University of Mumbai

Syllabus

B. Tech. Information Technology
(Second Year Semester III and IV)

From
Academic Year 2019 – 20
(KJSCE 2018 CBGS Pattern)
Approved by Academic Council 13/12 /2019
SY B. Tech /IT / Revision 2.1

K. J. Somaiya College of Engineering, Vidyavihar, Mumbai – 77
(Autonomous College Affiliated to University of Mumbai)

It is notified for information of all concerned that the Board of Studies at its meeting held on December01,2018 and the subsequent meeting of the Academic Council held on May 18, 2019 amended the syllabus of SY B. Tech IT and same be brought in to force from Academic Year 2019-20 with immediate effect.

The amendment in courses Programming Laboratory II - Advanced Java(2UIL401) and Web Programming I(2UIL402) is approved in the meeting of Board of Studies held on Nov 16, 2019 and subsequent meeting of Academic Advisory Board held on 13/12/2019.

Dr. Irfan A Siddavatam
(Head, Department of Information Technology)

Preamble

Technology is an integral part of everyday life. An Engineering education in Information Technology gives broad exposure to various technical subjects that develop skills that are transferable to most industries such as problem solving, decision making, innovation, project management, team working and communication which will contribute to a rapidly changing technological environment.

Academic Autonomy conferred by the University of Mumbai from the Academic Year 2014-15, gave us the freedom to develop and implement our own curriculum KJSCE2014 with features such as inclusion of choice based Interdisciplinary Course (IDC), Audit Courses, Add on Credit Courses, Add on Audit Courses, Exposure Courses, etc.

Our revision in syllabus KJSCE2018, to be introduced from the academic year 2018-19 and 2019-20 for SY, has been designed based on the revised AICTE guidelines as well as various accrediting bodies. Some of the highlights of the KJSCE2018 syllabus are: more focus on hands on, wide choice for branch specific electives, more number of open or interdisciplinary electives, streamlined courses based on thrust areas, increased opportunity for internships, etc. Laboratory courses like Programming labs will enhance the practical skills of the students.

We at IT department of KJSCE endeavor continuously to enable our students to move forward and confidently embrace change rather than follow; to innovate rather than stagnate and to initiate rather respond to become efficient technocrats and dynamic entrepreneurs.

Dr. Irfan Siddavatam
Head, Department of Information Technology

Vision

To become a center of excellence for holistic education by preparing world class professionals in the dynamic field of Information Technology.

Mission

Providing quality education to

- Develop competent IT professionals with ethical values and enable them in lifelong learning.
- Promote conducive ambience for research and creativity.

Program Educational Outcomes (PEO)

A graduate of Information Technology will

PEO1: Excel in professional career and contribute to social needs through Information Technology

PEO2: Pursue higher education, conduct research, demonstrate professionalism and ethics

PEO3: Exhibit innovation, adaptability, team work, leadership and communication skills

Program Outcomes (PO):

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

PO9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO 1: Develop secure and reliable IT based solutions to real world operational problems using appropriate technologies
PSO 2: Perform data analysis and interpretation required for building knowledge based systems using intelligent computing techniques

Acronym for category of courses		Acronyms used in syllabus document	
Acronym	**Definition**	**Acronym**	**Definition**
BS	Basic Science Courses	**CA**	Continuous Assessment
ES	Engineering Science	**ESE**	End Semester Exam
HS	Humanities and Social Sciences including Management Courses	**IA**	Internal Assessment
PC	Professional Core Courses	**O**	Oral
PE	Professional Elective courses	**P**	Practical
OE	Open Elective Courses	**P&O**	Practical and Oral
LC	Laboratory Courses	**TH**	Theory
PR	Project	**TUT**	Tutorial
AC	Audit Course	**TW**	Term work
AOCC	Add on Credit Course	**T – 1**	Test – 1
AOAC	Add on Audit Course	**T – 2**	Test – 2
AVAC	Add on Value Audit Course	**CO**	Course Outcome
EX	Exposure Course	**PO**	Program Outcome
I	Interdisciplinary courses	**PSO**	Program specific Outcome

Acronyms used in Course code e.g. 2UTC301

Acronym Serially as per code	Definition
2	Second revision after autonomy KJSCE 2016 (First revision KJSCE 2014
U	Undergraduate
T	Department of Electronics and Telecommunication Engineering
C	Core Course
L	Laboratory Course
W	Workshop
T	Tutorial
X	Exposure Course
S	Common to all
A	Audit Course
3	3- Semester 3 / 4- Semester 4
01	Course No.

Semester III

Credit Scheme

Course Code	Course Name	Teaching Scheme Hrs.) TH – P –TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
2UIC301	Discrete and Applied Mathematics	3 – 0 – 1	04	3 – 0 – 1	04	BS
2UIC302	Data Structures$	3 – 0 – 0	03	3 – 0 – 0	03	PC
2UIC303	Database Management Systems	3 – 0 – 0	03	3 – 0 – 0	03	PC
2UIC304	Digital Systems	3 – 0 – 0	03	3 – 0 – 0	03	PC
2UIC305	Data Communication and Networking	3 – 0 – 0	03	3 – 0 – 0	03	PC
2UIL301	Programming Laboratory I@	0 – 2–1	03	0 –1 –1	02	LC
2UIL302	Data Structures Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
2UIL303	Database Management Systems Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
2UIL304	Digital Systems Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
2UIL305	Data Communication and Networking Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
Total		**15-10-02**	**27**	**15-05-02**	**22**	
2USA3XX	Audit Course&	02	02	–	–	AC

@ Students will have a choice of Java or Python Programming Language
$ Course common with Computer Engineering
& Completion of the course equivalent to 25 activity points

Examination Scheme

Course Code	Course Name	Examination Scheme								
		Marks								
		CA			ESE	TW	O %	P	P&O #	Total
		T – 1	T – 2	IA						
2UIC301	Discrete and Applied Mathematics	15	15	20	50	25	--	--	--	125
2UIC302	Data Structures$	15	15	20	50	--	--	--	--	100
2UIC303	Database Management Systems	15	15	20	50	--	--	--	--	100
2UIC304	Digital Systems	15	15	20	50	--	--	--	--	100
2UIC305	Data Communication and Networking	15	15	20	50	--	--	--	--	100
2UIL301	Programming Laboratory I@	--	--	--	--	50*	--	--	25	75
2UIL302	Data Structures Laboratory	--	--		--	25	--	-	25	50
2UIL303	Database Management Systems Laboratory	--	--	--	--	25	--	--	25	50
2UIL304	Digital Systems Laboratory	--	--	--	--	25	25	--	--	50
2UIL305	Data Communication and Networking Laboratory	--	--	--	--	25	25	--	--	50
Total		**150**		**100**	**250**	**175**	**50**	**--**	**75**	**800**
2USA3XX	Audit Course&	–		–	– –		–	--	--	–

$ Course common with Computer Engineering
@ Students will have a choice of Java or Python Programming Language
% Oral examination based on entire theory syllabus
 # Practical and Oral examination based on syllabus
***Term Work based on continuous assessment**
& Completion of the course equivalent to 25 activity points

Semester IV
Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
2UIC401	Probability, Statistics and Optimization Techniques $	3 – 0 – 1	04	3 – 0 – 1	04	BS
2UIC402	Information Theory and Coding	3 – 0 – 1	04	3 – 0 – 1	04	PC
2UIC403	Analysis of Algorithms	3 – 0 – 0	03	3 – 0 – 0	03	PC
2UIC404	Advanced Databases	3 – 0 – 0	03	3 – 0 – 0	03	PC
2UIL401	Programming Laboratory II @	0 – 2 – 2	04	0 – 1 – 2	03	LC
2UIL402	Web Programming – I Laboratory	0 – 2 – 2	04	0 – 1– 2	03	LC
2UIL403	Analysis of Algorithms Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
2UIL404	Advanced Databases Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	PC
Total		**12-08-06**	**26**	**12-04-06**	**22**	
2USA4XX	Audit Course &	02	02	--	--	AC

$ Course common with Computer Engineering
@ Students will have a choice of Advance Java or Advance Python Programming Language
& Completion of the course equivalent to 25 activity points

Examination Scheme

Course Code	Course Name	Examination Scheme Marks								
		CA			ESE	TW	O %	P	P&O #	Total
		T-1	T-2	IA						
2UIC401	Probability, Statistics and Optimization Techniques $	15	15	20	50	25	–	–	–	125
2UIC402	Information Theory and Coding	15	15	20	50	25	–	–	–	125
2UIC403	Analysis of Algorithms	15	15	20	50	--	–	–	–	100
2UIC404	Advanced Databases	15	15	20	50	--	–	–	–	100
2UIL401	Programming Laboratory-II @	--	--	--	--	50*	--	--	50	100
2UIL402	Web Programming – I Laboratory	--	--	--	--	50*	–	–	50	100
2UIL403	Analysis of Algorithms Laboratory	--	--	--	--	25	–	--	25	50
2UIL404	Advanced Databases Laboratory	--	--	--	--	25	–	--	25	50
Total		**120**		**80**	**200**	**200**	**--**	**--**	**150**	**750**
2USA4XX	Audit Course &	--		–	–	–	–	–	--	AC

$ Course common with Computer Engineering
@ Students will have a choice of Java or Python Programming Language
% Oral examination based on entire theory syllabus
 # Practical and Oral examination based on syllabus
***Term Work based on continuous assessment**
& Completion of the course equivalent to 25 activity points

Semester III

SY B. Tech. Information Technology
(KJSCE 2018)

Course Code	Course Title							
2UIC301	Discrete and Applied Mathematics							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	03			--		01		04
Credits Assigned	03			--		01		04
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50	25	--	--	--	125

Course prerequisites:

- Applied Mathematics-I
- Applied Mathematics –II

Course Objectives

The objective of this course is to introduce different methods of finding Laplace Transform and Inverse Laplace transform of given function. The course also familiarizes students with the concepts of Relations, functions and different discrete structures. It will familiarize the students with different concepts of graph theory.

Course Outcomes

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

CO1: Apply Different methods to find Laplace Transform and Inverse Laplace Transform of a function

CO2: Find Fourier series, Fourier Integral and Fourier Transform of functions.

CO3: Apply Relations, Functions and different discrete structures to solve Engineering problems.

CO4: Apply various concepts of Graph theory to solve Engineering problems.

Module No.	Unit No.	Details	Hrs.	CO
1	**Laplace Transform**		12	CO 1
	1.1	Definition of Laplace Transform, Laplace Transform of sin(at), cos(at), , sinh(at), cosh(at), erf(t), Heavi-side unit step, dirac-delta function, Laplace Transform of periodic function		
	1.2	Properties of Laplace Transform (without proof): Linearity, first shifting theorem, second shifting theorem, multiplication by t , division by t, Laplace Transform of derivatives and integrals, change of scale.		
	1.3	Inverse Laplace Transform: Partial fraction method, convolution theorem, Application of Laplace Transform: Solution of ordinary differential equations		
2	**Fourier Series**		10	CO2
	2.1	Introduction: Definition, Dirichlet's conditions, Euler's formulae		
	2.2	Fourier Series of Functions: Exponential, trigonometric functions, even and odd functions, half range sine and cosine series		
	2.3	Complex form of Fourier series		
3	**Relations and Functions**		9	CO 3
	3.1	Pigeon hole principle		
	3.2	Relations: Definition, Types of relations, Equivalence relations, Partial ordering relations		
	3.3	Functions: Definition, Types of functions: Injective, Surjective, Bijective, Invertible function, Composite function		
4	**Algebraic Structure**		6	CO 3
	4.1	Operations, Semi-groups, Groups, Rings, Integral Domains and Fields		
	4.2	Isomorphism and Homomorphism of groups		
5	**Graph Theory**		8	CO 4
	5.1	Introduction to graphs, graph terminology, representing graphs and graph isomorphism, connectivity.		
	5.2	Euler and Hamilton paths		
	5.3	Introduction to Planar graphs		
	5.4	Introduction to trees, Isomorphism of trees, Prefix code , application of trees to coding and decoding of a message		
		Total	45	

Term-Work will consist of Tutorials covering entire syllabus. Students will be graded based on continuous assessment of their term work.
At least 2 tutorials will be conducted with the help of Mathematical and Statistical software in the Laboratory.

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	B. S. Grewal	*Higher Engineering Mathematics*	Khanna Publications, India	43rd Edition 2014
2.	Erwin Kreyszig	*Advanced Engineering Mathematics*	Wiley Eastern Limited, India	10th Edition 2015
3.	N.P. Bali and Manish Goyal	*A Textbook of Engineering Mathematics*	Laxmi Publications LTD, India	9th Edition 2016
4.	Bernard Kolman, Robert Busby and Sharon C. Ross	*Discrete Mathematical Structures*	Pearson, India	6th Edition 2017
5.	P. N. Wartikar and J. N. Wartikar	*A text book of Applied Mathematics Vol I & II*	Pune Vidyarthi Gruha, India	6th Edition 2012

Course Code	Course Title							
2UIC302	Data structures[$]							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	03			-		-		03
Credits Assigned	03			-		-		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50	-	-	-	-	100

$ Course common with Computer Engineering

Course prerequisites:

- Any Programming Language

Course Objectives

The objective of this course is to introduce different types of data structure and how user can use data structure in software development. The course also familiarizes students with the concepts of advanced data structures such as balanced search trees, hash tables, priority queues, sorting and searching. Students will be master in the implementation of linked data structures such as linked lists and binary trees using any preferable language. Course mainly focuses on choosing the appropriate data structure for a specified application.

Course Outcomes

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

CO1: Explain the different data structures used in problem solving.
CO2: Apply linear and non-linear data structure in application development.
CO3: Describe concepts of advance data structures like set, map & dictionary.
CO4: Demonstrate sorting and searching methods.

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction**		**02**	**CO 1**
	1.1	**Introduction to Data Structures** Types of Data Structures, ADT (Abstract data type)		
2	**Linear data structure**		**16**	**CO 2**
	2.1	**Linked List:** Introduction, Representation of Linked List, Linked List v/s Array, Implementation of Linked List, Circular Linked List, Doubly Linked List, Application – Polynomial Representation and Addition, Other additional applications/Case study		
		# Self Learning- Sparse matrix addition		
	2.2	**Stack**: The Stack as an ADT, Stack operations, Array Representation of Stack, Linked Representation of Stack, Application of stack – Polish Notation, Recursion and Other applications/Case study		
		#Self Learning: Application of stack in evaluation of postfix and prefix expressions		
	2.3	**Queues**: The Queue as an ADT, Queue operation, Array Representation of Queue, Linked Representation of Queue, Circular Queue. Priority Queue, Double ended queue, Application of Queues – Simulation and other applications/Case study		
		#Self Learning: Application of queue in Josephus Problem.		
3	**Non-Linear data structures: Trees, Graph**		**12**	**CO 2**
	3.1	**Trees**: Basic trees concept, Binary tree representation, Binary tree operation, Binary tree traversal, Binary search tree implementation, Threaded binary trees. Different Search Trees -AVL tree, Multiway Search Tree, B Tree, B+ Tree, and Trie, Applications/Case study of trees.		
		#Self learning Learning – Red-Black and Splay Trees.		
	3.2	**Graph** - Introduction, Graph Terminologies, Representation, Graph Traversals – Depth First Search (DFS) and Breadth First Search (BFS). Applications/Case study of Graphs.		
4	**Non-Linear data structures: Set, Map, Dictionary**		**7**	**CO 3**
	4.1	**Set:** Set ADT**,** Set Implementation, Partitions with Union-Find operations, Tree based partition implementation. **Map:** Map ADT, Implementation, Hash Tables Application of Maps **Dictionary** : Dictionary ADT, Implementation,. Application of Dictionaries		
		#Self learning : Exploring case studies on use of set, map and dictionary		

5	**Searching and Sorting**		**8**	**CO 4**
	5.1	**Sorting** :Sort Concept, Sort Stability , Bubble Sort, Shell Sort, Counting Sort		
		#Self learning : Bucket and Radix sort		
	5.2	**Searching** : Search concept, Linear Search, Binary Search, Hashed List Search, Comparison of searching Techniques		
		Total	**45**	

 # Students should prepare all Self Learning topics on their own . Self-learning topics will enable students to gain extended knowledge of the topic. Assessment of these topics may be included in IA and Laboratory Experiments.

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Michael T Goodrich Roberto Tamassia David Mount	*Data Structure and Algorithm in C++*	Wiley	First Edition
2.	Richard F. Gilberg & Behrouz A. Forouzan	*Data Structures A Pseudocode Approach with C*	CENGAGE Learning	Second Edition
3.	Aaron M Tanenbaum Yedidyah Langsam Moshe J Augentstein	*Data structure Using C*	Pearson	Twelfth Impression 2013
4.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed	*Fundamentals Of Data Structures In C*	University Press	Second Edition
5.	Jean Paul Tremblay, Paul G. Sorenson	*An introduction to data structures with applications*	Tata McGraw-Hill Education	Second Edition

Course Code	Course Title							
2UIC303	Database Management Systems							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	3					-		03
Credits Assigned	3					-		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50					100

Course prerequisites: NIL

Course Objectives

This course is imparting knowledge of database management system and its use in enterprise business. It enables students to perform entity-relationship modeling and relational database design. Student will learn and use Structured Query Language (SQL). It gives knowledge of applying normalization techniques to the database. Along with it, students are also introduced to the concept of transaction and query processing.

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

CO1: Understand the features of Relational database management systems.
CO2: Apply data models to real world scenario.
CO3: Illustrate the concept of security, Query processing, indexing and Normalization for Relational database.
CO4: Apply the concept of transaction, concurrency control and recovery techniques

Module No.	Unit No.	Details	Hrs.	CO
1	**Database concepts and Systems**		6	CO1
	1.1	**Introduction-** Purpose of Database Systems, DBMS system architecture, Data Models, Data Independence		
	1.2	Database languages, Database Users and Administrator		
	1.3	Different types of Database Systems		
2	**Database Models and SQL**		9	CO 2
	2.1	Database design phases, E-R Model		
	2.2	Constraints, E-R Diagrams, E-R design issues		
	2.3	Entity set, Extended E-R features		
	2.4	Relational model concepts, Constraints		
	2.5	**Relational Algebra:** Unary, Binary and Set theory relational operations		
	2.6	Data definition commands, attribute constraints, SET operations, Aggregate functions, Null Values, Nested sub queries, complex queries, Views Data control commands		
	2.7	Data manipulation commands: Insert, Update, Joined relations		
	2.8	**Integrity and security:** Domain constraints, Referential integrity, Triggers; Security and Authorization in SQL		
3	**Relational Database Design**		10	CO 3
	3.1	Design guidelines for relational schemas, Functional dependencies		
	3.2	First Normal form, Second Normal form, Third normal form.		
	3.3	Decomposition using functional dependencies, Boyce Codd normal form; decomposition using multivalued dependencies, fourth normal form.		
	3.4	The database design and implementation process		
4	**Indexing, Hashing , Query processing and Optimization**		10	CO 3
	4.1	Basic concepts, ordered indices: dense and sparse, multilevel indices, secondary indices		
	4.2	Hashing: Static hashing, dynamic hashing, comparison of ordered indexing and hashing		
	4.3	Query processing: Steps involved in query processing, measures of query cost, algorithms for SELECT and PROJECT operations.		
	4.4	Optimization: Overview, Transformation of relational expressions, Estimating statistics, Choice of evaluation plan		
5	**Transactions, Concurrency control and Recovery system**		10	CO4
	5.1	Transaction Concepts, Transaction state, ACID properties, concurrent executions, Serializability, Recoverability.		
	5.2	Concurrency control: Lock based , Timestamp based, validation based protocol, Deadlock Handling		
	5.3	Recovery system: Failure classification, Recovery and Atomicity, Log based recovery, Shadow paging		
		Total	45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Elmasri and Navathe	*Fundamentals of Database Systems*	Pearson Education	7th Edition 2016
2.	Korth, Slberchatz,Sudarshan	*Database System Concepts*	McGraw – Hil	7th Edition 2016
3.	Raghu Ramakrishnan and Johannes Gehrke	*Database Management Systems*	McGraw Hill	3rd Edition 2014
4.	C.J Date	*Introduction to Database Systems*	Pearson Education	8th edition 2006

Course Code	Course Title							
2UIC304	Digital Systems							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	03			--		--		03
Credits Assigned	03			--		--		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50	--	--	--	--	100

Course prerequisites: Nil

Course Objectives

This course lays the foundation for understanding the basics of digital computing. They also learn simulation tools to design digital logic systems.

Course Outcomes

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

CO1: Solve problems on number system conversion and Boolean algebra.
CO2: Understand the basic building blocks, techniques used in digital logic design
CO3: Design the combinational and sequential circuits using basic building blocks and MSI devices.
CO4: Design basic logic circuits using VHDL.

Module No.	Unit No.	Details	Hrs.	CO
1	**Number Systems and Codes**		6	CO 1
	1.1	Introduction to digital Systems		
	1.2	Binary, Octal, Decimal and Hexadecimal number Systems, their conversion and Arithmetic.		
	1.3	Binary Addition and Subtraction (1's and 2's complement method)		
	1.4	Gray Code, BCD Code, Excess-3 code, ASCII code, Error Detecting Code: Even and Odd Parity, Minimum Distance.		
2	**Logic Gates and Boolean Algebra**		11	CO 2
	2.1	Basic Digital Circuits: NOT,AND,OR,NAND,NOR,EX-OR,EX-NOR		
	2.2	Theorems and Properties of Boolean Algebra, Standard SOP and POS form. Simplification of expressions.		
	2.3	K-map method (2,3,4) ,Quine McClusky Method (4,5) . NAND-NOR Realization.		
3	**Combinational Logic Design**		12	CO 3
	3.1	Introduction, Half and Full Adder, Half and Full Subtractor, Carry Look ahead adder, 4 bit binary adder using IC 7483, one digit BCD Adder, Four Bit Binary Subtractor (1's and 2's compliment method)		
	3.2	Multiplexers and Demultiplexers/Decoder using Logic gates and using MSI devices IC 74151,74138, Binary Encoder, Priority Encoder, Code Conversion		
	3.3	Design of One bit, Two bit Magnitude Comparator, 4-bit Magnitude Comparator using IC 7485.		
4	**Sequential Logic Design**		12	CO 3
	4.1	Flip Flops: SR, D, JK, (IC 7476) JK Master Slave and T Flip Flop, Truth Tables and Excitation Tables, Flip-flop conversion. Design of sequential circuit using state equations		
	4.2	Counters: Design of Asynchronous and Synchronous Counters , Modulo Counters, UP- DOWN counter.		
	4.3	Shift Registers: Bidirectional Shift Register, Universal Shift Register, Ring and Johnson Counter.		
5	**VHDL Programming**		04	CO4
	5.1	Introduction to VHDL, Framework of VHDL program. Implementation of combinational and sequential logic circuits using VHDL		
		Total	45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	R. P. Jain	Modern Digital Electronics	Tata McGraw Hill	4th Edition 2009
2.	Donald p Leach, Albert Paul Malvino	Digital principles and Applications	Tata McGraw Hill	8th Edition 2014
3.	J. Bhasker Yalamanchili	A VHDL Primer	Phi Learning Private Limited	3rd Edition 2015
4.	Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss	Digital Systems – Principles and Applications	Pearson	10th Edition 2009

Course Code	Course Title							
2UIC305	Data Communication and Networking							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	03			--		--		03
Credits Assigned	03			--		--		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50			--	--	100

Course prerequisites:

- Fundamentals of Computer programming.

Course Objectives

This course provides an understanding of the concepts and mechanisms underlying the telecommunications and networking. Starting with the basics of data communication and types of networks, it introduces the transmission media. It also explains how two public networks, telephones and cable TV can be used for data transfer. A thorough background of the ISO-OSI model and the TCP/IP model will be given. The Application layer, Transport layer, Internet layer, Data link layer and Physical layers are covered in detail along with the protocols used. Top-down approach is used for this course will give students a better perception in terms of both usefulness and ease of understanding.

Course Outcomes

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

CO1: Understand the data communication systems, network topologies and network devices

CO2: Enumerate the layers of the OSI model and TCP/IP model, their functions and Protocols.

CO3: Build the skills of sub-netting and routing mechanisms.

CO4: Execute their knowledge of computer communication principles, including Error detection and correction, multiplexing, flow control, and error control.

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction**		05	CO 1
	1.1	Introduction: Data Communications, Networks, The Internet , Protocols and Standards, Uses of Computer networks		
	1.2	Network Models: Layered tasks ,The OSI Model, Layers in the OSI Model, TCP/IP Protocol Suite		
2	**The Application Layer**		09	CO 2
	2.1	Introduction: Providing services, Application layer paradigm, Client Server paradigm: Application programming Interface, Using services of the Transport layer.		
	2.2	Standard client server applications: Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Remote Logging(Telnet), Email(SMTP,MIME,POP3) , File Transfer(FTP) and SNMP		
3	**The Transport Layer**		07	CO 2
	3.1	The Transport Layer Services, Protocols: UDP, TCP		
	3.2	User datagram protocols: User datagram, services and UDP application		
	3.3	TCP features and services, Flow control, Error Control, Congestion Control, TCP segment, TCP Connection Establishment, Data transfer , TCP Connection Release		
4	**The Network Layer**		08	CO 3
	4.1	Network Layer Design Issues, IP Addressing, Sub-netting		
	4.2	The Network Layer In The Internet: The IP Protocol, IPv4 header, IPv6 header, Routing Algorithms, Congestion Control Algorithms, Quality Of Service		
	4.3	**# Self learning: Internet Control protocols, Routing protocols (Intra-domain-RIP,OSPF and Inter-domain-BGP)**		
5	**The Data Dink Layer & Physical layer (Host layer)**		16	CO4
	5.1	Error detection and correction: Types of errors, redundancy, detection versus correction, forward error correction versus retransmission, Error detection, Error correction, Hamming Code ,CRC, Checksum		
	5.2	Data Link Control: Framing, Fixed size and variable size framing; Flow and Error control, Protocols for Noiseless and Noisy Channels, Piggybacking, HDLC,PPP. Multiple Access: Random Access, Controlled Access, Channelization.		

	5.3	Data and Signals: Analog and Digital Signals, Transmission impairments, Data Rate Limits, Performance. Digital transmission: Digital –to-Digital Conversion, Analog –to-Digital Conversion. Analog transmission: Digital –to-Analog Conversion, Analog –to-Analog Conversion.		
	5.4	Transmission Media: Guided Media, Unguided Media, Switching and Multiplexing.		
		Total	**45**	

 # Students should prepare all self-learning topics on their own. Self-learning topics will enable students to gain extended knowledge of the topic. Assessment of these topics may be included in IA and Laboratory.

Recommended Books:

Sr. No.	**Name/s of Author/s**	**Title of Book**	**Name of Publisher with country**	**Edition and Year of Publication**
1.	B. A. Forouzan and Firouz Mosharraf	*Computer Networks A Top down Approach*	Tata McGraw Hill,India	1st Edition, 2011
2.	James F. Kurose and Keith W. Ross	*Computer Networking: A top down approach*	Peason, India	5th Edition, 2012
3.	A. S. Tanenbaum	*Computer Networks*	Prentice Hall, India	5th Edition, 2014
4.	B. F. Ferouzan	*TCP/IP Protocol Suite*	Tata McGraw Hill,India	4th Edition,2010
5.	Williams Stallings	*Data & Computer communications*	Pearson	9th Edition, 2017

Course Code	Course Title							
2UIL301	Programming Laboratory – I@							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		01		03
Credits Assigned	--			01		01		02
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	--	--	--	--	50*	--	--	25	75

@ Java Programming Language
* Term Work based on continuous assessment

Course prerequisites:

- Knowledge of Programming language(2UHL106)

Course Objectives

The objective of the course is to impart the fundamentals of Object Oriented Programming using JAVA programming language. The course emphasizes identifying simple real world problems and providing solution to them using object oriented paradigms.

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

CO1: Comprehend the need and features of object oriented programming.
CO2: Apply object oriented design methodology using JAVA programming.
CO3: Demonstrate the concept of exceptions handling.
CO4: Illustrate the concept of user defined package and multithreading in JAVA.

Module No.	Unit No.	Details	Hrs.	CO
1	**Principles of Object-Oriented Programming**		01	CO 1
	1.1	Need of Object Oriented Programming, Comparison of Procedural and Object Oriented Approach		
	1.2	Characteristics of OOPs–Object, Classes, Polymorphism, Inheritance, Reusability, Data Hiding and Abstraction etc		
	1.3	Features of Java, JDK		
2	**Classes, Array and String**		05	CO 2
	2.1	Class, Object , Method, Member, Dot Operator, Command Line Argument, Input Output using Scanner Class and Buffer-reader Class,		
	2.2	Constructor, Constructer Overloading , Destructor		
	2.3	One Dimensional Array, One Dimensional Array, Multidimensional Array, Array of an Object		
	2.4	String Class and Methods		
	2.5	String-Buffer Class and Methods		
3	**Inheritance, Interface**		04	CO 2
	3.1	Types of Inheritance: Single, Multilevel, Hierarchical		
	3.2	Access Specifiers		
	3.3	Method Overloading, Method Overriding		
	3.4	Final class, Abstract Class and Method		
	3.5	Interface, Multiple Inheritance		
4	**Managing Exception**		02	CO3
	4.1	Try, Catch, Finally, Throw, Throws,		
	4.2	Inbuilt Exception Handling		
	4.3	User Defined Exceptions Handling		
5	**Package, Multithread Programming**		03	CO4
	5.1	Creating and Using User Defined Package		
	5.2	Introduction to Multithreading, Thread Lifecycle		
		Total	15	

Term-Work will consist of Tutorials and laboratory work covering entire syllabus.
Students will be graded based on continuous assessment of their term work
Practical and Oral examination based on laboratory experiments and entire syllabus

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Herbert Schildt	*Java: The Complete Reference*	Tata McGraw-Hill Publishing Company Limited	10th Edition 2017
2.	Sachin Malhotra, Saurab Choudhary	*Programming in Java*	Oxford University Press	2nd Edition 2018
3.	Dt Editorial Services	*Java 8 Programming Black Book*	Dreamtech	Edition 2015

Course Code	Course Title							
2UIL301	Programming laboratory -1@							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	-			02		01		03
Credits Assigned	-			01		01		02
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	-	-	-	-	50*	-	-	25	75

@Python Programming Language
*Term Work based on continuous assessment

Course prerequisites

- Knowledge of programming languages.

Course Objectives

The objective of the course is to impart knowledge of python programming. The course mainly introduces basic in python programming language concepts like data structures, Decision Making statements and Functions. Further the course also covers Object Oriented Programming concepts and Files Handling in Python.

Course Outcomes

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

CO1: Use basic data structures in Python
CO2: Use different Decision Making statements and Functions in Python.
CO3: Apply Object oriented programming concepts in Python
CO4: Implement different File handling operations

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction Python**		01	CO 1
	1.1	Introduction, Features of Python, Installation of IDE for python		
	1.2	Spyder and Jupyter Notebook		
2	**Programming with python: Basic Concepts**		03	CO1
	2.1	Data Types in Python, Basic & Built-in Math functions, Number Formats, Strings, Quotes, print() Function, Variables, Operators in Python, Copying Data: Shallow Copy and Deep Copy		
	2.2	**Data Structures:** Tuples — Unchanging Sequences of Data, list— Unchanging Sequences of Data, Dictionaries— Groupings of Data Indexed by Name, Special String, Substitution Using Dictionaries , Arrays Treating a String Like a List, Special Types Ranges of Sequences, Working with Sets and Arrays		
3	**Programming with python: Decision Making and Functions**		03	CO2
	3.1	If statement: if, if-else, elif, Repetition using While loop, for loop, break statement		
	3.2	**Functions-** Defining a Function, Checking & Setting Parameters, Nested Functions, Closures, Factory Function, Decorators, Lambda and Filter, Map & range functions.		
4	**Object Oriented Programming using Python programming**		05	CO3
	4.1	Class, Object, Self-Variables, Constructors, Types of Methods, Access Modifiers		
	4.2	Inheritance and types, constructor in inheritance, The super() Method, Method Resolution order(MRO)		
	4.3	Polymorphism,		
	4.4	Exceptions Handling: Errors in python program, Exceptions, Exception Handling, Types of Exceptions, The Except Block, The assert statement		
	4.5	Multithreading in Python		
5	**Files Handling**		03	CO4
	5.1	Types of Files in Python, Opening a File, Closing a File. Writing Text Files, Knowing Whether a File Exists or Not		
	5.2	Working with Binary Files, Appending Text to a File, Reading Text Files, File Exceptions, The with Statement Pickle in Python		
		Total	15	

Term-Work will consist of Tutorials and laboratory work covering entire syllabus.
Students will be graded based on continuous assessment of their term work
Practical and Oral examination based on laboratory experiments and entire syllabus

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Reema Thareja	*Python Programming: Using Problem Solving Approach*	Oxford University Press	First Edition 2017, India
2.	Dr. R. Nageswara Rao	*Core Python Programming*	Wiley Publication.	Second Edition 2018,India
3.	Sheetal Taneja and Naveen Kumar	Python Programing: A Modular Approach	Pearson India	Second Edition 2018, India
4.	Swarroop C.H	*Byte of python*	e-book	Kindle edition
5.	Martin C Brown	*The Complete Reference Python*	Brandon A Nordin	First Edition 2001

Course Code	Course Title							
2UIL302	Data Structures Laboratory							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		--		02
Credits Assigned	--			01		--		01
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	--	--	--	--	25	--	--	25	50

- **Term-Work will consist of practical covering entire syllabus of "Data Structures" (2UIC302). Students will be graded based on continuous assessment of their term work.**
- **Practical and Oral Examination will be based on laboratory work and entire theory syllabus of "Data Structures" (2UIC302).**

Course Code	Course Title							
2UIL303	Database Management Systems Laboratory							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		-		02
Credits Assigned	--			01		-		01
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	-	-	-	-	25	-	-	25	50

- **Term-Work will consist of practical covering entire syllabus of "Database Management Systems laboratory" (2UIC303). Students will be graded based on continuous assessment of their term work.**
- **Practical and Oral Examination will be based on laboratory work and entire theory syllabus of "Database Management Systems laboratory" (2UIC303).**

Course Code	Course Title								
2UIL304	Digital Systems Laboratory								
	TH			P		TUT		Total	
Teaching Scheme(Hrs.)	--			02		--		02	
Credits Assigned	--			01		--		01	
Examination Scheme	Marks								
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	--	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Digital systems" (2UIC304). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Digital systems " (2UIC304).**

Course Code	Course Title								
2UIL305	Data Communication and Networking								
	TH			P		TUT		Total	
Teaching Scheme(Hrs.)	--			02		--		02	
Credits Assigned	--			01		--		01	
Examination Scheme	Marks								
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	--	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Data Communication and Networking" (2UIC305). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Data Communication and Networking " (2UIC305).**

Semester IV

SY B. Tech. Information Technology

(KJSCE 2018)

Course Code	Course Title							
2UIC401	Probability, Statistics and Optimization Techniques[$]							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	03			--		01		04
Credits Assigned	03			--		01		04
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50	25	--	--	--	125

$ Course common with Computer Engineering

Course prerequisites:

- Basics of Statistics and Probability
- Introductory LPP

Course Objectives

This course Exposes students to the concepts of Correlation, Regression for given bivariate data. Students are made familiar with different discrete and continuous probability distributions. The course acquaints students with concepts of Large sample test, Small sample test and Chi – Square test. The course familiarizes students with different methods of solving Linear and Non Linear Programming problems. Some basic queuing theory models are also discussed in the course.

Course Outcomes

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

CO1: Apply concepts of correlation, regression for given bivariate data.
CO2: Apply concepts of Binomial, Poisson, Exponential and Normal distribution to solve Engineering problems.
CO3: Apply Large sample test and small sample test to analyze collected data.
CO4: Apply concepts of Linear and Nonlinear programming methods to solve problems.
CO5: Solve Problems based on single server limited queue and single server unlimited queue models.

Module No.	Unit No.	Details	Hrs.	CO
1	**Correlation and Regression**		06	CO 1
	1.1	Correlation, Co-variance, Karl Pearson Coefficient of Correlation & Spearman's Rank Correlation Coefficient		
	1.2	Regression Coefficients , lines of regression & logistic regression		
2	**Probability and Probability Distribution**		12	CO 2
	2.1	Conditional Probability, Bayes' theorem, Joint Probability		
	2.2	Discrete and Continuous Probability Distribution		
	2.3	Binomial Distribution, Poisson Distribution		
	2.4	Uniform Distribution, Normal Distribution, Exponential Distribution		
3	**Sampling Theory**		07	CO 3
	3.1	Sampling distribution. Test of Hypothesis. Level of significance, critical region. One tailed and two tailed tests. Interval Estimation of population parameters. Large and small samples.		
	3.2	Difference between sample mean and population means for large samples, Test for significance of the difference between the means of two large samples.		
	3.3	Student's t-distribution: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two Samples, paired t-test.		
	3.4	Chi-square distribution as a Test of Independence, Test of the Goodness of fit and Yate's correction.		
	3.5	Fisher's z-test		
4	**Optimization Techniques**		13	CO 4
	4.1	Types of solution, Standard and Canonical form of LPP, Basic and feasible solutions, simplex method.		
	4.2	Artificial variables, Big –M method (method of penalty).		
	4.3	Duality and Dual Simplex method.		
	4.4	Unconstrained optimization, problems of two or three variables with one equality constraint using Lagrange's Multiplier method.		
	4.5	Problems of two or three variables with one inequality constraint using Kuhn-Tucker conditions		
5	**Queuing Theory**		07	CO5
	5.1	Introduction, Features of Queuing, solution of Queuing models.M/M/1(Singal Server ,Unlimited Queue Model)		
	5.2	M/M/1 Singal Server, limited Queue Model		
		Total	45	

Term-Work will consist of Tutorials covering entire syllabus. Students will be graded based on continuous assessment of their term work.
At least 2 tutorials will be conducted with the help of Mathematical and Statistical software in the Laboratory.

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	B. S. Grewal	*Higher Engineering Mathematics*	Khanna Publications, India	43rd Edition 2014
2.	Erwin Kreyszig	*Advanced Engineering Mathematics*	Wiley Eastern Limited, India	10th Edition 2015
3.	J. K. Sharma	*Operation research: Theory and Applications*	Laxmi Publications, India	6th Edition 2017
4.	S.C.Gupta and V.K.Kapoor	*Fundamentals of Mathematical Statistics*	Sultan Chand & Sons	11th Edition 2009
5.	Ronald E.Walipole, Raymond H.Myers	*Probabilities & Statistics for Engineers & Scientists*	Pearson Education	9th Edition 2010

Course Code	Course Title							
2UIC402	Information Theory and Coding							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	03			--		01		04
Credits Assigned	03			--		01		04
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50	25	--	--	--	125

Course prerequisites:

- Basic concepts of Discrete Mathematics, Computer networks

Course Objectives:

The objective of the course is to impart knowledge of foundation of Information theory – the theory that provides quantitative measures of information and allows us to analyze and characterize the fundamental limits of communication systems. It includes detailed knowledge of compression techniques and error control methods . The Course also covers concept of basic number theory which forms the foundation for the cryptography.

Course Outcomes:

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

CO1: Understand basics of Information Theory, Information Source and Channel.
CO2: Illustrate different Data Compression algorithms.
CO3: Demonstrate the concepts and techniques for error detection and correction.
CO4: Apply basic number theory concepts for securing information.

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Module No.	Unit No.	Details	Hrs.	CO
1	**Basics of Information Theory**		6	CO 1
	1.1	Introduction, Measure of Information, Entropy, Information Rate		
	1.2	Joint and Conditional entropies, Mutual Information		
	1.3	Channel models, Channel Capacity, Shannon's Theorem		
2	**Source Codes**		10	CO 2
	2.1	Introduction, Coding parameters, Source coding Theorem		
	2.2	Classification of Codes, Shannon-Fano coding		
	2.3	Huffman coding, Arithmetic coding		
	2.4	LZW coding, Run Length Encoding, Image Compression		
3	**Error Control Code :Linear block code**		10	CO 3
	3.1	Introduction, Types of codes, Types of Errors, Error Control Strategies, Modular Arithmetic, Galois field, Primitive root.		
	3.2	Linear block codes-Introduction, Generator matrices, Parity check matrices.		
	3.3	Error syndrome, Error detection, Error detecting and error correcting capability.		
	3.4	Standard Array and Syndrome, Decoding, Hamming Code.		
4	**Error Control Code: Cyclic code and Convolution code**		09	CO 3
	4.1	Cyclic codes- Introduction, Generation, Syndrome computation and error detection, Decoding.		
	4.2	Cyclic Hamming code, Golay code, Cyclic Redundancy Check.		
	4.3	Convolution codes- Introduction, Tree and Trellis Codes		
	4.4	Encoding, Decoding, Applications		
5	**Basic Number Theory**		10	CO4
	5.1	Solving ax+by=d, Congruences , Chinese Remainder Theorem.		
	5.2	Modular Exponentiation, Fermat's Little and Euler Theorem		
	5.3	Quadratic Residue, Legendre and Jacobi Symbols		
	5.4	Prime Number Generation, Random Number Generation.		
	5.5	Introduction to Cryptography: Symmetric and Asymmetric		
		Total	45	

Term Work will consist of Tutorials covering entire syllabus. Students will be graded based on continuous assessment of their term work

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	ArijitSaha, Nilotpal Manna, SurajitMandal	*Information Theory Coding and Cryptography*	Pearson Education, India	First Edition 2013
2.	Ranjan Bose	*Information Theory Coding and Cryptography*	TMH, India	Third Edition 2016
3.	Khalid Sayood	*Introduction to Data Compression*	Elsevier	Fourth Edition, 2013
4.	Trappe and Washington	*Introduction to Cryptography with Coding theory*	Pearson, India	Second Edition 2006
5.	S Gravano	*Introduction to Error Control Codes*	Oxford University Press	First Edition 2007

Course Code	Course Title							
2UIC403	Analysis of Algorithms							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	03			--		--		03
Credits Assigned	03			--		--		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50	--	--	--	--	100

Course prerequisites:

- Data Structures

Course Objectives

The objective of the course is to the introduce fundamentals of analysis of algorithms. The specifications and process for algorithm analysis is covered using sample algorithms. The course helps understanding efficiency of algorithms and comparison of algorithms based on efficiency. The course also covers different algorithm design strategies, along with examples..

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

CO1: Analyze time and space complexity of algorithms
CO2: Implement Divide and Conquer algorithms with recurrence
CO3: Implement Greedy and Dynamic Programming algorithms
CO4: Understand Backtracking and Branch-and-bound algorithms

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to Analysis of Algorithms**		8	CO1
	1.1	Introduction : Computation and Efficiency: Discussion of Computational tractability and defining efficiency		
	1.2	Asymptotic order of growth : Asymptotic notations		
	1.3	Common running times : Linear, quadratic, logarithmic etc.		
	1.4	Insertion Sort		
	1.5	Selection Sort		
	1.6	Radix sort		
	1.7	Naïve String Matching Algorithms		
		#**Self learning topic: Shell Sort, Bucket Sort, Rabin Karp Algorithm for Pattern Matching**		
2	**Divide and Conquer algorithms**		8	CO2
	2.1	Introduction to Divide and Conquer approach :Binary Search		
	2.2	Recurrences : Recurrence relations, Solving recurrence with recursion tree method, substitution method and Master's theorem		
	2.3	Merge sort		
	2.4	Quick sort		
	2.5	Strassen's Matrix Multiplication Algorithm		
	2.6	Multiplication of Large Integers		
3	**Greedy Algorithms**		9	CO3
	3.1	The Greedy approach		
	3.2	Minimum Spanning Trees : Prim's algorithm, Kruskal's algorithm		
	3.3	Single Source Shortest Paths: Dijkstra's algorithm		
	3.4	Ford-Fulkerson Algorithm		
	3.5	Huffman Algorithm		
	3.6	Knapsack Problem : 0/1 Knapsack, Fractional Knapsack		
	3.7	Job Sequencing: With and Without Deadlines		
		#**Self learning topic: Travelling Salesman Problem using Greedy Approach**		
4	**Dynamic Programming Algorithms**		10	CO3
	4.1	Dynamic Programming and Optimization problems		
	4.2	Optical Binary Search Trees		
	4.3	All Pair Shortest Path: Floyd-Warshall Algorithm		
	4.4	Sequence Alignment		
	4.5	Matrix Chain Multiplication		
	4.5	Longest Common Subsequence		
		#**Self learning topic: Travelling Salesman Problem using Dynamic Programming**		
5	**Backtracking and Branch and Bound Algorithms**		10	CO4
	5.1	The Backtracking Technique		
	5.2	n-Queens Problem		
	5.3	Hamiltonian Circuit Problems		
	5.4	Sum of Subsets Problem		

	5.5	0/1 Knapsack Problem (Branch and Bound)		
	5.6	Travelling Salesman Problem (Branch and Bound)		
	5.7	15 Puzzle Problem (Branch and Bound)		
		#Self learning topic: 0/1 Knapsack Problem using Backtracking		
		Total	**45**	

 # Students should prepare all self-learning topics on their own. Self-learning topics will enable students to gain extended knowledge of the topic. Assessment of these topics may be included in IA and Laboratory.

Recommended Books:

Sr. No.	**Name/s of Author/s**	**Title of Book**	**Name of Publisher with country**	**Edition and Year of Publication**
1.	Richard E. Neapolitan	*Foundation of Algorithms*	Jones & Bartlett Students Edition	5th Edition 2016
2.	Harsh Bhasin	*Algorithms : Design & Analysis*	Oxford Higher education, India	1st Edition 2013
3.	T.H. Coreman , C.E. Leiserson,R.L. Rivest, and C. Stein	*Introduction to algorithms*	Prentice Hall India Publication	3rd Edition 2009
4.	Jon Kleinberg, Eva Tardos	*Algorithm Design*	Pearson India Education Services Pvt. Ltd.	10th Edition 2013
5.	Jeffrey J. McConnell	*Analysis of Algorithms : An Active Learning Approach*	Jones and Bartlett Student Edition	2nd Edition 2017

Course Code	Course Title							
2UIC404	Advanced Databases							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	03					--		03
Credits Assigned	03					--		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	15	15	20	50	--	--	--	--	100

Course prerequisites:--

- Database Management systems

Course Objectives

The course will impart the skills that can help design and develop advanced database models. Students will be able to select appropriate advanced database model depending on the application requirement. This course will also make them aware of challenges and limitations while implementing the models. Further, the student will learn that how enterprise can organize and analyze large amounts of data by creating a data warehouse.

Course Outcomes

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

CO1: Design advanced database systems using Parallel, Distributed and In-memory Databases and its implementation.

CO2: Design advanced database systems using Object Relational, Spatial and NOSQL Databases and its implementation

CO3: Understanding of data warehouse and its multi-dimensional modeling

CO4: Apply ETL processing and Online Analytical Processing on the warehouse data.

Module No.	Unit No.	Details	Hrs.	CO
1	**Parallel and Distributed Databases**		10	CO 1
	1.1	Parallel Database Concepts, Parallel Query Evaluation		
	1.2	Parallelizing Individual Operations-Sorting, Join		
	1.3	Distributed Database - Concepts, Types , Architecture		
	1.4	Distributed Database Design - Data Fragmentation, Replication, and Allocation Techniques		
	1.5	Query Processing and Optimization in Distributed Databases		
	1.6	Concurrency Control and Recovery in Distributed Databases		
	1.7	In-memory Databases : Architecture, in- memory database vs disk residence database, practical applications of in-memory databases, challenges of in-memory database		
2	**Object Based, Spatial Databases and NOSQL Databases**		10	CO 2
	2.1	Features Of Object based DBMS		
	2.2	Database Design concepts for an ORDBMS		
	2.3	Nested Relations and Collections		
	2.4	Spatial Database Components, Spatial Objects		
	2.5	Spatial Dimensions, Spatial Relations, Spatial SQL Queries		
	2.6	NOSQL databases: What is NOSQL? , NOSQL business drivers		
	2.7	NOSQL data architectural patterns: Document type, Key-Value, Graph and Column family		
3	**Introduction to Data Warehousing and multi-dimensional Modeling**		10	CO 3
	3.1	Operational Vs Decisional Support System ,The Need for Data Warehousing		
	3.2	Data Warehouse Definition, Features , The Information Flow Mechanism, Architecture , Role of Metadata, Classification of Metadata		
	3.3	Data Warehouse Vs Data Marts, Data Warehousing Design Strategies, Data Warehouse Modeling Vs Operational Database Modeling		
	3.4	The Star Schema - Fact Tables and Dimension Tables, The Fact less Fact Table, Keys in the Data Warehouse Schema- Primary Keys, Surrogate Keys & Foreign Keys, The Snowflake Schema, Fact Constellation Schema(Family of Stars)		
	3.5	Updates To Dimension Tables - Slowly Changing Dimensions, Type 1, Type 2 and Type 3 Changes, Large Dimensions , Rapidly Changing Dimensions, Junk Dimensions, Aggregate Fact Tables		
	3.6	Data lake, Architecture of Data lake, Data Warehouse Vs Data lake		

4	**ETL Process**		**09**	**CO4**
	4.1	Introduction to ETL Process		
	4.2	Data Extraction - Identification of Data Sources, Types - Immediate Data Extraction and Deferred Data Extraction		
	4.3	Data Transformation: Tasks Involved in Data Transformation		
	4.4	Data Loading: Techniques, Loading the Fact Tables and Dimension Tables		
	4.5	Data Quality, Issues in Data Cleansing		
5	**Online analytical processing (OLAP)**		**06**	**CO4**
	5.1	Need for Online Analytical Processing; OLTP Vs OLAP, OLAP and Multidimensional Analysis		
	5.2	OLAP Operations in Multidimensional Data Model - Rollup, Drill-down, Dice, Slice and Pivot		
	5.3	OLAP Models: MOLAP, ROLAP, HOLAP		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Elmasri and Navathe	*Fundamentals of Database Systems*	Pearson Education	7th Edition 2015
2.	Korth, Slberchatz,Sudarshan	*Database System Concepts*	McGraw – Hil	6th Edition 2010
3.	Raghu Ramakrishnan and Johannes Gehrke	*Database Management Systems*	McGraw Hill	3rd Edition 2002
4.	Paulraj Ponniah,	*Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals*	Wiley India	2nd Edition 2009
5.	McCreary, D., and Kelly	*Making sense of NoSQL*	Manning Press	2014

Course Code	Course Title							
2UIL401	Programming Laboratory-II@							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		02		04
Credits Assigned	--			01		02		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	--	--	--	--	50*	--	--	50	100

@ Advanced Java
*Term Work based on continuous assessment

Course prerequisites:

- Basic knowledge of Java Programming (Programming Laboratory-I 2UIL301)

Course Objectives

The course aims to introduce the designing of the Graphical User Interface using Swing packages in Java. Through collection framework, the technique to represent and manipulate collections in Java is introduced. Advanced features of Java are studied. Networking concepts like socket programming, client-server communication using Servlet and JSP are introduced. Java application using Java Database Connectivity is developed and Java Persistence API (JPA) is introduced.

Course Outcomes :

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

CO1: Demonstrate use of Swing to design user interface and use of collection framework for storing data dynamically
CO2: Illustrate the wiring of front end with back end of Java application using database connectivity
CO3: Illustrate networking concepts such as socket programming and web based client-server communication
CO4: Understand the concept of design patterns and object relational features with Java.

Module No.	Unit No.	Details	Hrs.	CO
1	**GUI Programming with Java**		**06**	**CO 1**
	1.1	Introduction to GUI Programming and its importance		
	1.2	Swing in Java, Swing Class hierarchy, Swing Event Handlers, Swing Action Listeners		
2	**Collection Framework**		**06**	**CO 1**
	2.1	Introduction to Iterators		
	2.2	Collection interfaces		
	2.3	Collection classes		
	2.4	Lambda Expression, Functional Interface and Assertions		
3	**JDBC-Java Database Connectivity**		**06**	**CO 2**
	3.1	Introduction to JDBC		
	3.2	JDBC Drivers		
	3.3	CRUD operations using JDBC		
	3.4	Connection to Non-conventional databases		
4	**Basic Communication and Web Programming with Java**		**06**	**CO 3**
	4.1	Basic Network Communication with Java through Socket Programming		
	4.2	Web Server and its role in Communication, Client – Server Side Programming with Java using Servlet and JSP		
	4.4.	Introduction to JAVA Restful Services		
5	**Design Patterns and Object Relational Concepts**		**06**	**CO 4**
	5.1	Singleton design pattern, Factory Pattern, Decorator Pattern, Iterator Pattern		
	5.2	Java Persistence API (JPA),JPA Entity ,Mapping Inheritance and SQL		
		Total	**30**	

Term-Work will consist of Tutorials and laboratory work covering entire syllabus. Students will be graded based on continuous assessment of their term work
Practical and Oral examination based on laboratory experiments and entire syllabus
Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
5.	Herbert Schildt	*Java The Complete Reference*	McGraw-Hill, India	10th Edition 2017
6.	D.T. Editorial Services	*Java 8 Programming Black Book*	Dream tech Press	Edition 2015
7.	Santosh Kumar K.	*JDBC 4.2, Servlet 3.1, and JSP 2.3 Includes JSF 2.2 and Design Patterns, Black Book*	Dream tech Press	2nd Edition, 2016
8.	*Erich Gamma*	*Design Patterns*	*Pearson Publication*	*Edition 2015*

Course Code	Course Title							
2UIL401	Programming Laboratory- II@							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		02		04
Credits Assigned	--			01		02		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	--	--	--	--	50*	--	--	50	100

@Advanced Python
*Term Work based on continuous assessment

Course prerequisites:

- **Basics of Python Programming(Programming Laboratory – I 2UIL301)**

Course Objectives

The objective of this laboratory course is to impart knowledge of scientific and mathematical computing, networking, image processing, database handling and machine learning based applications using various python libraries.

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

CO1:Use python libraries like matplotlib, numpy, pandas, scipy for data visualization and scientific-mathematical data computing.
CO2:Understand network programming with Python scapy.
CO3:Demonstrate handling database with python
CO4:Illustrate python libraries for machine learning and image processing

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to Numpy and Pandas for data computing**		06	CO1
	1.1	Introduction Exploratory data analysis using Pandas and Numpy		
	1.2	Example of Numpy in Python for data computing Creation and manipulation of arrays and vectors.		
	1.3	Case study on Pandas for data analysis , Pandas series and data frames, Importing libraries, Object creation, Basic functionality of Pandas, Binary operations with Pandas		
2	**Scientific computing and visualization using python**		06	CO1
	2.1	Introduction, Basic functions, Special functions , statistical functions		
	2.2	Optimization , IO, Interpolation , Linear Algebra		
	2.3	Use of Matplotlib for data Visualization		
3	**Networking using Python**		06	CO2
	3.1	Network Fundamentals, network addressing and data transfer, ports, Using netstat, concept of Client/Server, request response cycle.		
	3.2	Introduction to sockets and socket programming, Server Implementation, TCP Server		
	3.3	Python networking with Telnet, Python networking with SSH		
	3.4	Using python library Scapy for networking. Creating your own packets. Designing basic network snipper		
4	**Persistence and databases using python**		06	CO3
	4.1	Shelve and Pickle, SQL Relational Databases Connection		
	4.2	Cursor, Row Objects, Create, Read, Update, Delete, Error Handing,		
	4.3	Query Results and Metadata, Create and Aggregate Functions, Exporting and Importing,		
	4.4	Transactions and Rollbacks, Database Objects		
5	**Python for machine learning and image processing**		06	CO4
	5.1	Sklearn for machine learning: linear regression		
	5.2	Skimage for image processing		
	5.3	Case study on machine learning using Sklearn		
			30	

Term-Work will consist of Tutorials and laboratory work covering entire syllabus. Students will be graded based on continuous assessment of their term work
Practical and Oral examination based on laboratory experiments and entire syllabus

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Yuxi Liu	*Python Machine Learning By Example: The easiest way to get into machine learning 1st Edition, Kindle Edition*	Packt publishing Ltd	1st edition 2017
2.	Martin C. Brown	*Python: The Complete Reference Paperback*	Osborne	2nd edition 2001
3.	Frank Millstein	*Data Analytics With Python: Data Analytics In Python Using Pandas*	Copyright at Frank Millstein	1st edition 2018

Course Code	Course Title							
2UIL402	Web Programming I Laboratory							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		02		04
Credits Assigned	--			01		02		03
Examination Scheme	Marks							
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
					50*	--	--	50	100

*Term Work based on continuous assessment

Course prerequisites:

- Knowledge of Programming language

Course Objectives

The objective of this project-driven course is to acquaint with necessary techniques for developing client/server applications. The course will introduce concept of HTML and CSS to create and maintain Web pages, grid layout and responsive web page. Students will be familiarizing with Document Object Model to learn how browser represents web page. In addition, the course will make students conversant with JavaScript, ReactJS, JSON, CBOR and Angular JS.

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

CO1: Comprehend basics of web technologies
CO2: Create Web pages using HTML 5 and CSS
CO3: Apply JavaScript for web application development
CO4: Implement web application using ReactJS, Angular JS, JSON &CBOR

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to web technologies**		02	CO1
	1.1	**Introduction:** Introduction to OSI layers, Web system architecture- 1,2,3 and n tier architecture, URL, domain name system, overview of HTTP		
	1.2	**Site Design Issues**: Planning a Web Site – Objective and Goals, Audience, Organizing contents, Publishing of Web Site , Function of Web Server ,Introduction to UI		
		#**Self-learning topic: Working of Web Browser, Introduction to Internet Application Protocols – FTP, Telnet, SMTP**		
2	**UI Design with HTML 5 and CSS3**		09	CO2
	2.1	Formatting and Fonts, Anchors, Backgrounds, images, Hyperlinks, Lists, Tables		
	2.2	HTML5, New Element, Forms, Audio and Video, HTML5 Canvas, SVG in HTML5, Google Map, Geolocation, Web storage, Web Worker, Application cache		
	2.3	CSS: The need for CSS, Basic syntax and structure using CSS, Positioning using CSS, Apply styles to Box Model , Class and ID		
	2.4	Create a flexible content layout Implement a layout using multi-column; implement a layout using position floating, implement a layout using grid alignment		
	2.5	Responsive Web page **,** Web accessibility		
		#**Self-learning topic: HTML <Meta Tag>, Introduction to XHTML**		
3	**Introduction to XML**		02	CO1
	3.1	Introduction: Syntax, Document structure, Document type definitions, Namespaces, XML schemas, Displaying raw XML documents, XSLT,XML Parsing		
		#**Self-learning topic: Using XML as Database**		
4	**Working with JavaScript**		09	CO3
	4.1	Introduction to JavaScript: Variables, Types, operators, conditions ,functions		
	4.2	JavaScript Object, Array, Regular Expression, Event handling		
	4.3	The DOM and the Web browser Environment, DOM manipulation		
	4.4	Introduction to JavaScript framework – AngularJS – Overview, Life Cycle, Environmental Setup, Features		
	4.5	Single page web application with Angular JS		
5	**Introduction to ReactJS, JSON and CBOR**		08	CO4
	5.1	Introduction to ReactJS: Syntax, Lifecycle, HTML rendering, components, forms, React SAss, React ES6, JSX		
	5.2	Introduction to Angular JS: Introduction, Expressions, Modules, Directives, Model, Binding, Controllers, Services.		

	5.3	Data handling with JSON – Data types, Objects, Arrays, JSON Parse, Stringify		
	5.4	Introduction to CBOR, JSON Vs. CBOR		
		#Self-learning: Displaying XML documents with CSS		
		Total	**30**	

 # Students should prepare all self-learning topics on their own. Self-learning topics will enable students to gain extended knowledge of the topic. Assessment of these topics may be included in term work and Laboratory.
Term-Work will consist of Tutorials and laboratory work covering entire syllabus. Students will be graded based on continuous assessment of their term work
Practical and Oral examination based on laboratory experiments and entire syllabus

Recommended Books:

Sr. No.	**Name/s of Author/s**	**Title of Book**	**Name of Publisher with country**	**Edition and Year of Publication**
1.	Kogent Learning Solutions Inc.,	*HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and jQuery*	DreamTech Press,India	2001
2.	Nixon, Robin	*Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5*	O'Reilly Media	4th Edition, (2014)
3.	Flanagan, David	*JavaScript: the definitive guide*	O'Reilly Media, Inc	6th Edition, 2006
4.	Kogent Learning Solutions Inc.,	*Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Black Book: HTML, Javascript, PHP, Java, Jsp, XML and Ajax, Black Book*	DreamTech Press,India	2013
5.	Brad Dayley	*Learning AngularJS*	O'Reilly Media	2015

Course Code	Course Title								
2UIL403	Analysis of Algorithms Laboratory								
	TH			P		TUT		Total	
Teaching Scheme(Hrs.)	--			02		-		02	
Credits Assigned	--			01		-		01	
Examination Scheme	Marks								
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	-	-	-	-	25	--	--	25	50

- **Term-Work will consist of practical covering entire syllabus of "Analysis of Algorithms" (2UIC403). Students will be graded based on continuous assessment of their term work.**
- **Practical and Oral Examination will be based on laboratory work and entire theory syllabus of "Analysis of Algorithms" (2UIC403).**

Course Code	Course Title								
2UIL404	Advanced Databases Laboratory								
	TH			P		TUT		Total	
Teaching Scheme(Hrs.)	--			02		-		02	
Credits Assigned	--			01		-		01	
Examination Scheme	Marks								
	CA			ESE	TW	O	P	P&O	Total
	T-1	T-2	IA						
	-	-	-	-	25	-	--	25	50

- **Term-Work will consist of practical covering entire syllabus of "Advanced databases" (2UIC404). Students will be graded based on continuous assessment of their term work.**
- **Practical and Oral Examination will be based on laboratory work and entire theory syllabus of "Advanced databases" (2UIC404).**