}V$, xV		
6.	Indeterminate forms	6.1	Indeterminate forms, L- Hospital Rule	7	1
7.	Basics of Complex Numbers	7.1	Roots of complex numbers by De'moivre's Theorem	1,2,3,4	1
		7.2	Relation between circular and hyperbolic function		1
		7.3	Logarithm of complex numbers.		1
				Total	**16**

References:-

[1] Dr.B.S.Grewal," Higher Engineering Mathematics" by Khanna Publication, New Delhi, 42ndEdition.

[2] H.K. Das, " Advanced Engineering Mathematics", byS.ChandPublication.NewDelhiTwelfth Revised Edition, 2004

[3] Erwin Kreyszig," Advanced Engineering Mathematics", by John Wiley Eastern Limited, UK Ninth Edition,

[4] Shanti Narayan, P. K. Mittal," A Text book of Matrices", by S. Chand publication, New Delhi, Eleventh Edition.

[5] Maharashtra state board of secondary and higher secondary education,Pune, Edition 2017.

[6] George B. Thomas, Ross L Finney," Calculus and Analytical Geometry by NarosaPublishing House, Mumbai,Ninth Edition.

[7] P.N.Wartikar and J.N.Wartikar," A text book of Applied Mathematics, Vol – I and II by

[8] VidyarthiGrihaPrakashan, Pune. Ninth Revised Edition,2004.

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Semester IV

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
BS41	**Applied Mathematics-II**	3	1	--	3	1	--	4
		Examination Scheme						
		ISE	MSE		ESE		Total	
		20	20		60		100	

Course Objectives:

- To familiarize learners with mathematical tools and methods to solve engineering problems

Course Outcomes:

Pre-requisite course codes		BS11 (Engineering Mathematics I) BS21 (Engineering Mathematics II)
After successful completion of the course, student will be able to		
Course Outcomes	**CO1**	Check if matrix is diagonalizable, derogatory & to calculate functions of a square matrix.
	CO2	Find Correlation between two variables.
	CO3	Find the measures of central tendency
	CO4	Solve a problem by identifying the appropriate distribution.
	CO5	Test the hypothesis for means and variances for single and multiple samples using't'& chi-square distribution tests.

Module No	Module name	Unit No.	Topics	Ref.	Hrs.
1	**Matrices**	1.1	Eigen values and Eigen vectors and its properties.	1,3,4	04
		1.2	Cayley-Hamilton theorem and its applications.		02
		1.3	Similar matrices, diagonalizable matrices. Singular Value Decomposition.		04
		1.4	Derogatory and non-derogatory matrices, functions of square matrix.		03
		1.5	Application to finding google page rank		01
2	**Probability**	3.1	Random Variables: - discrete & continuous random variables, expectation, Variance, Probability Density Function & Cumulative Density Function.	2,3,4, 5	04
		3.2	Moments, Moment Generating Function.		02
		3.3	Probability distribution: binomial distribution, Poisson & normal distribution.		07

3	**Sampling Theory**	4.1	Sampling, point and interval estimations, Test a hypothesis using Large sample test	2,3,4, 5	04
		4.2	Testing of hypothesis using't' and chi-square distribution tests.		04
4	**Correlation and Regression**	2.1	Karl Pearson's coefficient of correlation, covariance, Spearman's rank correlation		03
		2.2	Regression.	1,3,4	04
				Total	**42hrs**

NOTE: ISE component will be evaluated through assignments conducted in the tutorial sessions. (tutorials will be conducted class –wise)

References:

[1] Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley

[2] Kishor S. Trivedi, "Probability & Statistics with reliability", 2nd edition, Wiley India

[3] C. Ray Wylie & Louis Barrett, "Advanced Engg. Mathematics", 6th Edition, New York : McGraw-Hill, c1995.

[4] K. B. Datta, "Mathematical Methods of Science and Engineering", First edition, Cengage Learning India, 2011

[5] Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 3rd , Elsevier Academic Press,2004

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE41	Design and Analysis of Algorithms	3	--	--	3	--	--	3
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes	ES4 (Programming Methodology and Data structures) CE31 (Advanced Data Structures)

At the end of successful completion of this course, student will be able to

Course Outcomes		
	CO1	Analyze time and space complexity of an algorithm
	CO2	Apply divide and conquer strategy to solve problems
	CO3	Design an algorithm to illustrate the concept of dynamic programming
	CO4	Apply the concept of greedy approach to solve problems
	CO5	Describe the idea of backtracking, branch and bound strategy to solve problems.
	CO6	Apply the concept of linear programming to optimize the solution

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to analysis of algorithm** Performance analysis , space and time complexity Growth of function – Big –Oh ,Omega , Theta notation Mathematical background for algorithm analysis, Analysis of selection sort, insertion sort.	1,2, 3	10
	1.2	**Recurrences:** The substitution method Recursion tree method Master method	1	
	1.3	**Divide and Conquer Approach:** General method Analysis of Merge sort, Analysis of Quick sort, Analysis of Binary search, Finding minimum and maximum algorithm and analysis, Strassen's matrix multiplication.	1,5	
2	2.1	**Dynamic Programming Approach:** General Method Assembly-line scheduling 0/1 knapsack Travelling salesman problem Longest common subsequence	1,2, 3	12
	2.2	**Greedy Method Approach:** General Method Single source shortest path Knapsack problem Minimum cost spanning trees-Kruskal and prim's algorithm Hamming code Algorithm	1,2, 3	

3		**Backtracking and Branch-and-bound:** General Method 8 queen problem(N-queen problem) Sum of subsets Graph coloring 15 puzzle problem, Travelling salesman problem.	1,4	06
4		**Linear Programming** Standard and slack forms Formulating problems as linear problems The simplex algorithm Duality The initial basic feasible solution	1	08
5		**String Matching Algorithms:** The naïve string matching Algorithms The Rabin Karp algorithm String matching with finite automata The knuth-Morris-Pratt algorithm	1,5	06
			Total	**42**

References:

1. T.H .Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, "*Introduction to algorithms*", 3rd edition, PHI publication 2009.
2. Ellis Horowitz, SartajSahni, S. Rajasekaran. "*computer algorithms*" 2nd edition, Computer Science Press, 1997
3. SanjoyDasgupta, Christos H. Papadimitriou, UmeshVazirani, "*Algorithms*", 1st edition, Tata McGraw- Hill, 2006.
4. Jon Kleinberg, Eva Tardos, "*Algorithm Design*", 1st edition, Pearson, 2006.
5. Michael T. Goodrich, Roberto Tamassia, "*Algorithm Design and Application*", 1st edition ,Wiley Publication, 2015.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE42	Database management System	3	--	-	3	--	-	3
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes		-
At the end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Design effective database systems, leading to development of elegant Information System.
	CO2	Analyze the real world problem and construct a relational database.
	CO3	Construct a secure database.
	CO4	Design a relation database using concept of functional dependencies.
	CO5	Analyze the effect of concurrency control for transaction processing.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction Database Concepts and ER Modeling**		
1	1.1	**Introduction Database Concepts** **I**ntroduction, Characteristics of databases, File system V/s Database system, Users of Database system, Database Administrator, Concerns when using an enterprise database, Data Independence, codd's Rule, DBMS system architecture,	1,2,3	04
	1.2	**ER Modeling**		
		Introduction to ER model, Benefits of Data Modeling, Types of data Models, Phases of Database Modeling, The Entity-Relationship (ER) Model, Generalization, Specialization and Aggregation, Extended Entity-Relationship (EER) Model.		04
2		**Relational Algebra and SQL**	1,2,3	
	2.1	**Relational Algebra**		05
		Introduction, Mapping the ER and EER Model to the Relational Model , Data Manipulation , Data Integrity , Relational Algebra , Relational Algebra Queries, Relational Calculus.		
	2.2	**SQL**		10
		Overview of SQL, Data Definition Commands, Set operations, aggregate function, null values, , Data Manipulation commands, Data Control commands , Views in SQL, Nested and complex queries ,PL/SQL		
3		**Relational database design**	1,2,3	
	3.1	**Integrity and Security in Database**		03
		Domain Constraints, Referential integrity, Assertions, Trigger, Security, and authorization in SQL,		
		Normalization		05

	3.2	Design guidelines for relational schema, Functional dependencies, Normal Forms- 1NF, 2 NF, 3NF, BCNF and 4NF		
4		**Transaction Processing**	1,2,3	
	4.1	**Transactions Management**		
		Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability, Concurrent Executions, Serializability , Recoverability, Implementation of isolation, Concurrency Control: Lock-based ,Timestamp-based , Validation-based protocols, Deadlock handling,		05
	4.2	**Recovery System**		
		Failure Classification, Storage structure, Recovery and atomicity, Log based recovery, Shadow paging.		03
			Total	**39**

References:

[1] Korth, Slberchatz, Sudarshan, :"Database System Concepts", 6th Edition, McGraw – Hill

[2] Elmasri and Navathe, "Fundamentals of Database Systems", 5th Edition, PEARSON Education.

[3] G. K. Gupta :"Database Management Systems", McGraw – Hill.

[4]Peter Rob and Carlos Coronel, "Database systems Design, Implementation and Management", Thomson Learning, 5th Edition.

[5] Raghu Ramkrishnan and Johannes Gehrke , "Database Management Systems", TMH

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE43	Operating Systems	3	--	-	3	--	-	3
		Examination Scheme						
		Theory Marks						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes		CEL35 (Linux Lab)
At the end of successful completion of the course, student will be able to		
Course Outcomes	CO1	Explain the basic functions of operating systems- Understanding
	CO2	Make use of various process scheduling and disk scheduling algorithm - Applying
	CO3	Experiment inter process communication solution - Applying
	CO4	Categorize various memory management techniques - Analyzing
	CO5	Explain various file systems - Understanding
	CO6	Discover functions of operating systems in different environment-Analyze

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Operating Systems**		06
	1.1	Operating systems objectives and functions, Evolution of OS, Booting.	1,2, 3	2
	1.2	Process, system calls.	1	2
	1.3	Operating system structure.	3	2
2		**Process Management**		07
	2.1	Process description: Process , Process states, Process Control Block (PCB).	1	2
	2.2	Process Scheduling: FCFS, RR, SJF , Priority , Comparison of different scheduling policies.	1	3
	2.3	Threads and Thread management.	2	2
3		**Process Synchronization**		10
	3.1	Principle of concurrency, race condition, critical section.	1,2, 3	1
	3.2	Mutual Exclusion – Hardware and Software approaches, semaphores, monitors, message passing	1,2, 3	2

	3.3	Synchronization problems: Readers Writers problem, Dining Philosophers problem, Producer Consumer problem, Sleeping Barber problem.	1,2, 3	2
	3.4	Deadlocks:Principles of deadlock, deadlock detection, Deadlock Avoidance: Bankers algorithm, Deadlock prevention.	1,2, 3	5
4		**Memory Management**		08
	4.1	Memory management requirements.	1,2	1
	4.2	Memory partitioning.	1,2	1
	4.3	Virtual memory: paging; segmentation.	1,2	4
	4.4	Page replacement policies and page faults	1,2	2
5		**File Management**		04
	5.1	File structure, file system layout, file organization and access, file sharing, Record Blocking	1,2	2
	5.2	Secondary storage management, NTFS	1,2	2
6		**I/O Management**		04
	6.1	I/O devices, Organization of the I/O function, Operating system design issues	1,2	1
	6.2	I/O buffering, RAID.	1,2	1
	6.3	Disk scheduling and disk scheduling algorithms: FCFS, SSTF, SCAN, CSCAN, LOOK	1,2	2
7*		**Explore operating system functions**		03
	7.1	Real time OS, Mobile OS	1,2, 3	1
	7.2	Distributed OS	1,2, 3	1
	7.3	Cloud OS	1,2, 3	1
			Total	**42**

*** Chapter 7 will be evaluated as part of ISE for poster presentation.**

Reefernces:

[1] Silberschatz A., Galvin P., Gagne G. "Operating Systems Principles", Willey , 9th edition.

[2] Maurice J. Bach,"The Design of Unix Operating System", Prentice Hall.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CE44	Computer Organization and Architecture	3	--	-	3	--	-	3
		Examination Scheme						
		Theory Marks						
		ISE			MSE	ESE		Total
		20			20	60		100

Pre-requisite Course Codes		CE32 (Digital Logic Design and Applications)
At the end of successful completion of this course, student will be able to		
Course Outcomes	CO1	To describe basic structure of computer
	CO2	To apply arithmetic algorithm for solving problems
	CO3	To demonstrate processor architectures with control signal generation.
	CO4	To describe the memory mapping techniques
	CO5	To apply I/O concept for simulating I/O device operations.
	CO6	To analyze different parallel processing and pipelining concepts

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Overview of Computer Architecture & Organization:**		
	1.1	Introduction of Computer Organization and Architecture, Basic organization of computer and block level description of the functional units,Evolution of x86 Computers, Von Neumann model, Harvard Model, Embedded system, ARM architecture	1,4	4
	1.2	Performance Issues: Designing for performance, Multicore, Mics, GPGPU.	1,4	2
2		**Data Representation and Arithmetic Algorithms:**		
	2.1	Number representation: Floating-point representation, Floating point arithmetic, IEEE 754 floating point number representation	5,7	2
	2.2	Integer Data computation: Addition, Subtraction. Multiplication: Signed multiplication, Booth's algorithm.	5,7	2
	2.3	Division of integers: Restoring and non-restoring division	5,7	2
3		**Processor Organization and Control Unit:**		
	3.1	CPU Architecture, Register Organization , ISA categories : Complex Instruction Set Computing ISA Features, Reduced Instruction Set Computing ISA Features. Instruction formats, basic instruction cycle. Instruction interpretation and sequencing,	2,4,6	4
	3.2	Control Unit :Soft wired (Micro-programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations, concepts of nano programming.	2,3	4
	3.3	RISC and CISC: Introduction to RISC and CISC architectures and design issues.	3	1
4		**Memory Organization:**		
	4.1	Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAM and ROM,	3	3

		Allocation policies, Memory hierarchy and characteristics.		
	4.2	Cache memory: Concept, architecture (L1, L2, L3), mapping techniques. Cache Coherency, Interleaved and Associative memory.	2,3	4
	4.3	Virtual Memory: Concept, Segmentation and Paging, Page replacement policies. LRU,FIFO	4,5	4
5		**I/O Organization and Introduction to Parallel Processing:**		
	5.1	Buses: Types of Buses ,Bus Arbitration, BUS standards	5,7	3
	5.2	I/O Interface, I/O channels, I/O modules and IO processor, Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA.	2,5,7	4
	5.3	Introduction to parallel processing concepts ,Flynn's classifications ,pipeline processing ,Pipeline stages, Hazards	5	3
			Total	**42**

References:

[1] Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization", Fifth Edition, Tata McGraw-Hill.

[2] John P. Hayes, "Computer Architecture and Organization", Third Edition.

[3] William Stallings, "Computer Organization and Architecture: Designing for Performance", Eighth Edition, Pearson.

[4] B. Govindarajulu, "Computer Architecture and Organization: Design Principles and Applications", Second Edition, Tata McGraw-Hill.

[5] Dr. M. Usha, T. S. Srikanth, "Computer System Architecture and Organization",First Edition, WileyIndia."Computer Organization" by ISRD Group, Tata McGraw-Hill.

[6] Ramesh Gaonkar ,"Microprocessor architecture ,Programming and application with 8085",5th Edition, Penram

[7] Nicholas P Carter Adapted by Raj Kamal" "Computer Architecture and Organization",Schaum's Outline ,2nd edition.,Tata McGraw Hill.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL41	Design and Analysis of Algorithms Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		20	60

Pre-requisite Course Codes		ES4 (Programming Methodology and Data structures) CE31 (Advanced Data Structures)
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Compare time and space complexity of different sorting and searching techniques
	CO2	Solve various problems using dynamic programming approach
	CO3	Illustrate the concepts of greedy approach
	CO4	Demonstrate the applicability of backtracking, branch and bound strategies to solve problems in different domains
	CO5	Demonstrate various string matching algorithms

Exp. No.	Experiment Details (Implementation can be in C/C++ Language)	Ref.	Marks
1	Experiment on finding the running time of algorithm Selection sort Insertion sort	1,3	5
2	Experiment based on divide and conquer approach Merge sort Quick sort Binary search	2,3	5
3	Experiment on finding minimum and maximum numbers using divide and conquer approach	1	5
4	Experiment using dynamic programming approach Multistage graphs single source shortest path all pair shortest path 0/1 knapsack Travelling salesman problem Longest common subsequence	1,4	5
5	Experiment based on greedy approach Single source shortest path Knapsack problem Job sequencing with deadlines Optimal storage on tapes	1,5	5
6	Experiment on minimum spanning tree using Greedy approach	1,2,5	5
7	Experiment using Backtracking strategy	2,3	5

	8 queen problem (N-queen problem) Sum of subsets Graph coloring, 15 puzzle problem Travelling salesman problem		
8	Implement string matching algorithms The naïve string matching Algorithm The Rabin Karp algorithm The knuth-Morris-Pratt algorithm	1	**5**
		Total Marks	**40**

ESE Evaluation:

The ESE evaluation will take place through Practical Examination based on the Lab course at the end of semester. The distribution of marks is as follows.
Practical: (Any experiments based on the Lab course): 10 Marks
Oral: (Oral based on any experiments in the Lab course): 10 Marks

References:

1. T.H .Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, "*Introduction to algorithms*", 3rd edition, PHI publication 2009.
2. Ellis Horowitz, SartajSahni , S. Rajasekaran. "*computer algorithms*" 2nd edition, Computer Science Press, 1997
3. SanjoyDasgupta, Christos H. Papadimitriou, UmeshVazirani, "*Algorithms*", 1st edition, Tata McGraw- Hill, 2006.
4. Jon Kleinberg, Eva Tardos, "*Algorithm Design*", 1st edition, Pearson, 2006.
5. Michael T. Goodrich, Roberto Tamassia, "*Algorithm Design and Application*", 1st edition ,Wiley Publication, 2015.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL42	Database Management System Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE	ESE		Total
		40			--	--		40

Pre-requisite Course Codes		CE32 (Database Management System)
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Design a relational database for real world system.
	CO2	Apply SQL commands on database.
	CO3	Execute various transaction and recovery commands over database.
	CO4	To examine effect of concurrency control on database.

Assign a case study for group of 2/3 students and each group to perform on their case study following experiments.

Exp. No.	Experiment Details	Ref.	Marks
1	Create a database for real world system. ➢ E-R Diagram ➢ Mapping of E-R to relational Model ➢ Perform database administration related commands DCL	1,2	5
2	Build a database and populate using SQL. 1. DDL 2. DML	1,2	5
3	Perform various nested queries on database. JOIN	1,2	5
4	Create a reports using view.	1,2	5
5	Perform TCL and Store procedure on database	1,2	5
6	Examine integrity of database using Assertion and Triggers	1,2	5
7	Examine the consistency of database using various concurrency control techniques. Creation of serializability schedule.	1,2	5

8	Check for deadlock condition over database	1,2	**5**
	Total Marks		**40**

ESE Evaluation:
The ESE evaluation will take place through Practical Examination based on the Lab course at the end of semester. The distribution of marks is as follows.
Practical: (Any experiments based on the Lab course): 10 Marks
Oral: (Oral based on any experiments in the Lab course): 10 Marks

References:

1. SharamanShah ,"Oracle for Professional", SPD.
2. Dr.P.S.Deshpande ,"SQL &PLSQL for oracle"Black Book

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL43	Operating Systems Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		--	40

Pre-requisite Course Codes		CEL35 (Linux Lab)
Course Outcomes	CO1	Illustrate process/file system call in Unix – Understanding.
	CO2	Illustrate multi threading – Understanding.
	CO3	Apply various process scheduling/disk scheduling algorithm-Applying.
	CO4	Develop inter process communication – Applying.
	CO5	Examine memory management strategy – Analyzing.

Exp. No.	Experiment Details	Ref.	Marks
1	Implement system call in Unix OS.	1,2	5
2	Implement multi threading application.	1	5
3	Implement CPU scheduling algorithm.	1	5
4	Implement Producer consumer problem using Semaphore.	1	5
5	Implement bankers algorithm for deadlock avoidance.	1	5
6	Implement demand paging.	1,2	5
7	Implement disk scheduling algorithm	1	5
8	Mini project	1	5
		Total Marks	40

References:

[1] Silberschatz A., Galvin P., Gagne G. "Operating Systems Principles", Willey 9th edition.

[2] "The Design of Unix Operating System", Maurice J. Bach, Prentice Hall.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL44	Computer Organization and Architecture	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		-		-		40

Pre-requisite Course Codes		Digital Logic Design and Analysis
After Successful completion of course, students will be able to		
Course Outcomes	CO1	Identify the components of Computers and Assemble the computer system.
	CO2	Design ALU operations using LabView and VHDL tool.
	CO3	Apply data arithmetic algorithms for implementing arithmetic operations
	CO4	Apply various memory management technique for memory allocation and page replacement algorithms
	CO5	Demonstrate I/O operations
	CO6	Analyze the performance of the systems.

Exp. No.	Experiment Details	Ref.	Marks
1	To recognize the components of computer ,dismantling and assembling of CPU and to study processor simulator (open source)	9	5
2	To demonstrate the working of Assembler using NASM	1	5
3	To simulate the ALU operations using LabView and VHDL.	1,2,3	5
4	To implement various algorithms like Booth's algorithm ,division by restoration and non-restoration for arithmetic operations	2,3,4 6,7	5
5	To implement page replacement and memory allocation algorithms.	2,3,4, 6,7	5
6	To implement the mapping techniques of Cache memory.	2,3,4, 6,7	5
7	To implement serial communication using RS232.	1	5
8	Write a program that simulates the behavior of a pipelined processor using open DLX simulator	5,6,8	5
		Total Marks	**40**

References:

[1] **Manual to use the simulator for computer organization and architecture.** Developed by the Department of CSE, IIT kharagpur (http://cse10-iitkgp.virtual-labs.ac.in/)

[2] **William Stallings**, "Computer Organization and Architecture: Designing for Performance", Pearson Publication, 10th Edition, 2013

[3] **B. Govindarajulu**, "Computer Architecture and Organization: Design Principles and Applications", Second Edition, McGraw-Hill (India).

[4] **Morris Mano. "**Computer System Architecture" Pearson Publication, 3rd Edition, 2007

[5] **Kai Hwang, FayéAlayé Briggs**. "Computer architecture and parallel processing**",** McGraw-Hill

[6] **P. Pal Chaudhuri.** "Computer Organization and Design**"** Prentice Hall India, 2004

[7] **Dr. M. Usha, T.S. Shrikant. "**Computer System Architecture and Organization" Wiley India, 2014.

[8] P. López. DLXide web page. http://www.gap.upv.es/people/plopez/english.html

[9] https://youtu.be/obSsX7-ZwWc

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CEL45	Web Technology Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes		ES4 (Programming Methodology and Data Structures)
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Design static web pages using HTML5 and CSS3
	CO2	Apply client side scripting to static web pages
	CO3	Build dynamic web pages using server side scripting
	CO4	Develop a web application using web development frameworks

Exp. No.	Experiment Details	Ref.	Marks
1	**Static Web Page Design: HTML5** Basic structure of an HTML5 document, Creating an HTML5 document, Mark up Tags, Heading-Paragraphs, line Breaks HTML5 Tags - Introduction to elements of HTML, Working with Text, Lists, Tables and Frames, Hyperlinks, Images and Multimedia, Forms and other HTML5 controls. ***(Programming assignments based on the above topics)***	1,2	**5**
2	**Static Web Page Design: CSS3** Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts), Working with block elements and objects, Lists and Tables, CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties), CSS Advanced(Grouping, Dimension, Display,Positioning, Floating, Align,Pseudo class, Navigation Bar, Image Sprites, Attribute sector), Creating page Layout and Site Designs ***(Programming assignments based on the above topics)***	1,2	**5**
3	**Client side scripting – Javascript** Introduction to JavaScript, Lexical Structure, Types, Values, and Variables , Expressions and Operators, Statements, Objects, Arrays, Functions, Pattern matching with regular expressions, Javascript in Web Browsers, The Window object, Scripting Documents, Scripting CSS, Handling Events ***(Programming assignments based on the above topics)***	2	**5**
4	**Client side scripting – JQuery** jQuery Basics, jQuery Getters and Setters, Altering Document Structure, Handling events with jQuery, Animated Effects, Utility	3	**5**

	functions, jQuery Selectors and Selection Methods, Extending jQuery with Plug-ins, The jQuery UI Library ***(Programming assignments based on the above topics)***		
5	**Bootstrap** Introduction to Bootstrap, downloading and installing Bootstrap, The Grid System: Introducing the Grid, Offsetting and Nesting, Responsive Features, Utility Classes, and Supported Devices, CSS Foundations: Typography in Bootstrap, Styling Tables, Styling Forms, Styling Buttons, Images, icons, and Thumbnails, Navigation Systems: Tabs, Pills, and Lists, Breadcrumbs and Pagination, Navigation Bar, Making the Navigation Bar Responsive, Javascript Effects: Drop-downs, Modal Windows, Tooltips and Popovers, Navigation Aids: Tabs, Collapse, Affix, Carousel, Bootstrap Customization: Combining Elements in Bootstrap, Customizing by Components, Plugins, and Variables ***(Programming assignments based on the above topics)***	4	**5**
6	**Server side-scripting – PHP** Introduction to PHP, PHP Tags, Adding Dynamic content, Accessing form variables, Identifiers, user-declared variables, Data types, Constants, Operators, Control structures, Conditionals, Iteration constructs, Using arrays, string manipulation and regular expressions, reusing code and writing functions ***(Programming assignments based on the above topics)***	5	**5**
7	**Server side-scripting – PHP** Designing and creating your web database, Accessing MySQL database from the Web with PHP, Session Control in PHP ***(Programming assignments based on the above topics)***	5	**5**
8	**Server side-scripting – Laravel Framework** Managing Your Project Controllers, Layout, Views, and Other Assets, Talking to the Database, Model Relations, Scopes, and Other Advanced Features, Integrating Web Forms, Authenticating and Managing Your Users, Deploying, Optimizing and Maintaining Your Application ***(Programming assignments based on the above topics)***	6	**5**
		Total Marks	**40**

References:

[1] J. Millman and A. Grabel, "*Head First HTML and CSS*", 2nd edition, O' Reilly..

[2] Ben Frain, *"Responsive Web design with HTML5 and CSS3",* PACKT Publishing Ltd.

[3] David Flanagan, *"Javascript: The Definitive Guide"*, 6th edition, O' Reilly.

[4] Jennifer Kyrnin, *"SAMS Teach Yourself Bootstrap in 24 hours"*, 1st edition, Pearson Education.

[5] L. Welling and L. Thomson, "*PHP and MySQL Web Development*", 4th edition, Adison Wesley Professional.

[6] Martin Bean, *"Laravel 5 Essentials",* PACKT Publishing Ltd

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
LA1	Yoga-Vidya	1	-	-	Non-Credits			
		Examination Scheme						
		ISE1		ISE2	Attendance			Total
		20		20	10			50

Student will be evaluated after six sessions for 20 Marks (ISE1) and at the end of last session for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.

Pre-requisite Course Codes		-
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Perform various techniques of Yoga
	CO2	Follow healthy habits to improve immune system
	CO3	Describe the importance of Yoga in one's life
	CO4	Make resolution to practice techniques of Yoga

Through this course, students will get an all round experience of how Yoga can benefit their body, breath, emotions along with relaxation techniques to maintain a calm and balanced state of mind.

Day No.	Topics	Hrs.
1	What is Yoga, why Yoga? Techniques: warm up stretches for hands, legs, neck; Sukhasana, Padmasana	1
2	Introduction to Ashtanga Yoga Techniques: Talasana, Utkatasana, Konasana 2	1
3	Asana classification and importance of different types of Asanas Techniques: Sthita-prarthanasana, Ekpadasana, Garudasana	1
4	Yogendra rhythm- breathing pattern Techniques: Parvatasana, Yashtikasana	1
5	Forward bending and abdominal compression Techniques: Konasana 3, Yogamudra	1
6	ShuddhiKriyas- Prevention of diseases by improving immune system Techniques: Jalaneti, Kapalabhati	1
7	Yogic Aahar Techniques: Vajrasana, Pavanmuktasana	1
8	Relaxation and it's importance Techniques: Shavasana	1
9	Spine and it's importance in Yoga Techniques: Bhujangasana, Makarasana, Vakrasana	1
10	Pranayama Techniques: Basic techniques	1
11	Attitude training Techniques: connecting techniques to concepts.	1

12	Pranayama Techniques: Traditional Pranayama	1
13	Yogachara- The Yoga way of living Techniques: Games	1
14	Revision	1

References:

[1] SadashivNimbalkar, "Yoga for Health & Practices", Yoga VidyaNiketan,Mumbai.

[2] Swami SatyanandaSaraswati, "Asana Pranayama Mudra Bandha", Yoga Publications Trust, Munger, Bihar, 2008

[3] Dr.H.R.Nagendra, Dr.R.Nagarathna, "New Perspectives in Stress Management", Vivekananda Yoga Research Foundation, Bangaluru

[4] Books from The Yoga Institute, Santacruz:
a) Yoga Cyclopedia Vol 11
b) Yoga of caring
c) Insights through Yoga
d) Growing with Yoga

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
LA2	Music Appreciation	1	-	-	Non-Credits			
		Examination Scheme						
		ISE1		ISE2	Attendance			Total
		20		20	10			50
Student will be evaluated after six sessions for 20 Marks (ISE1) and at the end of last session for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.								

Pre-requisite Course Codes		---
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Appreciate various processes of Music composition
	CO2	Appreciate the role of engineers in sound recording

S.N.	Topics	Hrs.
1	Introduction to audio and digital audio	2 hr
2	Types of Mics and Speakers	1 hr
3	Introduction to instruments	2 hr
4	Introduction to Audio Console	2 hr
5	Audio Production Process	2 hr
6	Effects	2 hr
7	Mixing aesthetics	2 hr
8	Make your song	2 hr

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
LA3	Dramatics	1	-	-	Non-Credits			
		Examination Scheme						
		ISE1		ISE2	Attendance			Total
		20		20	10			50

Student will be evaluated after six sessions for 20 Marks (ISE1) and at the end of last session for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.

Pre-requisite Course Codes	-

At end of successful completion of this course, student will be able to

Course Outcomes	CO1	Understand an Art of Theatre.
	CO2	Express their thoughts.
	CO3	Create and visualize new ideas.
	CO4	Perform impressively.

Day No.	Topics	Hrs.
1	Lalitkala (Forms of Art)	1
2	Drama – Show and Text	1
3	Techniques – Abhinay (Acting)	1
4	1. VachikAbhinay (Reading)	1
5	2. AngikAbhinay (Expressions)	1
6	3. SatvikAbhinay	1
7	Digdarshan (Direction)	1
8	Nepathya (Settings)	1
9	Veshbhusha (Drapery)	1
10	Natyabhasha (Dialogs and Language)	1
11	Kaal and Avakash (Time and Space)	1
12	Natya Rasa (Theory of Rasa)	1
13	Natya Rasa (Theory of Rasa)	1
14	Aswadprakriya	1
	Total	14

References:

[1] An Actors prepare – Stanislavsky (English)

[2] A building a Character – Stanislavsky(English)

[3] Natyashastra – Bharatmuni (English And Marathi)

[4] Abhinaysadhana- K. Narayan Kale (Marathi)

[5] Natyavimarsh-K. Narayan Kale (Marathi)

[6] JagatikRangabhumichaItihas – Kru. Ra. Sawant (Marathi)

[7] Marathi RangabhumichaItihas- Shri. Na. Banahatti (Marathi)

[8] Lalitkalamimansa- Go. Chi. Bhate(Marathi)

[9] SahityaAdhyapanAniPrakar- va.la. KulakarniGauravgranth(Marathi)

[10] VachikAbhinay- Dr. ShriramLagoo (Marathi)

[11] Rangnayak- Arwind Deshpande

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'Activity Based Learning'

ABL1: Building Automation, Fire Safety and Electronic Security

This is non-credit activity conducted in semester III for all the branches of engineering. It is compulsory for all the students to appear for this activity.
This is one day event involving following activities:

1. Invited Talks on the related topics
2. Poster Presentation
3. Fire/Safety Drills
4. Design competition in building automation, fire safety and security.

This event shall be conducted in association with Fire and Security Association of India (FSAI).

ABL2:OCCUPATIONAL SAFETY & LEGAL STUDIES FOR ENGINEERS

Engineering is the branch of science and technology concerned with design, building and the use of engine, machines and structures. In this fast moving world scenario, it is seen that the field of Engineering has travelled a very long distance of time space. In the modern parlance, this field must be properly knitted with the other two important dimensions—SAFETY & LAW. An Engineer must have adequate knowledge of these vital subject if he ever wishes to establish himself in this Industrial world.

The following activities have been designed to meet up with the growing expectations with the concerned topic. Students are requested to actively participate in those activities based learning to catch up with the realities of the industrial world.

Hence, the activities are divided into 5 parts—MOOT COURT, DEBATE, ELOCUTION, PRESENTATION & ROLE PLAY

1) ***MOOT COURT:***

It is a process in which participants take part in simulated court proceedings, usually involving drafting memorials or memoranda and participating in oral argument. It is just a dummy presentation of the actual court proceedings. It will have a pair of counsel from the defendant as well as the prosecution side. The case write up will be given to both the sides well in advance. They need to study the case along the lines of actual law pertaining to the case which will be more or less company law, intellectual property laws, banking laws, insurance laws or negotiable instrument laws. Both sides will have a researcher who will work along with his respective team to unearth any backdated supportive cases. The sides has to come in common consensus to work on issues which should not be more than five. Based on those issues both sides will present their case turn by turn with the permission of the judge. Judge can consist of persons ranging from 1 to 3. The issues should be dealt with in the book called memorial which should be prepared by both the sides. The prosecution will start the case followed by the defendants. Nobody can criss-cross each other's time of presentation. The judge/s have to control the whole proceedings properly. The judge has the power to give permission for rebuttal as per his own whims. In the end he will pass the judgment based on law.

2) ***DEBATE:***

Debates will have topics based on safety and law based and the pair of participants need to stand for or against the motion.

3) ***ELOCUTION:***

Same will be the case with elocution but it will be extempore and the participants will have to present their insights on the topic given on the spot.

4) ***PRESENTATION:***

A PPT presentation will have topics based on legal laws and students need to prepare the same.

The list of topics are:

Sale deed, WILL, Gift Deed, Agreement, Power of attorney, MOU(Memorandum of Understanding), Non-Disclosure agreements, Affidavit, Charter, Partnership deed, Copyrights Transfer Agreement, Franchise Termination, Lease purchase contract, Letters Patent, Legal Threat, Promissory Note, Share Certificate, Share transmission, PIL (Public Interest Litigation).

5) ***ROLE PLAY:***

This activity is a group activity whereby they have to work as a team and enact some situation pertaining to law or safety in the Industrial premises. It's a fun activity whereby they camouflage themselves stepping into the shoes of the role that they will be performing to create an awareness amongst the audience of what to do in case they find themselves in same situations in near future.

6) ***Client Counseling***

The Client Counseling addresses fundamental skill of ability to interview, counsel, and support a client through their legal issue. Competitors conduct an initial interview with a person playing the role of the client and then address both the client's legal and non-legal needs.

7) ***Negotiation***

Negotiation provides a means for students to practice and improve their negotiating skills. The activity simulates legal negotiations in which students, acting as lawyers, negotiate a series of legal problems. The simulations consist of a common set of facts known by all participants and confidential information known only to the participants representing a particular side.

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Competitive Examinations Preparation (CEP): (Extra credits=2)

Salient Features of CEP:

- ➢ It is optional module
- ➢ Motivation, mentoring and preparation of students to pursue higher education
- ➢ Modules as per national level technical competitive examination **GATE**
- ➢ Motivation, mentoring and preparation of students to join public sector or government organizations like BARC, DRDO etc.
- ➢ Motivation, mentoring and preparation of students to join top ranking technical institutes in country like IISc and IIT.
- ➢ Module design as per the courses studies in that semester or prior semester by considering syllabus of GATE examination
- ➢ Help to sharpen the problem solving skills of students and concerned teachers
- ➢ Course mentors will be allotted at the start of academic year
- ➢ Two (2) extra credits will be given if
    3. Student submit **Valid Gate Score card**.
    4. Must pass CEP1 to CEP6 in modal question papers given by the faculty
    5. Maintains regular contact with CEP course teachers

CEP Courses:

Semester III:
CEP1: Introduction to CEP

One hour introduction session to entire class about CEP.

Student shall be assigned as 'Teaching Assistant' to Engineering Mathematics Course –I.
Student shall maintain regular contact with the semester III course teachers (once in a week per course). Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve. At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of Semester-I and Semester-III courses. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester IV:
CEP2: Problem solving module-I

Student shall be assigned as 'Teaching Assistant' to Engineering Mathematics Course–II and Basics of electrical Engineering.
Student shall maintain regular contact with the semester IV course teachers (once in a week per course). Teacher shall maintain the attendance of the student. Teacher shall mentor student and

give assignments with GATE level problems to solve. At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of Semester-II and Semester-IV courses. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester V:
CEP3: Problem solving module-II

Student shall be assigned as 'Teaching Assistant' to Semester III courses.
Student shall maintain regular contact with the semester V course teachers (once in a week per course). Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve. At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of Semester-V courses. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester VI:
CEP4: Problem solving module –III

Student shall be assigned as 'Teaching Assistant' to Semester IV courses.

Self-Learning: Numerical Ability and Verbal Ability

Student shall maintain regular contact with the semester VI course teachers (once in a week per course). Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve. At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of Semester VI courses and self-learning module on numerical ability and verbal ability. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester VII:

CEP5: Problem solving module-IV

Student shall be assigned as 'Teaching Assistant' to Semester V courses.

Self-Learning: Contents not covered in any semester of study

Student shall maintain regular contact with the semester VII course teachers (once in a week per course).Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve.
At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of entire syllabus of GATE Examination. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester VIII:
CEP6: Problem solving module-V

At the start of the semester student shall appear for the TWO Model Test papers based on the pattern of the actual GATE Examination. This paper shall be based on the contents of entire syllabus of GATE Examination. The negative marking is applicable as per GATE pattern.

Student shall submit 'Valid GATE Score Card' after declaration of GATE result.

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai

Mapping with Syllabus for GATE Exam (Semester-wise)

Semester - I
Engineering Mathematics-I : Linear Algebra: Matrices, determinants, system of linear equations, Calculus:. Maxima and minima.
Semester-II
Engineering mathematics –II: Integration.
Programming Methodology and Data Structures: Programming in C. Recursion. Arrays, stacks, queues, linked lists.
Semester-III
Advanced Data Structures: linked lists, trees, binary search trees, binary heaps, graphs, Graph search, hashing.
Digital Logic Design and Analysis: Number representations, Combinational and sequential circuits. Minimization.
Discrete Structures and Graph Theory: Boolean algebra, Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Groups. Graphs: connectivity, matching, coloring.recurrence relations, generating functions.
Semester-IV
Applied Mathematics-II: Linear Algebra: eigenvalues and eigenvectors Matrices, determinants, Probability: Random variables, poisson and binomial distributions. and Bayes theorem.
Analysis of Algorithms: Searching, sorting, Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide and conquer, minimum spanning trees, shortest paths.
Database Management Systems: ER- model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. . Transactions and concurrency control.
Operating Systems: Processes, threads, inter- process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management. File systems.
Computer Organization and Architecture: computer arithmetic (fixed and floating point), ALU, data path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode),virtual memory
Semester V:
Computer Networks: Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.
Theory of Computer Science: Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and contex-free languages, pumping lemma. Turing machines and undecidability.

Microprocessor:-Machine instructions and addressing modes.
Semester VI:
System Programming and Compiler Construction: Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.
Covered in previous standards:-
Mean, median, mode and standard deviation. Conditional probability, Limits, continuity and differentiability
Not covered in any Semester
LU decomposition, Mean value theorem, Combinatorics: counting, File organization, indexing (e.g., B and B+ trees)

Self-Learning Module: General Aptitude

I. Verbal Ability

1. Grammar
2. Nouns, Pronouns, Articles
3. Verbs, Auxiliaries, Modals
4. Adjectives, Adverbs
5. Prepositions, Conjunctions
6. Active/ Passive Voice, Direct/ Indirect Speech
7. Verbal phrases
8. Sentence Completion
9. Vocabulary
10. Synonyms
11. Antonyms
12. Analogy
13. Reverse Analogy
14. Verbal Reasoning
15. Critical Reasoning
16. Logical Reasoning

II. Numerical Ability

I. Quantitative Aptitude:

1. Simple Equations
2. Ratio-proportion-variation
3. Numbers
4. Percentage, Profit and Loss
5. Simple Interest and Compound Interest
6. Average, mixtures and Alligations
7. Time and Work
8. Time and Distance
9. Indices, Surds, Logarithms
10. Quadratic Equations
11. Inequalities
12. Progressions

13. Permutations and Combinations
14. Data Interpretation

II. Reasoning

1. Number and Letter Series
2. Analogies
3. Odd man out (Classification)
4. Coding and Decoding
5. Blood relations
6. Venn Diagrams
7. Seating Arrangements
8. Puzzles
9. Clocks and Calendars