Bharatiya Vidya Bhavan's
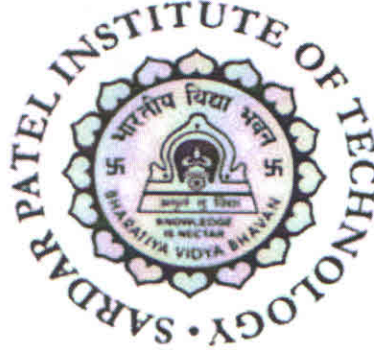# Sardar Patel Institute of Technology
(Autonomous Institute Affiliated to University of Mumbai)

Bachelor of Technology (B.Tech)
in
Information Technology
(Program Code: UIT)

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

Board of Studies Approval:	13/12/2017
Academic Council Approval:	20/01/2018

Dr. Radha Shankarmani	Dr. Surendra Rathod	Dr. Prachi Gharpure
Head of Department	Dean Academics	Principal

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Scheme for B.Tech. Information Technology (SEM III)						
SEM III						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
BS31	Applied Mathematics I*	BS	3	1	--	4
IT31	Advanced Data Structures*	PC	3	--	--	3
IT32	Digital Logic Design and Analysis*	PC	3	--	--	3
IT33	Discrete Structures	PC	3	1	--	4
IT34	Object Oriented Programming*	PC	3	--	--	3
ITL31	Advanced Data Structures Lab	PC	--	--	2	1
ITL32	Digital Logic Design and Analysis Lab	PC	--	--	2	1
ITL34	Object Oriented Programming Lab	PC	--	--	2	1
ITL35	Web Programming Lab-I	PC	--	1	2	2
ITL36	Open Source Operating System Lab	PC	--	1	2	2
BS32	Human Health Systems Approach	BS	2	--	--	2
SDX	SCOPE Course (Optional)	SD	--	--	--	--
ABL1	Building Automation, Fire Safety and Electronic Security (Noncredit)	ABL	--	--	--	--
CEP1	Introduction to CEP (Optional)	CEP	--	--	--	--
BC	Fundamentals of Mathematics (only for direct second year students)	BC	2$	--	--	--
	Total		17+2$	4	10	26

* Common courses with Computer Engineering

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

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Scheme for B.Tech. Information Technology (SEM IV)						
SEM IV						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
BS41	Applied Mathematics II*	BS	3	1	--	4
IT41	Design and Analysis of Algorithms*	PC	3	--	--	3
IT42	Computer Organization and Architecture*	PC	3	--	--	3
IT43	Database Management Systems*	PC	3	--	--	3
IT44	Operating Systems*	PC	3	--	--	3
ITL41	Design and Analysis of Algorithms Lab	PC	--	--	2	1
ITL42	Computer Organization and Architecture Lab	PC	--	--	2	1
ITL43	Database Management Systems Lab	PC	--	--	2	1
ITL44	Operating Systems Lab	PC	--	--	2	1
ITL45	Web Programming Lab-II	PC	--	1	2	2
LA^	Liberal Arts (Non credit) LA1: Yoga Vidya LA2: Music Appreciation LA3: Dramatics	LA	1	--	--	--
SDX	SCOPE Course (Optional)	SD	--	--	--	--
ABL2	Occupational Safety and Legal Studies for Engineers (Noncredit)	ABL	--	--	--	--
CEP2	Problem solving module-I (Optional)	CEP	--	--	--	--
	Total		16	2	10	22

* Common courses with Computer Engineering

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Evaluation Scheme

Course Code	Course Name	Marks			
B. Tech. Information Technology (SEM III)					
		ISE	MSE	ESE	Total
BS31	Applied Mathematics I*	20	20	60	100
IT31	Advanced Data Structures*	20	20	60	100
IT32	Digital Logic Design and Analysis*	20	20	60	100
IT33	Discrete Structures	20	20	60	100
IT34	Object Oriented Programming*	20	20	60	100
ITL31	Advanced Data Structures Lab	40	--	20	60
ITL32	Digital Logic Design and Analysis Lab	40	--	--	40
ITL34	Object Oriented Programming Lab	40	--	--	40
ITL35	Web Programming Lab-I	40	--	--	40
ITL36	Open Source Operating System Lab	40	--	--	40
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) &	ISE1= 20	ISE2= 20	Attendance= 10	50&
	Total				**770**
B. Tech. Information Technology (SEM IV)					
Course Code	Course Name	Marks			
		ISE	MSE	ESE	Total
BS41	Applied Mathematics II*	20	20	60	100
IT41	Design and Analysis of Algorithms*	20	20	60	100
IT42	Computer Organization and Architecture*	20	20	60	100
IT43	Database Management Systems*	20	20	60	100
IT44	Operating Systems*	20	20	60	100
ITL41	Design and Analysis of Algorithms Lab	40	--	20	60
ITL42	Computer Organization and Architecture Lab	40	--	--	40
ITL43	Database Management Systems Lab	40	--	--	40
ITL44	Operating Systems Lab	40	--	--	40
ITL45	Web Programming Lab-II	40	--	--	40
LA^	Liberal Arts (Non credit) LA1: Yoga Vidya LA2: Music Appreciation LA3: Dramatics	ISE1= 20	ISE2= 20	Attendance= 10	50
ABL2	Occupational Safety and Legal Studies for Engineers (Noncredit)	--	--	--	--
	Total				**770**

* Common courses with Computer Engineering
& only for direct second year students (Since it is non-credit course it will not be counted in total marks)

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

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		2.3	Inverse Laplace transform with Partial fraction and Convolution theorem (without proof).		04
		2.4	Application to solving Differential Equations with given initial conditions.		02
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 $Z(a^n)$, $Z(\cos ak)$, $Z(\sin ak)$, 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**

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

Recommended Books:
1. Kreyszig, "*Advanced Engineering Mathematics*", 9[th]edition, John Wiley.
2. C. Ray Wylie & Louis Barrett, "*Advanced Engg. Mathematics*", 6th Edition, New York: McGraw-Hill, c1995.
3. K. B. Datta, "*Mathematical Methods of Science and Engineering*", 1st 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
IT31	Advanced Data Structures	3	-	-	3	-	-	3
		Examination Scheme						
		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 using non linear data structures.
	CO2	Apply concepts of Trees and Graphs to a given problem.
	CO3	Build various Heap Structure
	CO4	Illustrate the hashing and collision resolution techniques.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Linear and Non-linear Data Structures** Introduction to Data Structures (Stack, Queue and Singly Linked List), Circular Linked List, Doubly Linked List, Application of Linked List.	1,2	05
2	2.1	**Trees** 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	3.1	**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	5.1	**Hashing** Introduction to Hash Table, Hash functions, Collision Resolution Technique	1,2	04
			Total	**42**

Recommended Books:

1. Thomas H.Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "*Introduction to Algorithms*", 3rd edition, MIT Press, Massachusetts, 2009.
2. Horowitz E, Sahni S and S.Rajasekaran, "*Fundamentals of Computer Algorithms*", 2nd edition, Galgotia Publications, New Delhi, 2010.
3. Subrahmanian V S, "*Principles of Multimedia Database Systems*", 2nd edition, Morgan Kaufman series in Database management systems, USA, 2013.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
IT32	**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. Quine Mccluskey 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

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	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**

Recommended Books:

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. 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
IT33	Discrete Structures	3	1	-	3	1	-	4
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course Codes	--	
After successful completion of the course, student will be able to:		
Course Outcomes	CO1	Make use of logic and various proof techniques to solve problems.
	CO2	Apply the concepts of set, relations to solve problems
	CO3	Apply the concepts of functions to various technical domains.
	CO4	Solve problems using graphs and trees.
	CO5	Use fundamental concepts of algebraic structures, lattice to solve problems

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1	Logics and Proofs : Predicates, Quantifiers, Propositions, Conditional Propositions, Logical Connectivity, Proposition calculus, Universal and Existential Quantifiers, Equivalence, Normal Forms, Introduction to proofs, Mathematical Induction, Logical inference	1,2	06
2	2.1	Set theory:- Sets, Venn diagram, Operations on set, laws of set theory, partitions of set, types of sets , The principle of Inclusion and Exclusion	1,6	04
	2.2	Relations:- relations, equivalence relation, partial order relation, binary relation, Digraphs, posets and Hasse diagram, recurrence relation, Chains and Anti chains, theorems on chains, transitive closures, Warshall's algorithm	3,6	04
	2.3	Functions:- Injective, Surjective, Bijective, Inverse, Composiion, Identity, Graph of a function. Pigeon-hole principle	1	04
	2.4	Recursive function:- series, sequences, recurrence relation Applications – Divide-and-Conquer algorithm	1	03

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3	3.1	Graphs:- Basic terminology, Eulerian graph, Bipartite graph, Hamiltonian graph, planar graph, subgraphs Isomorphism of graph and subgraphs, cliques, connected components, Maximum flow and minimal cut edges, Chromatic number, Graph color problem	4,6	04
	3.2	Applications of Graph theory:- maximum matching using augmenting paths, perfect matching in bipartite graphs, Chinese postman problem,	4,6	04
4	4	Trees:- weighted trees, spanning trees, minimum spanning trees, isomorphism of trees, Kruskal's algorithm for minimal spanning tree. Prim's algorithms for minimal spanning tree.	1,5	03
5	5	Algebric structures:- semigroup, monoids and groups, Isomorphism, Homomorphism, Automorphism Cyclic groups, Codes and group codes	1,3	05
6	6	Lattice theory: Lattices and algebras systems, principles of duality, basic properties of algebraic systems defined by lattices, distributive and complimented lattices, Boolean lattices and Boolean algebras, uniqueness of finite Boolean expressions, prepositional calculus, Coding theory: Coding of binary information and error detection, decoding and error correction	2,3	05
			Total	**42**

Recommended Books:

1. Kenneth H. Rosen "*Discrete Mathematics and it's applications*", 7th edition, Tata McGraw-Hill
2. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, "*Discrete Mathematical Structures*", 4th edition, Pearson Education.
3. C. L. Liu, "*Elements of Discrete Mathematics*", 2nd edition, Tata McGraw-Hill, 2002, ISBN: 0-07-043476-X.
4. Douglas B. West, "*Introduction to graph Theory*", 2nd edition, PHI publication.
5. Joe L. Mott, Abraham Kandel, Theodore P. Baker "*Discrete mathematics for computer Scientists and mathematicians*", 2nd edition, Reston Publishing Company
6. S.K.Yadav, "*Discrete Mathematics and Graph Theory*" 1st edition, Anne Books Pvt. Ltd

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
IT34	**Object Oriented Programming**	3	-	-	3	-	-	3
		Examination Scheme						
		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		
	1.2	Object & Class, Constructor , Command line argument, Static Variable, Method & block		4
	1.3	Branching & looping		
2		**OOP CONCEPTS**	1,2,4	
	2.1	Inheritance (IS – A), Aggregation & Composition (Has – A)		
	2.2	Method overloading & overriding, Constructor overloading & overriding, this, super, final keyword		8
	2.3	Runtime polymorphism, Static and Dynamic Binding		
3		**ABSTRACT CLASS, INTERFACE, PACKAGE**	1,2	
	3.1	Abstract class & interface, instanceof operator		
	3.2	Package and access modifier		5
	3.3	Object class, Nested class		
4		**STRING HANDLING**	1,2	
	4.1	Immutable string ,Methods of String class,		
	4.2	String comparison, concatenation, substring, toString method		4
	4.3	StringBuffer class, StringBuilder class, StringTokenizer class		

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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

Recommended Books:

1. Ralph Bravaco , Shai Simoson , "*Java Programing From the Group Up*" , 1st edition, Tata McGraw-Hill.
2. Herbert Schildt, "*Java The Complete Reference*", 8th edition, Tata McGraw-Hill.
3. Jaime Nino, Frederick A. Hosch, "*An introduction to Programming and Object Oriented design using Java*",3rd Edition, Wiley.
4. C Xavier, "*Java Programming a Practical Approach*", 1st 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
ITL31	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
	IT31: Advanced Data Structures

After successful completion of the course, student will be able to:		
Course Outcomes	Student will be able to	
	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.	Suggested List of Experiments	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

Recommended Books:
1. Thomas H.Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "*Introduction to Algorithms*", 3rd edition, MIT Press, Massachusetts, 2009.
2. Horowitz E, Sahni S andS.Rajasekaran, "*Fundamentals of Computer Algorithms*", 2nd 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
ITL32	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
		IT32: Digital Logic Design and Analysis
At the End of the course students will be able to		
Course Outcomes	CO1	Construct and test logic circuits using logic gates to realize given function.
	CO2	Construct and Test logic circuits using MSI ICs to realize given function.
	CO3	Construct and test the design of combinational and sequential logic circuits by hardware implementation.
	CO4	Construct and test design of counters/shift registers.

Exp. No.	Suggested List of Experiments	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**

Recommended Books:

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.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITL34	**Object Oriented Programming Lab**	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	ES4: Programming Methodology and Data Structure
	IT34: Object Oriented Programming
After successful completion of the course, student will be able to:	

	CO1	Demonstrate object oriented programming concepts for a scenario.
Course outcomes	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.	Suggested List of Experiments	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	5
	Total Marks		**40**

Recommended Books:
1. Ralph Bravaco,Shai Simoson , "*Java Programing From the Group Up*" , 1st edition, Tata McGraw-Hill.
2. Herbert Schildt, "*Java - The Complete Reference*", 8th edition, Tata McGraw-Hill.
3. Jaime Nino, Frederick A. Hosch, "*An introduction to Programming and Object Oriented Design using Java*", 3rd edition, Wiley Student Edition.
4. C Xavier, "*Java Programming A Practical Approach", 1st edition,* Tata McGraw-Hill.
5. James Holmes, "*Struts: The Complete Reference*", 2nd edition, Tata McGraw-Hill.
6. Jim Keogh, *"J2EE: The Complete Reference"*, 1st 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
ITL35	Web Programming Lab - I	--	1	2	--	1	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	ES24: Programming Methodology and Data Structures	
After successful completion of the course, student will be able to:		
Course Outcomes	ITL35.1	Design basic web page layout using HTML
	ITL35.2	Use CSS for designing attractive web pages
	ITL35.3	Apply client side scripting to static web pages
	ITL35.4	Create responsive web pages using Bootstrap

Module No.	Topics	Ref.	Hrs.
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.	1,2	01
2	**Static Web Page Design: CSS3 Basics** 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)	1,2	02
3	**Static Web Page Design: CSS3 Advanced** CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), Creating page Layout and Site Designs	1,2	02
4	**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	3	02

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5	**Client side scripting – JQuery** jQuery Basics, jQuery Getters and Setters, Altering Document Structure, Handling events with jQuery, Animated Effects, Utility functions, jQuery Selectors and Selection Methods, Extending jQuery with Plug-ins, The jQuery UI Library	3	02
6	**Bootstrap - CSS** 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,	4	03
7	**Bootstrap – Java script** Java script Effects: Drop-downs, Modal Windows, Tooltips and Popovers, Navigation Aids: Tabs, Collapse, Affix, Carousel,	4	01
8	**Bootstrap – Java script** Bootstrap Customization: Combining Elements in Bootstrap, Customizing by Components, Plug ins, and Variables	4	01
	Total		**14**

Exp. No.	Suggested List of Experiments	Ref.	Marks

1	**Static Web Page Design: HTML5**
	1. Write the HTML code for demonstrating the use of basic html tags
	2. Write the HTML code for displaying the following lists (give few lists)
	3. Write the HTML code for displaying the following table(give any table)
	4. Write the HTML code for displaying the following form(any sample form)
	5. Design a web page demonstrating the use of
	    a. image mapping
	    b. marquee
	    c. iframes
	6. Design a webpage with following frame structure (Give some sample frame structure)
		1,2	05

2	**Static Web Page Design: CSS3 Basics** Design a web page using CSS displaying following rules: 1. In-line CSS to change colors of certain text portion, bold, underline and italics certain words. 2. Group paragraphs into single class and add styling information to the class in CSS. 3. Style elements using ID selector. 4. Set a background image for both the page and single elements on the page. Control the repetition of the image with the background-repeat property.	1,2	05
3	**Static Web Page Design: CSS3 Advanced** Design a web page with following layout using positioning property of css (without using <table> tag). Make use of navbars and image sprites in your page design.	1,2	05
4	**Client side scripting – Javascript** 1. Write a JavaScript function that accepts a string as a parameter and find the shortest word within the string. *Example string* : "Web Development Scene" *Expected Output :* "Web" 2. Create an HTML page and JavaScript script that includes three input fields. The relationship of the value of the fields is that the second field is twice the value of the first field, and the third field is the square of the first field. If a user enters a value in the second or third field, the script should calculate the appropriate value in the other fields. 1. Demonstrate mouseOver and mouseOut events in javascript with the help of any example of your choice 2. Write a JavaScript program to add and delete items in an array and display the array contents dynamically. In order to add or delete elements, take the input in an input box. Create 3 buttons, add, delete and display, each of which will perform the respective functionality 3. Write javascript which allows the user to play a rock, paper and scissors game. Try to add some innovation in the same and make it as interactive as possible.	3	05
5	**Client side scripting – JQuery** Design any form of your choice which uses all the different form elements and validate it using jquery using UI Library and form validation plugin	3	05

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6	**Bootstrap - CSS** 1. Design a web forum page using bootstrap 2. Design a resume template using bootstrap 3. Design a credit card form using bootstrap	4	05
7	**Bootstrap – Java script** Design a login form using modal windows, Design a bootstrap navigation bar example where the logo changes size on window scroll.	4	05
8	**Mini Project based on above topics** Designing the front-end and client side scripting for a website	1,2,3,4	05
	Total Marks		**40**

Recommended Books:

1. J. Millman and A. Grabel, *"Head First HTML and CSS"*, 2nd edition, O' Reilly, 2012.
2. Ben Frain, *"Responsive Web design with HTML5 and CSS3"*, 2nd edition, PACKT Publishing Ltd.
3. David Flanagan, *"Javascript: The Definitive Guide"*, 6th edition, O' Reilly, 2011.
4. Jennifer Kyrnin, *"SAMS Teach Yourself Bootstrap in 24 hours"*, 1st edition, Pearson Education, 2016.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITL36	Open source operating system lab	--	1	2	--	1	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	--
At the end of the course students will be able to	

Course Outcomes	ITL36.1	Distinguish the concept of open Source Software ,close software and proprietary software
	ITL36.2	Demonstrate the installation process of open source operating systems based on the Linux kernel.
	ITL36.3	Demonstrate responsibilities performed by the system administrator
	ITL36.4	Identify and use UNIX/Linux utilities to create and manage Linux Processes
	ITL36.5	Use common decision constructs in shell scripts effectively

Module No.	Topics	Ref.	Hrs.
1	Over View of Open Source Software Need of Open Sources – Advantages of Open sources –Applications FOSS – FOSS usage – Free Software Movement –comparison with close source / Proprietary software – Free Software	1	1
2	Widely used open source software license : Apache License, BSD license, GNU General Public License, GNU Lesser General Public License, MIT License, Eclipse Public License and Mozilla Public License.	1	1
3	Open Source Operating System Installation of Linux (Redhat-CentOS): Theory about Multiboot Enviroment, Hardisk Partitioning, Swap space, LVM, and Bootloader	2, 3	2
4	Basic File System Management Task, Working with files, Piping and Redirection, Working with VI editor, understanding FHS of Linux	2, 3	2
5	Open Source Operating System: system Administrator task Job management, Process Management, Mounting Devices and file system working with Linux, Backup	2, 3	2

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6	working with user, group and permission, Managing Software. Understanding Boot process and relatedfiles, Common kernel Management Task	2, 3	2
7	Open Source Operating System: Shell Programming Bash Shell Scripting, Executing Script, Working with Variables and Input, Using Control Structures, Script control,	4, 5	2
8	Handling with signals, Creating functions, working sed and gawk. Working with web using shell script: Downloading web page as formatted text file and parsing for data, working cURL etc	4, 5	2
	Total		**14**

Exp. No.	Suggested List of Experiments	Ref.	Marks
1	Installation of open source operating systems	2, 3	5
2	Exploring Linux file system commands-1: • Viewing Files and Directories • Displaying the Contents of Text Files • Searching for Text Within Files • Finding Files • Linking Files.	2, 3	5
3	Exploring Linux file system commands-2: I/O redirection, Filters, Awk, Sed	2, 3	5
4	Exploring Linux System Administration task	2, 3	5
5	Exploring Linux process management.	2, 3	5
6	Techniques for • Compression • System Backup • Package management	2, 3	5
7	Managing Environment Variables and User-Defined Variables	4, 5	5
8	Program based on shell scripting	4, 5	5
	Total Marks		**40**

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Recommended Books:

1. Lawrence Rosen, "Open *Source Licensing*", Prentice Hall, July 2004.
2. Sander van Vugt, "*Red Hat Enterprise Linux 6 Administratin* ", Wiley India Pvt Ltd, 2013
3. Jason W. Eckert, "*Linux+ Guide to Linux Certification*", 3rd edition, Paperback, 2012
4. Clif Flynt, Sarath Lakshman, Shantanu Tushar,"*Linux Shell Scripting Cookbook*", 3rd edition, Packt Publication, 2017
5. Peter Seebach, "*Beginning Portable Shell Scripting: From Novice to Professional (Expert's Voice in Open Source)*", Paperback, 2008

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 Fluid Dynamics**	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
		ISE1		1
4		**Control, Coordination and Regulatory Systems**		4
	4.1	Sense Organs	1	1
	4.2	Nervous systems		2
	4.3	Endocrine Systems (Pancreas and Diabetes, Thyroid and its functions)		1

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5	**Defense Systems**		1	3
	5.1	Integumentary System		1
	5.2	Immune System		2
6	**Molecular Biology and Genetical Information**		1	6
	6.1	Hereditary Molecules: DNA RNA		2
	6.2	Horizontal flow of Genetic Information		2
	6.3	Vertical flow of Genetic Information		2
	ISE2			1
			Total	**28**

Recommended Books:

1. Text book of Anatomy and Physiology for Nurses and allied Health Sciences by Indu Khurana & Arushi.
2. Simplified Course in Molecular Biology by V. K. Agarwal - S. Chand Publication.

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**

Recommended Books:-

1. Dr. B.S. Grewal, "Higher Engineering Mathematics" by Khanna Publication, New Delhi, 42nd Edition.
2. H.K. Das, "Advanced Engineering Mathematics,"by S.Chand Publication, New Delhi, 12th Revised Edition, 2004
3. Erwin Kreyszig, "Advanced Engineering Mathematics," by John Wiley Eastern Limited, UK 9th Edition,
4. Shanti Narayan, P. K. Mittal," A Text book of Matrices," by S. Chand publication, New Delhi, 11th 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 Narosa Publishing House, Mumbai, 9th Edition.
7. P.N. Wartikar and J.N.Wartikar, "A text book of Applied Mathematics, Vol – I and II by Vidyarthi Griha Prakashan, Pune. 9th Revised Edition, 2004.

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.

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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)

Recommended Books:

1. Kreyszig, "Advanced Engineering Mathematics", 9[th]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", 1st edition, Cengage Learning India, 2011
5. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 3rd edition, 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**
IT41	**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	

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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**

Recommended Books:

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. Sanjoy Dasgupta, Christos H. Papadimitriou, Umesh Vazirani, "*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**
IT42	**Computer Organization and Architecture**	3	-	-	3	-	-	3
		Examination Scheme						
		ISE		**MSE**		**ESE**		**Total**
		20		20		60		100

Pre-requisite Course Codes	IT32: Digital Logic Design and Analysis	
After successful completion of the course, student will be able to:		
Course Outcomes	CO1	Describe basic structure of computer.
	CO2	Apply arithmetic algorithm for solving problems.
	CO3	Compare different processor architectures.
	CO4	Describe the memory mapping techniques.
	CO5	Apply I/O concept for simulating I/O device operations.
	CO6	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

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	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, Allocation policies, Memory hierarchy and characteristics.	3	3
	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 Safwat Zaky, "*Computer Organization*", 5th edition, Tata McGraw-Hill, 2011.
2. John P. Hayes, "*Computer Architecture and Organization*", 3rd edition, Tata McGraw-Hill, 2012.
3. William Stallings, "*Computer Organization and Architecture: Designing* for *Performance*", 9th edition, Pearson, 2012.
4. B. Govindarajulu, "*Computer Architecture and Organization: Design Principles and Applications*", 2nd edition, Tata McGraw-Hill, 2010.
5. Dr. M. Usha, T. S. Srikanth, *"Computer System Architecture and Organization"*, 1st edition, Wiley India, 2012.
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*", 2nd edition, Schaum's Outline, Tata McGraw Hill,2010.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	**T**	**P**	**L**	**T**	**P**	**Total**
IT43	**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	**Introduction Database Concepts** Introduction, 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.		05
2		**Relational Algebra and SQL**	1,2,3	
	2.1	**Relational Algebra**		06
		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		

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3		Relational database design	1,2,3	
	3.1	**Integrity and Security in Database**		04
		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**		05
		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,		
	4.2	Recovery System		03
		Failure Classification, Storage structure, Recovery and atomicity, Log based recovery, Shadow paging.		
			Total	42

Recommended Books:

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
IT44	Operating Systems	3	--	2	3	--	1	4
		Examination Scheme						
		Theory Marks						
		ISE		MSE	ESE		Total	
		20		20	60		100	

Pre-requisite Course Codes	ITL36: Open Source Operating System Lab
	Student will be able to
Course Outcomes	CO1	Explain the basic functions of operating systems
	CO2	Make use of various process scheduling and disk scheduling algorithm
	CO3	Experiment inter process communication solution
	CO4	Categorize various memory management techniques
	CO5	Explain file systems
	CO6	Discover functions of operating systems in different environment

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 only.

Recommended Books:

1. Silberschatz A., Galvin P., Gagne G. "*Operating Systems Principles*", Willey, 9th edition.
2. William Stallings, "*Operating* Systems Internals and Design Principles", 7th edition.
3. Andrew S. Tanenbaum , Herbert Bos, "Modern Operating System", Pearson, 4th edition.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITL41	**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 IT31: 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.	Suggested List of Experiments (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

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6	Experiment on minimum spanning tree using Greedy approach	1,2,5	**5**
7	Experiment using Backtracking strategy 8 queen problem (N-queen problem) Sum of subsets Graph coloring, 15 puzzle problem Travelling salesman problem	2,3	**5**
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

Recommended Books:

1. T.H .Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, "*Introduction to algorithms*", 3rd edition, PHI publication 2009.
2. Ellis Horowitz, Sartaj Sahni, S. Rajasekaran. "*computer algorithms*" 2nd edition, Computer Science Press, 1997
3. Sanjoy Dasgupta, Christos H. Papadimitriou, Umesh Vazirani, "*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
ITL42	Computer Organization and Architecture Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	ITL32: Digital Logic Design and Analysis	
At the End of the 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	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**

Recommended Books:

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
ITL43	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.	Suggested List of Experiments	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 [1] 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. [1] 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. [1] Creation of serializability schedule.	1,2	5
8	Check for deadlock condition over database	1,2	5
	Total Marks		**40**

Recommended Books:
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			
ITL44	**Operating Systems Lab**	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
		--	--	2	--	--	1	1
		Examination Scheme						
		ISE		**MSE**		**ESE**		**Total**
		40		--		--		**40**

Pre-requisite Course Codes	ITL36: Open Source Operating System 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.	Suggested List of Experiments	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**

Recommended Books:

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
ITL45	Web Programming Lab - II	--	1	2	--	1	1	2
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	ES24: Programming Methodology and Data Structures ITL35: Web Programming Lab – I
After successful completion of the course, student will be able to:	

	ITL45.1	Build dynamic web pages using server side scripting
	ITL45.2	Apply session control over web pages
Course Outcomes	ITL45.3	Demonstrate web database connectivity via scripting language
	ITL45.4	Develop the server side of a web application using web development frameworks

Module No.	Topics	Ref.	Hrs.
1	**PHP Basics - I** Introduction to PHP, PHP Tags, Adding Dynamic content, Accessing form variables, Identifiers, user-declared variables, Data types, Constants, Operators, Control structures, Conditionals, Iteration constructs,	1,2	02
2	**PHP Basics - II** Using arrays, string manipulation and regular expressions, reusing code and writing functions	1,2	02
3	**PHP Sessions** Session Control in PHP	1,2	02
4	**PHP Database Connectivity** Designing and creating your web database, Accessing MySQL database from the Web with PHP	1,2	02
5	**Laravel Framework** Managing Your Project Controllers, Layout, Views, and Other Assets,	3	02
6	**Laravel Framework** Talking to the Database, Model Relations, Scopes, and Other Advanced Features, Integrating Web Forms,	3	02
7	**Laravel Framework** Authenticating and Managing Your Users, Deploying, Optimizing and Maintaining Your Application	2	02
		Total	**14**

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Exp. No.	Suggested List of Experiments	Ref.	Marks
1	**PHP Basics – I** 1. Write a function countWords($str) that takes any string of characters and finds the number of times each word occurs. 2. Write a PHP script for sorting an array.	1,2	05
2	**PHP Basics – II** Using arrays, string manipulation and regular expressions, reusing code and writing functions	1,2	05
3	**PHP Sessions** Create a Login.html page which will have user name and. In welcome page, display the user name with the help of sessions	1,2	05
4	**PHP Database Connectivity** Write a PHP file that will output a form containing 2 fields: username and password. Upon submission of the form, the code should check against the database to see whether the username-password pair was correct. If so, display a welcome message. If not, display the message "Invalid username or password" followed by the same login form. Once again, there should only be one PHP file, and you should redirect to the same place after submitting. The output should be one of three options: 1. The login form. 2. The welcome message, if successful login. 3. The invalid message and the login form, if failed login.	1,2	05
5	**Laravel Framework** Create a test PHP project with several files (e.g. login). Set the layout and views using Laravel.	3	05
6	**Laravel Framework** Integrate web forms and connect to the database via Laravel framework	3	05
7	**Laravel Framework** Deploy a test web project using Laravel framework	2	05
8	**Mini Project on server side scripting**	1,2,3	05
	Total Marks		**40**

Recommended Books:
1. L. Welling and L. Thomson, "*PHP and MySQL Web Development*", 5th edition, Addison Wesley, 2016.
2. Steven Holzner, "PHP: The Complete Reference", McGraw Hill Education, Indian Edition, 2007.
3. Martin Bean, *"Laravel 5 Essentials",* PACKT Publishing Ltd., 2015

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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

Recommended Books:

1. Sadashiv Nimbalkar, "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	Aswad prakriya	1
	Total	14

Recommended Books:

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. SahityaAdhyapan Ani Prakar- va.la. KulakarniGauravgranth(Marathi)
10. VachikAbhinay- Dr. ShriramLagoo (Marathi)
11. Rangnayak- Arwind Deshpande

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'<u>Activity Based Learning</u>'
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) <u>MOOT COURT:</u>

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:
1. It is optional module
2. Motivation, mentoring and preparation of students to pursue higher education
3. Modules as per national level technical competitive examination **GATE**
4. Motivation, mentoring and preparation of students to join public sector or government organizations like BARC, DRDO etc.
5. Motivation, mentoring and preparation of students to join top ranking technical institutes in country like IISc and IIT.
6. Module design as per the courses studies in that semester or prior semester by considering syllabus of GATE examination
7. Help to sharpen the problem solving skills of students and concerned teachers
8. Course mentors will be allotted at the start of academic year
9. Two (2) extra credits will be given if
10. Student submit **Valid Gate Score card**.
11. Must pass CEP1 to CEP6 in modal question papers given by the faculty
12. 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.

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

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

Numerical Ability
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

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