Regulation 2020		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
F	20PMAF101T	MATHEMATICAL FOUNDATIONS OF COMPUTER APPLICATIONS (Master of Computer Applications)	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Improve the logical and mathematical ability of the student
2	Understand the applications of Set Theory, Propositional Logic, Predicate Logic etc., to solve the practical problems
3	Understand the basic probability concepts

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Find Eigen values and Eigen vectors of real symmetric and non-symmetric matrices
CO2	Understand the basic concepts of set theory to be applied in programming
CO3	Know the concepts of relations and functions needed for designing and solving problems
CO4	Illustrate the logical operations and predicate calculus needed for computing
CO5	Apply basic probability techniques and models to analyze the performance of computer systems

CO-PO Mapping

COs	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	1	-	-	-	-	1	-
CO2	3	1	-	-	-	-	1	-
CO3	3	1	-	-	-	-	1	-
CO4	3	1	-	-	-	-	1	-
CO5	3	1	-	-	-	-	1	-
CO (Avg)	3	1	-	-	-	-	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	MATRIX ALGEBRA	9+3
Matrices - Rank of a matrix - Eigen values and Eigen vectors - Properties - Cayley - Hamilton theorem - Solving system of equations by Gauss Elimination and Gauss Jordan methods - Inverse of a matrix by Gauss Jordan method.		
UNIT II	**BASIC SET THEORY**	**9+3**
Basic definitions - Venn diagrams and set operations - Laws of set theory - Principle of inclusion and exclusion – Partitions - Permutation and combination.		
UNIT III	**RELATIONS AND FUNCTIONS**	**9+3**
Relations - Properties of relations - Closure operations on relations; Functions – Types: Injective, Surjective and Bijective functions - Composition, Identity, Inverse functions.		
UNIT IV	**MATHEMATICAL LOGIC**	**9+3**
Propositions and logical operators - Truth table - Propositions generated by set - Equivalence and Implication - Basic laws - Some more connectives - Functionally complete set of connectives - Normal forms - Proofs in propositional calculus - Predicate calculus.		
UNIT V	**BASICS OF PROBABILTY**	**9+3**
Sample spaces and events – Probability - The axioms of probability - Some elementary theorems - Conditional probability - Total probability – Bayes' theorem (only statement) - Random variable - Probability mass function - Probability density function -Expected values and moments: Mathematical expectation and its properties (Statements only), Moments (including variance), Moment generating function:		

Reference (s)

1	Venkataraman M.K, "Engineering Mathematics", 2nd Edition, Volume-II, National Publishing Company, 1989.
2	Grewal B.S and Grewal J.S, " Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 2004.
3	David Makinson, "Sets, Logic and Maths for Computing", Springer Indian Reprint, 2011.
4	Grimaldi R.P and Ramana B.V, "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education, 2006
5	Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Tata McGraw Hill, 4th Edition, 2002.
6	Sengadir T, "Discrete Mathematics and Combinatorics" Pearson Education, New Delhi, 2009.
7	Trembley J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, New Delhi, 2007 .
8	Ross S.M, "Introduction of Probability Models", Academic Press, N.Y.

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Regulations 2020		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC101T	**DATA STRUCTURES**	3	1	0	4

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To understand the linear and non- linear data structures available in solving problems
2	To know about the sorting and searching techniques and its efficiencies
3	Using the data structures and algorithms in real time applications

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	An ability to analyze of algorithm and its time complexity
CO2	An ability to apply the Linked list data structure
CO3	An ability to design the Stack and Queue data structure
CO4	An ability to develop the Trees and their implementations
CO5	An ability to implement Graphs, hash tables and Hashing methods

CO-PO Mapping

	Pos						PSOs	
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO 1**	**PSO 2**
CO1	2	1	2	-	-	2	1	-
CO2	2	3	2	-	-	1	2	2
CO3	3	3	2	-	-	1	2	2
CO4	2	3	2	-	-	1	1	-
CO5	2	2	2	-	-	1	1	-
CO (Avg)	2.2	2.4	2	-	-	1.2	1.4	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

19 OCT 2020

UNIT I	DATA STRUCTURES	12
Introduction, Basic terminology, Data structures, Data structure operations, ADT, Algorithm basics, Mathematical notations and functions, Asymptotic notations, Linear and Binary search, Bubble sort, Insertion sort		
UNIT II	**ARRAYS AND LIST**	**12**
Array implementation of List, Traversing, Insertion, Deletion, Application of List, Polynomial Arithmetic, Linked list, Implementation, Insertion, Deletion and Search, Sparse Matrix, Circular Linked List, Applications, Josephus Problem, Double linked list		
UNIT III	**STACK AND QUEUE**	**12**
STACK: Array implementation, Linked list implementation, Applications of stack: Infix to Postfix, Evaluation of Postfix, Balancing symbols, Nested function calls, Recursion, Towers ofHanoi.QUEUE: Array implementation, Linked List implementation, Circular Queue, Applications of queue: Priority queue, Double ended queue		
UNIT IV	**TREES**	**12**
General trees, Terminology, Representation of trees, Tree traversal- Binary tree, Representation, Expression tree, Binary tree traversal, Threaded Binary Tree, Binary Search Tree: Construction, Searching, Insertion, Deletion, AVL trees: Rotation, Insertion, Deletion, B-Trees, Splay trees, Red-Black Trees.		
UNIT V	**GRAPHS**	**12**
Graphs – An Application of Graphs – Representation – Transitive Closure - Warshall's Algorithm – Shortest Path Algorithm – A Flow Problem – Dijkstra's Algorithm – An Application of Scheduling - Linked Representation of Graphs – Graph Traversals.		

Reference (s)

1	Seymour Lipschutz, "Data Structures with C", Revised First Edition, McGraw Hill Education, 2014.
2	Dr.R.Venkatesan,Dr.S.Lovelyn Rose,"Data Structures",Second Edition,Wiley Publication 2015

Regulations 2020		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC102T	DATABASE MANAGEMENT SYSTEMS (R)	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To understand the fundamentals of data base and identify the data models
2	To make a study of SQL and relational database design.
3	To understand the functional dependencies and normal forms
4	To impart knowledge in transaction processing, concurrency control techniques and recovery procedures
5	To know about data storage techniques and file structure

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Explain the basic concepts of the database and data models
CO2	Create database tables and perform data management and retrieval operations.
CO3	Explain the functional dependencies and its relationship to keys
CO4	Demonstrate the transaction processing and concurrency control
CO5	Explain the Storage techniques and indexing strategies

CO-PO Mapping

COs	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2	3	-	-	-	1	3	2
CO2	3	2	1	-	-	2	3	1
CO3	2	1	-	-	-	1	2	1
CO4	2	-	-	-	-	1	1	1
CO5	2	-	-	-	-	1	1	1
CO (Avg)	2.2	2	1	-	-	1.2	2	1.2

UNIT I	INTRODUCTION	9
File systems versus Database systems – Views of Data - Data Models – DBMS Architecture – Data Independence – Entity–Relationship Model – Additional features of ER Model – Introduction to relational databases – Relational Model – Keys - Logical Database Design : ER to Relational		
UNIT II	**STRUCTURED QUERY LANGUAGE**	**9**
DDL – DML – DCL – TCL - Basic Queries – Sub queries – Views – Constraints – Joins – Set Operations – Aggregate Functions – Null Values - Triggers		
UNIT III	**DATABASE DESIGN**	**9**
Functional Dependencies – Non-loss Decomposition Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation – Boyce / Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form		
UNIT IV	**TRANSACTION MANAGEMENT**	**9**
Transaction Concepts – ACID Properties – Serializability – Transaction Isolation Levels – Concurrency Control – Protocols – Crash Recovery		
UNIT V	**FILE ORGANIZATION**	**9**
Overview of Physical Storage Media – RAID - File Organization – Organization of records in files – Indexing – Ordered Indices – B+ Trec Index Files – Hashing – Static and Dynamic – Query processing overview – Query Optimization		

Reference (s)

1	Abraham Silberschatz, Henry F.Korth and S.Sudharshan "Database System Concepts", Tata McGraw Hill, Seventh Edition, 2021.
2	Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, Third Edition, Tata McGraw-Hill, 2014
3	C.J.Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education - 2010
4	Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2017
5	G. K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011

Regulations 2020		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC102T	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To understand the fundamentals of data base and identify the data models
2	To make a study of SQL and relational database design.
3	To understand the functional dependencies and normal forms
4	To know about data storage techniques and file structure
5	To impart knowledge in transaction processing, concurrency control techniques and recovery procedures

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Explain the basic concepts of the database and data models
CO2	Create database tables and perform data management and retrieval operations
CO3	Explain the functional dependencies and its relationship to keys
CO4	Explain the Storage techniques and indexing strategies
CO5	Demonstrate the transaction processing and concurrency control

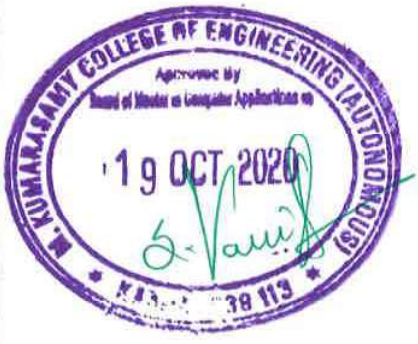
CO-PO Mapping

COs	POs						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2	3	-	-	-	1	3	2
CO2	3	2	1	-	-	2	3	1
CO3	2	1	-	-	-	1	2	1
CO4	2	-	-	-	-	1	1	1
CO5	2	-	-	-	-	1	1	1
CO (Avg)	2.2	2	1	-	-	1.2	2	1.2

UNIT I	INTRODUCTION	9
File systems versus Database systems – Data Models – DBMS Architecture – Data Independence – Data Modeling using Entity – Relationship Model		
UNIT II	**DATABASE DESIGN**	**9**
DDL – DML – Basic Queries – Subqueries – Views – Constraints		
UNIT III	**FUNCTIONAL DEPENDENCIES AND NORMALIZATION**	**9**
Armstrong Axioms, Attribute Closure, Functional Dependencies: Definition, Trival and Non Trivial Function Dependencies, Normalization		
UNIT IV	**FILES AND INDEXING**	**9**
Storage and File Structure – Indexing – Hashing Techniques : Static Hashing – Dynamic Hashing		
UNIT V	**TRANSACTION AND CONCURRENCY CONTROL**	**9**
Transaction concepts, Serializability, Recoverability, ConcurrencyControl		

Reference (s)

1	Abraham Silberschatz, Henry F.Korth and S.Sundarshan "Database System Concepts", Sixth Edition, McGraw Hill, 2010.
2	Raghu Ramakrishnan, Johannes Gehrke - Database Management Systems - Third Edition - McGraw-Hill - 2014
3	C.J.Date, Longman, Dr.S.Swamynathan, Introduction to Database Systems, Pearson Education - 2010



Regulations 2020		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC103T	SOFTWARE ENGINEERING	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To provide an insight into software life cycle and various software process models
2	To understand the fundamental concepts of requirements engineering and Analysis Modeling
3	To know the various designing concepts and notations for modeling thesoftware.
4	To prepare the test cases for the project, apply various testing techniques, strategies and metrics to evaluate the software

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Understand the problem domain to choose process models
CO2	Apply the concept of requirement engineering
CO3	Design software projects using appropriate design notations
CO4	Apply the various testing strategies to check the quality
CO5	Able to analyze, design, verify, validate, implement, and maintain software systems.

CO-PO Mapping

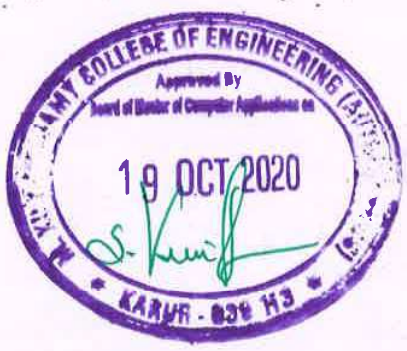
	Pos						PSOs	
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO 1**	**PSO 2**
CO1	3	-	3	-	2	1	2	1
CO2	3	-	1	-	2	2	2	1
CO3	3	-	1	-	2	2	2	2
CO4	3	3	3	-	3	3	3	3
CO5	3	3	3	-	3	3	3	3
CO (Avg)	3	3	2.2	-	2.4	2.2		

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	SOFTWARE PROCESS MODELS	9
The Evolving role of Software – Software – The changing Nature of Software – Legacy software — A generic view of process– A layered Technology –The Waterfall Model – Incremental Model – Prototype model– The RAD Model – Evolutionary Process Models – V-Model – The Spiral Model – Agile Process Model		
UNIT II	**REQUIREMENT ANALYSIS AND SPECIFICATION**	**9**
Software Requirements: Functional and Non-Functional, User requirements, System requirements– Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.		
UNIT III	**DESIGN CONCEPTS**	**9**
Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design		
UNIT IV	**TESTING & QUALITY**	**9**
Software Testing Fundamentals – Software Testing Strategies – Black Box Testing —Internal and external views of Testing-white box testing — basis path testing-control structure testing-black box testing- Regression Testing- – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging- Testing Tools -Software Quality Management		
UNIT V	**SOFTWARE PROJECT MANAGEMENT**	**9**
Introduction– Measures and Measurement-Software Cost Estimation-Function Point Model-COCOMO Model – Make/Buy Decision -Project Scheduling – Scheduling, Earned Value Analysis Risk Management -Risk Identification-CASE TOOLS.		

Reference (s)

1	Roger S. Pressman ,Software Engineering, A practitioner's Approach, 8th Edition, McGrawHill International Edition, 2014
2	Sommerville,Software Engineering, 10th edition, Pearson Education,2017



Regulations 2020		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC104T	PROGRAMMING IN C AND C++	4	0	0	4

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Learn C Programs using basic programming concepts
2	Understand C programs using Arrays, String and structures
3	Learn applications in C using functions and pointers
4	Learn C++ Programs using basic programming concepts
5	Gain a knowledge about the concepts of object oriented programming

Course Outcome (s) (Cos):

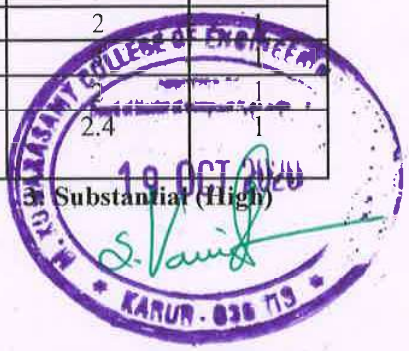
At the end of this course, learners will be able to:

CO1	Understand simple applications in C using basic concepts
CO2	Implement Arrays, String and structures using C
CO3	Develop applications in C using functions and pointers
CO4	Implement C++ programs using functions and pointers
CO5	Apply the object oriented programming concepts in real time.

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	2	3	-	-	1	2	1
CO2	2	-	-	-	2	2	3	1
CO3	2	-	2	-	2	2	2	1
CO4	3	3	3	-	2	3	2	1
CO5	3	3	3	-	2	3	2	1
CO (Avg)	2.6	2.6	2.75	-	2	2.2	2.4	1

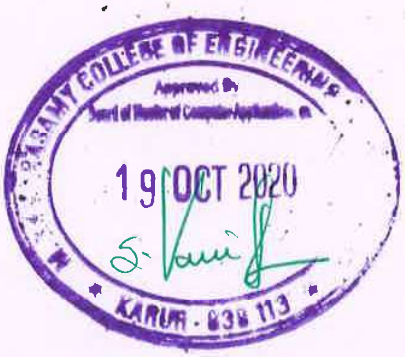
1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTRODUCTION TO C LANGUAGE	12
ntroduction to programming paradigms - Structure of C program - Constants – variables and Data types - Operators: Precedence and Associatively - Expressions - Input/output statements, Assignment statements – Decision making statements – Switch statement – Looping statements - Compilation process.		
UNIT II	**ARRAYS,STRINGS AND STRUCTURES**	**12**
rrays – One Dimensional, Two Dimensional and Multi Dimensional arrays. - Character arrays and Strings –String handling functions – Comparing Two Strings - Structure - Nested structures –Implementing Structure variable- Array of structures – Example Program using structures		
UNIT III	**FUNCTIONS AND POINTERS**	**12**
User defined Functions- General form of a Function - Accessing a function - Scope of a Function - Passing Arguments to function -Function prototype - Call by value - Call by reference- Recursion - storage classes - Auto - Static - Extern and Register.– Pointers – Chain of Pointers -Pointer expressions- – Pointers and character strings -Array of pointers		
UNIT IV	**INTRODUCTION TO C++**	**12**
Principles of object oriented program – concepts – Applications - Beginning with C++ - Tokens, Expressions – Operator Overloading - Call by value –Call by reference –Inline functions – Friend functions		
UNIT V	**OBJECT OREINTED PROGRAMMING CONCEPTS**	**12**
Classes – Objects – Inheritance – Types of Inheritance – constructor – Parameterized constructor - constructor with default arguments – copy constructor – destructor – Polymorphism - Exception Handling		

Reference (s)

1	E. Balagurusamy, "Programming in ANSI C", 8th Edition, Tata McGraw Hill, 2020.
2	E. Balagurusamy, "Object oriented programming with C++.", 7th Edition, Tata McGraw Hill, 2017.
3	Byron S Gottfried, "Programming with C", Fourth Edition, Tata McGraw Hill, 2018



Regulations 2020		Semester I	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	20PCAB101T	DIGITAL LOGIC AND COMPUTER ORGANIZATION	2	0	0	0

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To become familiar with Boolean algebra
2	To study the different types of combinational and sequential circuits
3	To comprehend the basis operations that happen in a CPU
4	To learn the data path and control path implementation
5	To become familiar with the memory hierarchy design and I/O design

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

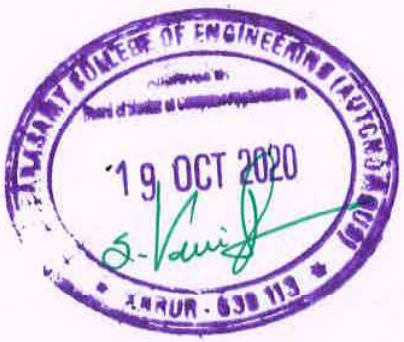
CO1	Simplify using laws of Boolean algebra and Karnaugh map method
CO2	Design various combinational and sequential circuits
CO3	Differentiate between various addressing modes
CO4	Differentiate between the various mapping policies used in cache memories
CO5	Discuss the various types of I/O transfers

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	2	3	1	-	1	2	2
CO2	2	2	-	1	2	2	3	2
CO3	2	2	2	1	2	2		2
CO4	3	2	3	1	2	3	3	
CO5	3	2	3	1	2	3	2	2
CO (Avg)	2.6	2	2.75	1	2	2.7	2.4	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	DIGITAL FUNDAMENTALS	6
Number Systems and Conversions – Boolean Algebra and Simplifications – Minimization of Boolean Functions – Karnaugh MapLogic Gates		
UNIT II	**DESIGN OF COMBINATIONAL CIRCUITS**	**6**
Design of Circuits –Adder /Subtracter – Encoder – Decoder – MUX /DEMUX – Comparators		
UNIT III	**SEQUENTIAL CIRCUITS**	**6**
Flip flops – Triggering – Master – Slave Flip Flop – State Diagram and Minimization		
UNIT IV	**BASIC STRUCTURE OF COMPUTER**	**6**
Functional Units - Basic Operational Concepts – Bus structures –instruction and instruction sequencing –Addressing modes – Instruction Sets		
UNIT V	**MEMORY AND I/O SYSTEMS**	**6**
Memory technology – Memory Systems- Virtual Memory – Caches –Associative memories – Input /output system		
Reference (s)		
1	Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, "Computer Organization and Embedded Systems", 6thEdition, Tata McGraw Hill, 2012.	
2	Charles H. Roth, Jr., "Fundamentals of Logic Design", Jaico Publishing House, Mumbai, 4thEdition 1992.	



Regulations 2020		Semester I	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	20PCAP101L	**DATA STRUCTURES LABORATORY**	0	0	4	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To obtain in-depth practical knowledge in data structures.
2	To apply concepts of data structures in solving real time problems

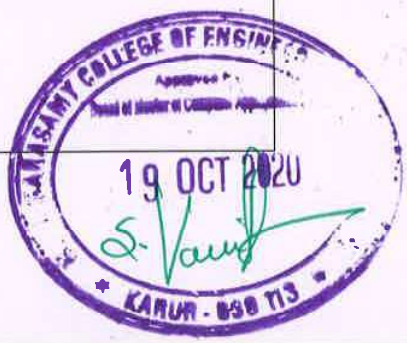
Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

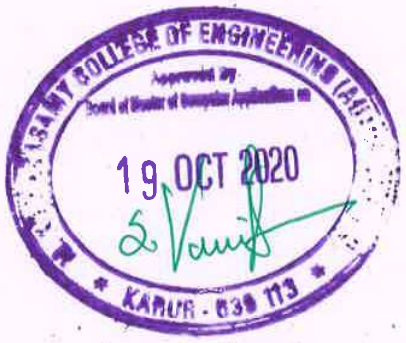
CO1	Ability to identify and implement appropriate data structure for a given application.
CO2	An ability to identify all the trade-offs involved in choosing static versus dynamic data structures
CO3	Graduates will be able to understand the concepts of data structures and applications
CO4	An ability to identify and implement appropriate data structures for a given application

LIST OF EXPERIMENTS	**30**

1. Implementation of Stack and its operation.
2. Implementation of Queue and its operation.
3. Implementation of Singly Linked list and its operations.
4. Implementation of doubly Linked list and its operations.
5. Implementation of polynomial addition using Linked list.
6. Implementation of binary search tree and its operation.
7. Implementation of insertion sort, selection sort.
8. Implementation of Quick sort.
9. Implementation of Linear and binary search.
10. Implementation of Shortest path algorithm.



CO-PO Mapping								
	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	2	2	2	1	2
CO2	2	3	2	2	2	1	2	1
CO3	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	1
CO	2	2.25	2	2	2	1.75	1.75	1.5



Curriculum 2020		Semester I	Total Hours			30
Category	Course Code	COURSE NAME	Hours / Week			C
			L	T	P	
P	20PCAP102L	DBMS LABORATORY	0	0	4	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To familiarize with SQL queries.
2	To learn front end tools to integrate with databases

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Design and Implement databases
CO2	Formulate complex queries using SQL
CO3	Design and Implement applications that have GUI and access databases for backend connectivity

List of Experiments

1. Creation of base tables and views
2. Data Manipulation INSERT, DELETE and UPDATE in Tables. SELECT, Sub Queries and
3. Data Control Commands
4. High level language extensions – PL/SQLOr Transact SQL – Packages
5. Use of Cursors, Procedures and Functions
6. Embedded SQL or Database Connectivity
7. Oracle or SQL Server Triggers – Block Level – Form Level Triggers
8. Working with Forms, Menus and ReportWriters for a application project in any domain
9. Front-end tools – Visual Basic/Developer 2000

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	1	2	3	-	-	2	2	-
CO2	1	2	3	-	-	3	3	-
CO3	1	3	3	-	-	3	2	2
CO (Avg)	1	2.3	3	-	-	2.6	2.3	2

Regulations 2020		Semester I	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	20PCAP103L	ENGLISH LANGUAGE LABORATORY	0	0	4	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
2	To expose the students to a variety of self-instructional and learner-friendly modes of language learning.
3	To improve the fluency in spoken English and neutralize mother tongue influence

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Learners learn how to pronounce words using the rules they have been taught.
CO2	Students learn the importance of speaking English using rhythm and intonation.
CO3	Students learn to overcome stage fear and make presentations with ease
CO4	Students learn to use right words and phrases in keeping the demands of occasion
CO5	Students learn to face different types of interviews with confidence.

UNIT I — **LISTENING**

Listening to pre-recorded short episodes, conversations, passages, stories, news bulletin, speeches by famous personalities – Listening for general and specific information

UNIT II — **READING**

Reading aloud – by students individually –proverbs – passages on various topics of interest – Newspaper reading – Reading humorous passages – Anecdotes – Stories – tricky sounds (conditioners) – Reading manuals – Reading individual sentences with articulation, pronunciation, Tones, Punctuation, pauses etc- Reading the titles of popular books, movies and poems.

UNIT III — **SPEAKING**

Self-introduction – introducing one self, one's family – one's friends and relatives – one's country

Short speech on simple topics on simpler themes for about one minute – Role play – Group Discussion – Debate –Comparing – Interviewing others by Asking Questions – Interview Techniques – Conversational Practice – Telephonic Conversation – Telephonic Interviews

19 OCT 2020

UNIT IV	WRITING
Writing Resume, preparing Curriculum Vitae - Converting newspaper headlines into sentences - Formation of Sentences – Using the table of Sentence - making and producing multiple sentences - Framing Questions for the responses givenTips for better performance in interviews - Describing Objects - Describing Situations	
UNIT V	**PROJECT REPORT WRITING**
Significant features of Project Report Writing – Organization – Presentation – Use of Impersonal Passives – Acknowledgements.	

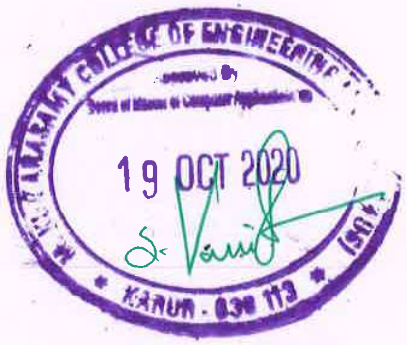
Reference (s)

1	Spoken English for you – Level I& Level II by Radha Krishna Pillai – Emerald Publishers.
2	A Course of English Pronunciation - J D O'Connor – BBC
3	Courseware on "Technical Communication for Scientists and Engineers", IIT Bombay, 2015.
4	Sue Prince, Emma, The Advantage: The 7 Soft Skills You Need to Stay One Step Ahead, Pearson; 1 Edition, 2013.
5	Hart, Guy Brook, Cambridge English Business Benchmark: 2 Ed., CUP 2014

CO-PO Mapping

	Pos						PSOs	
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO 1**	**PSO 2**
CO1	2	2	2	2	2	2	2	2
CO2	2	1	2	2	2	2	2	2
CO3	2	2	1	2	2	2	2	2
CO (Avg)	2	1.6	1.6	2	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



Regulation 2020		Semester I	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	20PCAM101L	CAREER SKILL DEVELOPMENT I	0	0	2	1

Course Objective (s): The purpose of learning this course is to:

1	To educate arithmetic, logical and reasoning ability problems
2	To sharpen problem solving skill and to improve thinking capability of the students
3	To defeat the fear while communicating in group and to master the effective communication

Course Outcome (s) (Cos): At the end of this course, learners will be able to:

CO1	Students should be able to solve both analytical and logical problems in an effective manner
CO2	The quality of student's communication with practical experience is improved

UNIT I	Module - 1	6

Aptitude: Direction Sense Test - Data Interpretation.

Communication: Self-Introduction and SWOT analysis.

UNIT II	Module - 2	6

Aptitude: Time and Work - Pipes and Cisterns. **Communication:** Debate.

UNIT III	Module - 3	6

Aptitude: Averages - Ages.

Communication: News of the week - Tech Talk.

UNIT IV	Module - 4	6

Aptitude: Time and Distance - Boats and Streams.

Communication: Launch a Product.

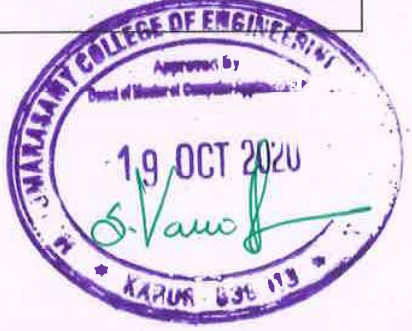
UNIT V	Module - 5	6

Aptitude: Clocks & Calendars - Mensuration.

Communication: Presentation Skills - Just a Minute and public speaking activity.

Text Book (s)

1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015



Regulations 2020		Semester II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC105T	OPERATING SYSTEMS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	To get a comprehensive knowledge of the types of operating system
CO2	To gain knowledge about CPU scheduling algorithms
CO3	To understand the deadlock and their solutions in distributed environments
CO4	To provide a detailed description of various ways of organizing memory hardware.
CO5	To get the knowledge of file access and Directory structure to know the file allocation and protection mechanisms for distributed environments

Course Outcome (s) (Cos):

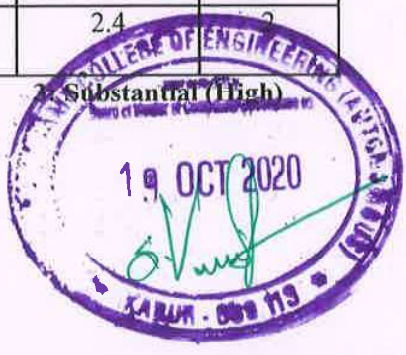
At the end of this course, learners will be able to:

CO1	Able to know the basics of operating systems and its components
CO2	Able to apply scheduling algorithms, know about the critical section problem
CO3	Able to apply semaphores and Deadlock Condition
CO4	Able to understand storage management, paging and segmentation
CO5	Able to know disk structure and disk scheduling algorithms and analyze the concept of allocation methods, directory structure and free space management.

CO-PO Mapping

	Pos						PSOs	
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO 1**	**PSO 2**
CO1	3	1	1.5	1	-	1	2	2
CO2	3	1	1.5	1	-	2	2	2
CO3	3	1	1.5	1	-	2	2	2
CO4	3	1	1.5	1	-	1	3	2
CO5	3	1	1.5	1	-	1	3	2
CO (Avg)	3	1	1.5	1	-	1.4	2.4	2

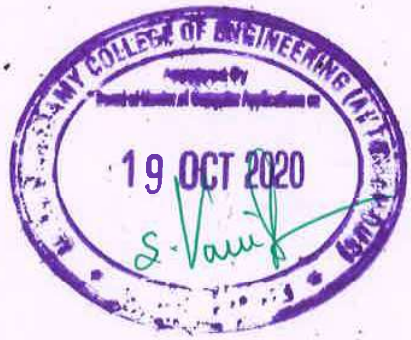
1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTRODUCTION	9
Definition of OS - Mainframe System - Desktop Systems - Multi Processor System – Distributed - Clustered - Real Time Systems - Handheld Systems - Operating System Structure – System Components - Services - System Calls - System Programs - System Design and Implementation		
UNIT II	**PROCESS MANAGEMENT**	**9**
Concepts - Process Scheduling - Operations on Processes - Co-Operating Processes – Inter Process Communication - CPU Scheduling - Scheduling Concepts - Criteria – Scheduling Algorithms - Multiprocessor Scheduling - Real Time Scheduling.		
UNIT III	**PROCESS SYNCHRONIZATION**	**9**
Critical Section - Synchronization Hardware – Semaphores - Problems of Synchronization - Critical Regions – Monitors – Deadlocks – Characterization - Handling Deadlocks – Deadlock Prevention – Avoidance – Detection - Deadlock Recovery		
UNIT IV	**MEMORY MANAGEMENT**	**9**
Storage Hierarchy - Storage Management Strategies – Contiguous - Non Contiguous Storage Allocation - Single User - Fixed Partition - Variable Partition – Swapping - Virtual Memory – Basic Concepts - Multilevel Organization - Block Mapping – Paging – Segmentation – Page Replacement Methods		
UNIT V	**I/O AND FILE SYSTEMS**	**9**
Disk Scheduling - File Concepts - File System Structure - Access Methods - Directory Structure – Protection – Directory Implementation - Allocation Methods - Free Space Management – Case Study: Linux System, Windows.		

Reference (s)

1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Tenth Edition, John Wiley & Sons (Asia) Pvt. Ltd, 2018
2	William Stallings, Operating Systems: Internals and Design Principles, Ninth Edition, Pearson Education, 2018
3	P.C.Bhatt, An Introduction to Operating Systems-Concepts and Practice, Fourth Edition,Prentice Hall of India, 2013.



Regulations 2020		Semester II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC106T	PYTHON AND R PROGRAMMING	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	Describe the core syntax and semantics of Python programming language
CO2	Learn the process of structuring the data using lists, dictionaries, tuples and sets.
CO3	Learn Python Programs using basic object oriented programming concepts
CO4	Understand the basics in R programming
CO5	Able to Understand the R Programming Matrices, Arrays and Lists

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Able to understand the basic concepts of python programming
CO2	Design and implement Python programs using lists, tuples and sets
CO3	Develop applications using Object Oriented Programming concepts in Python
CO4	Learn to apply R programming functions and Vector Operations
CO5	Develop applications using Matrices, Arrays, List using R.

CO-PO Mapping

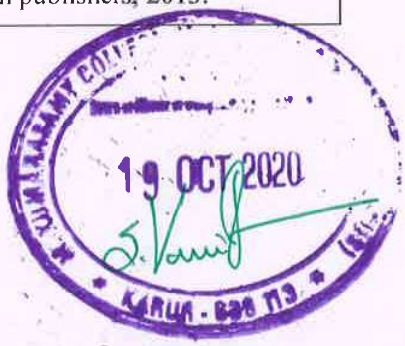
	Pos						PSOs	
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO 1**	**PSO 2**
CO1	3	2	3	3	2	2	3	2
CO2	3	2	3	3	2	2	3	2
CO3	3	2	3	3	2	2	3	2
CO4	3	2	3	3	3	3	3	2
CO5	3	2	3	3	3	3	3	2
CO (Avg)	3	2	3	3	2.4	2.4	3	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	INTRODUCTION	9
Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Types, Operators and Expressions		
UNIT II	**DATA STRUCTURES, FUNCTIONS**	**9**
Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions. Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments Modules, Python packages		
UNIT III	**OBJECT ORIENTED PROGRAMMING OOP IN PYTHON**	**9**
Object Oriented Programming OOP in Python: Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding. Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions-File Handling		
UNIT IV	**INTRODUCTION TO R**	**9**
R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names		
UNIT V	**MATRICES, ARRAYS AND LISTS**	**9**
Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive List		

Reference (s)

1	Vamsi Kurama, Python Programming: A Modern Approach, 1st edition, Pearson Publishers, 2018.
2	Mark Lutz, Learning Python, Third edition, O'Reilly Media, 2006.
3	Ashok Namdev Kamthane, Amith Ashok Kamthane, Programming and Problem Solving With Python, Second Edition, McGraw Hill Education, 2020.
4	W.J. Chun, Core Python Programming , 3rd Edition, Pearson publishers, 2013.



Regulations 2020		Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC107T	INTERNET AND JAVA PROGRAMMING	3	1	0	4

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	To understand the concept of Internet and WWW
CO2	To provide the knowledge about Java basics
CO3	To understand the concept of Packages and Interfaces
CO4	To understand the Exception, Multithreading and I/O Packages
CO5	To understand the Collections and Generic Programming

Course Outcome (s) (Cos):

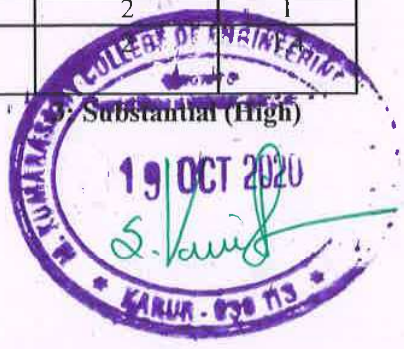
At the end of this course, learners will be able to:

CO1	Able to know the basics of Internet Technologies
CO2	Able to understand the object oriented features of Java
CO3	Able to create user defined packages and interfaces
CO4	Able to design Exception handling and Multithreading
CO5	Able to implement Generics and Collections classes in real time applications

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	1	1	2	1	2	1	2	1
CO2	2	1	2	1	2	1	2	1
CO3	2	1	2	1	1	2	2	2
CO4	2	2	1	2	1	2	2	2
CO5	1	1	2	1	2	1	2	1
CO (Avg)	1.6	1.2	1.8	1.2	1.6	1.4		

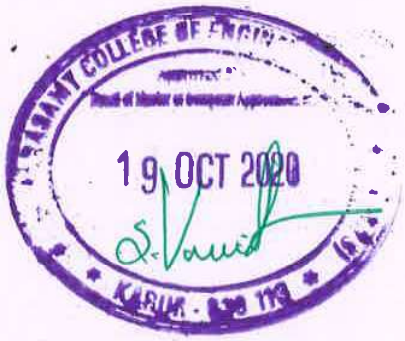
1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTERNET	12
Internet – Introduction- Understanding Internet- Internet Addressing - Browsers, Servers, Protocols – Web Application Architectures- Hardware Requirements to Connect to the Internet- Internet Standards – Introduction to WWW – WWW Architecture – Working with URLs		
UNIT II	**JAVA BASICS**	**12**
Java Basics: Overview of Java – Program Structure -Data Types, Variables, Arrays, Operators - Control Structures - Classes - Objects – Methods -Constructors- this keyword – finalize() method - Access Specifiers - Method Overloading - Constructor Overloading – Strings and String Buffers.		
UNIT III	**PACKAGES AND INTERFACES**	**12**
Inheritance, Packages and Interface: Inheritance: Member Access and Inheritance - Multilevel Hierarchy - Method Overriding – Dynamic Method Dispatch - Keywords: Abstract – Super - Final – Static - Packages: Defining a Package - Access Protection - Importing Packages. Interfaces: Defining an Interface - Implementing Interfaces.		
UNIT IV	**EXCEPTION, MULITHREADING AND I/O PACKAGES**	**12**
Exception handling: Exception Types - Try and Catch statement – Throw – Throws – Finally. Multithreading: Single Thread Creation - Multiple Threads Creation, Thread Priorities – Synchronization –I/O Packages: Byte Streams - Character Streams.		
UNIT V	**COLLECTIONS**	**12**
Collections: Benefits of Collections - List, Set and Map Interfaces with implementation-Java Templates –Java Frameworks: Introduction- Generic Programming: A Simple Generic class, generic methods		

Reference (s)

1	Herbert Schildt, "Java The Complete Reference", Twelth Edition,Tata McGraw Hill, 2018
2	E Balagurusamy, "Programming with JAVA", Sixth Edition, McGraw Hill, 2019
3	Deitel and Deitel, "JAVA – How to Program",Eleventh Edition, Pearson Education India, 2018



Regulations 2020		Semester II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC108T	COMPUTER NETWORKS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	To understand networking concepts and basic communication model.
CO2	To understand network architectures and components required for data communication.
CO3	To analyze the function and design strategy of physical, data link, network layer and transport layer.
CO4	To understand the basic functionality of Transport and Session Layer
CO5	To acquire knowledge of various application protocol standard developed for internet.

Course Outcome (s) (Cos):

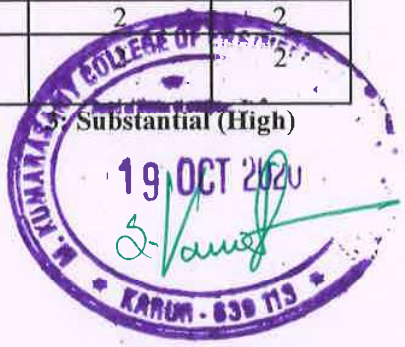
At the end of this course, learners will be able to:

CO1	Describe the functions of each layer in OSI and TCP/IP model.
CO2	Understand the functionalities needed for data communication into layers
CO3	Classify the routing protocols and analyze how to assign the IP addresses for the given network.
CO4	Understand the concepts of Transport layer
CO5	Explain the functions of Application layer and Presentation layer paradigms and Protocols

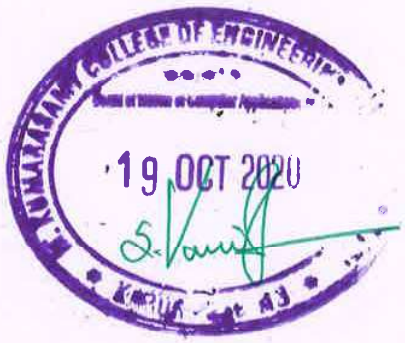
CO-PO Mapping

	Pos						PSOs	
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO 1**	**PSO 2**
CO1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	2
CO3	2	2	3	2	2	2	2	2
CO4	2	2	2	1	1	2	2	2
CO5	2	2	2	2	2	2	2	2
CO (Avg)	2	2	2.2	1.8	1.8	2		2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

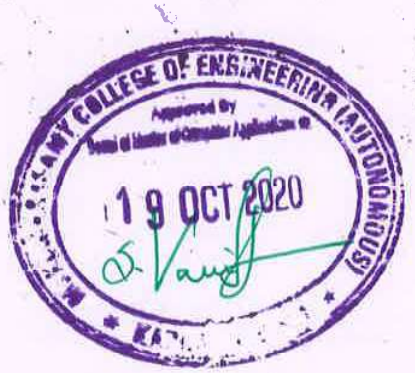


UNIT I	NETWORK FUNDAMENTALS	9
Data Communication – physical structure – Topologies – The OSI model – TCP/IP protocol suite –Digital and Analog Transmission – Transmission Media – Modem standards.		
UNIT II	**DATA LINK LAYER**	**9**
Error Detection And Correction : Types of Errors- Single Bit and Multiple bit errors – VRC – LRC –CRC - checksum. Data Link Control And Protocols: Stop and Wait ARQ – Go-back-N ARQ- SelectiveRepeat ARQ – Connecting Devices: Repeaters, Hubs, Switches – Introduction to IEEE Project802:Ethernet,Token Ring, FDDI-802.11.		
UNIT III	**NETWORK LAYER**	**9**
Internetworking – IP addressing – Subnetting- Classless IP addresses – ARP – RARP – ICMP – Routing – Distance Vector and Link State Routing, BGP.		
UNIT IV	**TRANSPORT& SESSION LAYER**	**9**
Transport Services – Elements of Transport Protocols - UDP - Connection oriented, Reliable service –TCP – Connection establishment – TCP Congestion control – Transactional TCP- Session Layer-Design issues, remote procedure call		
UNIT V	**PRESENTATION &APPLICATION LAYER**	**9**
Presentation Layer-Design issues, Data compression techniques, cryptography DNS – Remote Logging –FTP –WWW -SMTP– VOIP – Network Management Protocol: SNMP – HTTP.		
Reference (s)		
1	William Stallings, "Data and Computer Communication", Tenth Edition,Pearson Education, 2017	
2	Andrew S.Tanenbaum , "Computer Networks", Fifth Edition, Pearson Education, 2011.	
3	Behrouz A. Forouzan, " Data Communication and Networking", Fifth Edition , TMH 2013.	



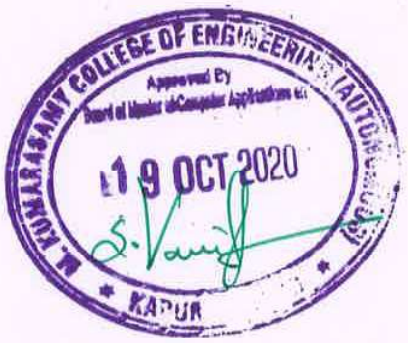
Regulations 2020		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	20PCAB102T	**PROBLEM SOLVING ASPECTS IN PROGRAMMING**	2	0	0	0

Prerequisite Course (s)	
Nil	
Course Objective (s): The purpose of learning this course is to:	
1	To understand the basic concepts of problem solving approaches and to develop the algorithms
2	Apply the techniques of structured (functional) decomposition to break a program into smaller pieces and describe the mechanics of parameter passing.
3	To design, implements, test, and apply the basic C programming concepts.
Course Outcome (s) (Cos): At the end of this course, learners will be able to:	
CO1	Able to design a computational solution for a given problem
CO2	Able to break a problem into logical modules that can be solved (programmed).
CO3	Able to transform a problem solution into programs involving programmingconstructs.
CO4	Able to get the knowledge of array techniques
CO5	Able to examine the concept of merging, sorting and searching



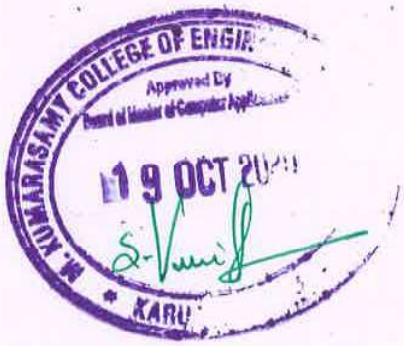
UNIT I	INTRODUCTION TO PROBLEM SOLVING	6
Problem Solving: Introduction - The Problem-solving Aspect - Top-down Design-implementation of Algorithms- Program Verification - The Efficiency of Algorithms.		
UNIT II	**FUNDAMENTALS OF ALGORITHMS**	**6**
Fundamental Algorithms: Exchanging the values of Two Variables - Counting - Summation of a set of Numbers - Factorial Computation-Sine function computation - Generation of the Fibonacci sequence - Reversing the Digits of an Integer - Base Conversion Character to Number Conversion.		
UNIT III	**FACTORING ASPECTS**	**6**
Factoring Methods: Finding the square Root of a number - The Greatest Common Divisor of Two Integers - Generating Prime Numbers - Generation of Pseudo - random Numbers - Raising a Number to a Large Power.		
UNIT IV	**ARRAY TECHNIQUES**	**6**
Array Techniques: Array Order Reversal-Array Counting or Histogramming - Finding the Maximum Number in a Set - Removal of Duplicates from an Ordered Array - Partitioning an Array - Finding the kth Smallest Element.		
UNIT V	**MERGING,SORTING AND SEARCHING**	**6**
Merging, Sorting and Searching: Two way merge - sorting by selection, insertion, diminishing increment and partitioning -Binary search.		

Reference (s)	
1	How to solve it by Computer, R. G. Dromey, Pearson education, 2011.
2	PradipDey, ManasGhosh, —Computer Fundamentals and Programming in C, Second Edition, Oxford University Press, 2013.

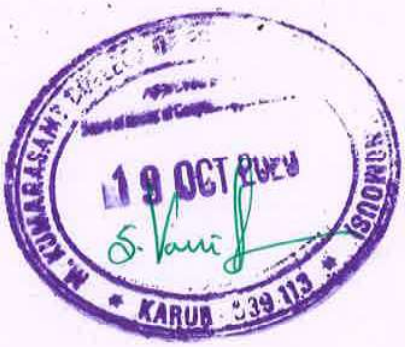


Regulations 2020		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	20PCAB103T	**DATA COMMUNICATION NETWORKS**	2	0	0	0

Prerequisite Course (s)	
Nil	
Course Objective (s): The purpose of learning this course is to:	
1	To understand networking concepts and basic communication model
2	To understand network architectures and components required for data communication
3	To analyze the function and design strategy of physical, data link, network layer and transport layer
4	To acquire basic knowledge of various application protocol for internet And WWW
Course Outcome (s) (Cos): At the end of this course, learners will be able to:	
CO1	Able to trace the flow of information from one node to another node in the network
CO2	Able to Identify the components required to build different types of networks
CO3	Able to understand the functionalities needed for data encoding
CO4	Able to choose the required functionality at data layer for given application
CO5	Able to understand the working principles of various internet application protocols and WWW

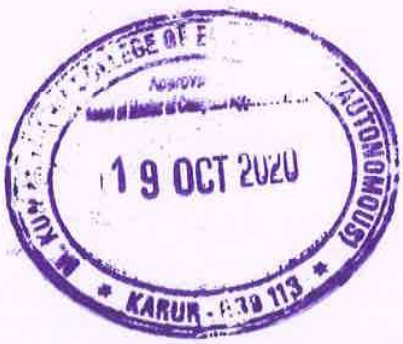


UNIT I	INTRODUCTION	6
Introduction to Computer Network: Definition and Uses of Computer Network, Criteria for a Data Communication Network, Classification of Computer network, Network Architecture, OSI Reference Model.		
UNIT II	**DATA COMMUNICATION**	**6**
Data Communication, Transmission Impairments, Transmission Medium		
UNIT III	**DATA ENCODING**	**6**
Line Encoding, Types of Line Coding, Analog-to-Digital Conversion- Pulse code modulation (PCM), Delta modulation (DM);Transmission Modes.		
UNIT IV	**DATA LINK LAYER**	**6**
Error Detection and Correction- One and two dimensional parity checks, Hamming code, Cyclic redundancy check (CRC); Framing- Character stuffing, Bit stuffing; Flow and Error Control		
UNIT V	**INTERNET AND WWW**	**6**
Internet and WWW: Internet basics, Hypertext Transfer Protocol (HTTP), World Wide Web (WWW), Security in Internet, E-mail Security.		
Reference (s)		
1	Behrouz A. Forouzan, —Data communication and Networkingl, Fifth Edition, Tata McGraw – Hill, 2013	
2	James F. Kurose, Keith W. Ross, —Computer Networking - A Top-Down Approach Featuring the Internetl, Seventh Edition, Pearson Education, 2016.	

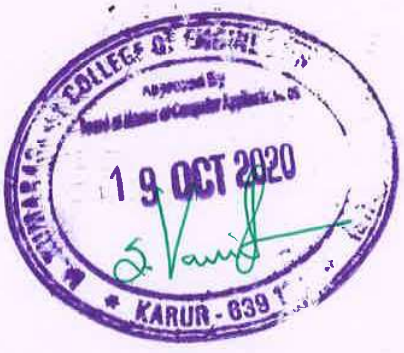


Regulations 2020		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	20PCAB104T	**BASICS OF WEB DESIGN**	2	0	0	0

Prerequisite Course (s)	
Nil	
Course Objective (s): The purpose of learning this course is to:	
1	To understand the concept of Internet and WWW
2	To get the knowledge of HTML
3	To understand and practice of Inline CSS
4	To understand and practice web development techniques
Course Outcome (s) (Cos): At the end of this course, learners will be able to:	
CO1	Able to know the basics of Internet and WWW Technologies
CO2	Able to understand the basic HTML tags
CO3	Create a basic website using HTML and Cascading Style Sheets.
CO4	Examine the basic skills of Javascript
CO5	Add interactivity to websites using Java Script



UNIT I	INTERNET & WWW	6
Internet – Introduction- Understanding Internet- Internet Addressing - Browsers, Servers, Protocols – Hardware Requirements to Connect to the Internet- Internet Standards — Working with URLs - Introduction to WWW – WWW Architecture- Web Application Architectures - Web Standards – W3C-Technologies involved in Web development		
UNIT II	**HTML**	**6**
HTML Documents-Understanding markup languages-Structure of HTML Documents-Markup Tags-Basic markup tags-Working with Text-Working with Images- Hyperlinks -Images-Tables-List-SVG-Advanced HTML- Iframes-HTML5 Video and Audio tags		
UNIT III	**INLINE CSS**	**6**
CSS properties for text (Color, font, weight, align,etc.) and working with colors-Selecting with classes, IDs, tags -Ways of linking CSS to HTML-CSS Pseudo selectors-Understanding the box model - Margins, padding and border – Inline and block elements -Structuring pages using Semantic Tags		
UNIT IV	**JAVA SCRIPT**	**6**
The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.		
UNIT V	**DOM MODEL**	**6**
JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event HandlingDHTML with JavaScript		
Reference (s)		
1	Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How to Program", Fifth Edition, Pearson Education, 2012	
2	Keith J Grant; "CSS in Depth", Manning Publications. 1st edition,2018	
3	Thomas Powell; "Java Script : The completer reference", Third edition,2017	



Regulation 2020		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	20PCAM102L	CAREER SKILL DEVELOPMENT II	0	0	2	1

Course Objective (s): The purpose of learning this course is to:

1.	To learn the application of mathematical or statistical models to different real-world contexts
2.	To sharpen problem solving skill and to improve thinking capability of the students
3.	To expertise the creative thinking and presentation skills to meet the corporate expectations.

Course Outcome (s) (Cos): At the end of this course, learners will be able to:

CO1	Students should be able to solve both analytical and logical problems in an effective manner
CO2	The communication quality will be upgraded in near future

UNIT I	Module - 1	6

Aptitude: Alligations or Mixtures - Blood Relations.

Communication: Job Application - Resume.

UNIT II	Module - 2	6

Aptitude: Partnership - Statement and Assumptions.

Communication: How to set Goals - Career opportunities - know your industry.

UNIT III	Module - 3	6

Aptitude: Arithmetic and Geometric Progressions - Profit or Loss.

Communication: Email Etiquette - Essay writing.

UNIT IV	Module - 4	6

Aptitude: Permutations and Combinations - Probability.

Communication: Group Discussion and guidelines.

UNIT V	Module - 5	6

Aptitude: Simple Interest & Compound Interest - Statement and Conclusion.

Communication: Interview skills - Mock Interview.

Text Book (s)

1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

Curriculum 2020		Semester II	Total Hours			30
Category	Course Code	COURSE NAME	Hours / Week			C
			L	T	P	
P	20PCAP104L	PYTHON AND R PROGRAMMING LABORATORY	0	0	4	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	Interpret the use of procedural statements like assignments, conditional statements, loops and function calls
CO2	Infer the supported data structures like lists, dictionaries and tuples in Python.
CO3	Illustrate the application of matrices and regular expressions in Python programs.

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Examine the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data.
CO2	Analyze the f Object-oriented programming concepts in Python
CO3	Implementation of learning a programming language

List of Experiments

Python :

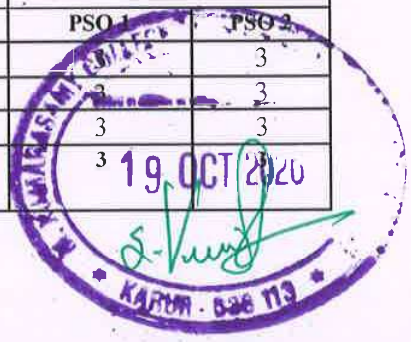
1. Write a python function to find the union, intersection and difference of set of integer datas.
2. Write a python function to find number of vowels, consonents and special characters in a given String.
3. Write a python function to print all possible substring from a given string.
4. Write a python function to reverse the given string without using loop.
5. Write a python function to convert all the lower cases into upper cases and vice versa in given String.
6. Write a python function to count the number of primes numbers and fibbonacci numbers in a given list of numbers.

R Programming :

1. Write a R script to perform matrix addition, subtraction and multiplication.
2. Write a R script to perform various vector operations.
3. Write a R script to perform various list operations.
4. Write a R script to draw a histogram for the set of integer numbers, by finding the frequency count of the numbers.
5. Write a R script to find the sum of numbers in a Comma Separated text file.
6. Write a R script to find the longest string from an excel file containing set of words.

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	-	3	3	2	2	3	3
CO2	3	-	3	3	2	2	3	3
CO3	3	-	3	3	2	2	3	3
CO (Avg)	3	-	3	3	2	2	3	3



Curriculum 2020		Semester II	Total Hours			30
Category	Course Code	COURSE NAME	Hours / Week			C
			L	T	P	
P	20PCAP105L	JAVA PROGRAMMING LABORATORY	0	0	4	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	To gain the practical knowledge in Java Programming concepts.
CO2	To understand and apply the fundamentals core java, packages, database connectivity for computing

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Apply the Object Oriented features of Java for programming on the internet
CO2	An ability to implement overloading, overriding, packages and string concepts
CO3	An ability to implement the exception handling, Collections and Generic classes

List of Experiments

java program to implement the following concepts .

1. Java classes and Objects
2. Constructor overloading and overriding concepts
3. Method overloading and overriding concepts.
4. Inheritance
5. Interfaces
6. Packages
7. Exception Handling
8. Multithreading Concepts
9. String Handling
10. Collections
11. Generic Classes
12. Database Connectivity

CO-PO Mapping

	POs						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	2	3	3	2	2	3	3
CO2	3	2	3	3	2	2		
CO3	3	2	3	3	2	2	3	3
CO (Avg)	3	2	3	3	2	2	3	3

Regulations 2020		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC201T	MOBILE APPLICATION DEVELOPMENT	3	1	0	4

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Understand the essentials of mobile app development
2	Design an Android application with basic building blocks
3	Illustrate the Graphics and Multimedia used for Android application development
4	Demonstrate the mobile application testing strategies
5	Dramatize the distribution of Mobile Application into market

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Appreciate the Mobility Landscape
CO2	Familiarize with Mobile Apps development aspects
CO3	Design and develop mobile apps, using Android as development platform, with key focus on user experience design, native data handling and background tasks and notifications.
CO4	Appreciation of nuances such as native hardware play, location awareness, graphics and multimedia
CO5	Perform testing, signing, packaging and distribution of mobile apps

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	2	2	2	2	2
CO2	3	3	2	2	2	2	2	2
CO3	2	2	3	2	2	2	3	2
CO4	2	2	2	1	1	2	3	2
CO5	2	2	2	2	2	2	2	2
CO (Avg)	2.2	2.2	2.2	1.8	1.8	2	2.4	

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	GETTING STARTED WITH MOBILITY	12
Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator, a case study on Mobile app development		
UNIT II	**BUILDING BLOCKS OF MOBILE APPS**	**12**
App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities. App functionality beyond user interface - Threads, Async task, Services – states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs		
UNIT III	**NATIVE DATA HANDLING AND SPRUCING UP MOBILE APPS**	**12**
Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet) Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)		
UNIT IV	**TESTING MOBILE APPS**	**12**
Debugging Mobile Apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, MonkeyTalk		
UNIT V	**SOFTWARE TESTING AND QUALITY METRICS**	**12**
Versioning, signing and packaging mobile apps, distributing apps on mobile market place		

Reference (s)

1	Anubhav Pradhan, Anil V Deshpande, "Mobile Apps Development", First Edition,2013
2	Barry Burd, "Android Application Development All in one for Dumnries". Second Edition, John Wiley & Sons Inc.,2015
3	Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
4	Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012
5	Lauren Darcey, Shane Conder, "Teach Yourself Android Application Development In 24 Hours", SAMS Publication,2010
6	Glenford J. Myers, Tom Badgett, Corey Sandler, "The Art of Software Testing", 3rd Edition, John Wiley & Sons Publication, 2012

Regulations 2020		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC202T	DATA WAREHOUSING AND DATA MINING	3	1	0	4

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Introduce the basic principles, concepts of data warehousing
2	Introduce the basic concepts and techniques of Data Mining
3	Discuss the association techniques and the ways of classifying the data
4	Study Classification algorithms
5	Gain knowledge of clustering techniques

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

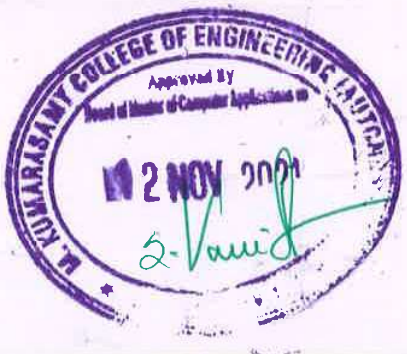
CO1	Understand the functionality of data warehousing components
CO2	Determine the categories of data preprocessing
CO3	Apply the Association Rule Mining techniques for mining the data to identify the kinds of pattern
CO4	Design and deploy appropriate classification techniques
CO5	Perform clustering in the datasets into groups

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	1	1	2	2	2	2
CO2	2	2	1	1	2	2	2	2
CO3	2	2	1	1	2	2	3	2
CO4	2	2	1	1	2	2	2	2
CO5	2	2	1	1	2	3	2	2
CO (Avg)	2	2	1	1	2	2.2	2.2	

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	INTRODUCTION TO DATA WAREHOUSING	12
Goals of Data warehousing and Business intelligence - Components of data warehouse, Datawarehouse Architecture and Infrastructure – Dimensional Modeling Introduction – Basic Fact Table Techniques – Basic Dimension Table Techniques- Case Study : Retail Sales		
UNIT II	**INTRODUCTION TO DATA MINING**	**12**
KDD vs Data mining , DBMS vs Data mining , Issues and Challenges – Supervised Learning-Preprocessing – Concepts , Discretization , Feature extraction & Selection , Missing data , Post processing , Attribute Oriented Induction		
UNIT III	**ASSOCIATION RULE MINING**	**12**
Introduction - Data Mining Functionalities - Association Rule Mining - Mining Frequent Item sets with and without Candidate Generation - Mining Various Kinds of Association Rules - Constraint-Based Association Mining.		
UNIT IV	**CLASSIFICATION TECHNIQUES**	**12**
Classification -Data preparation for Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification byBack Propagation – Support Vector Machines – Associative Classification – Lazy Learners – random forest algorithm		
UNIT V	**CLUSTERING TECHNIQUES**	**12**
Introduction to Clustering , Partitioning Method – K Means algorithm - Hierarchical Method , Density Based Method – DBSCAN method , Conceptual clustering		
Reference (s)		
1	Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012	
2	G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, Third Edition, 2014	
3	K. P. Soman, Shyam Diwakar, V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.	
4	Ralph Kimball,Margy Ross,"The Data warehouse Toolkit:The Definitive Guide to Dimensional Modeling",Third Edition,Wiley Publication,2013	
5.	Paulraj Ponniah,"Data Warehousing Fundamentals for IT Professionals", Wiley, 2010	



Regulations 2020		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	20PCAC203T	CRYPTOGRAPHY AND NETWORK SECURITY	3	1	0	4

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Understand various cryptographic techniques and security trends.
2	Discuss various algorithms based on symmetric key cryptography.
3	Discuss various algorithms based on public key cryptography.
4	Understand the different authentication requirements and functions.
5	Illustrate about system security practices.

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Understand the fundamentals of networks security, security architecture and the classical encryption techniques.
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3	Apply the different cryptographic operations of public key cryptography
CO4	Apply the various Authentication schemes to simulate different applications.
CO5	Understand various Security practices and System security standards

CO-PO Mapping

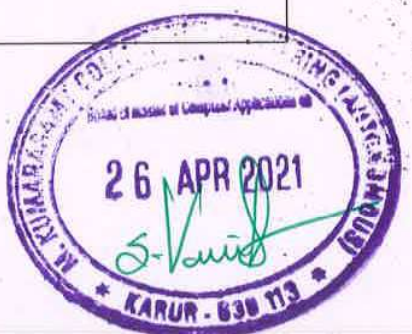
	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	2	1	2	2	2
CO2	2	2	2	2	1	2	2	2
CO3	2	2	3	2	1	2	2	2
CO4	2	2	2	2	1	2	2	2
CO5	2	2	2	2	1	2	2	2
CO (Avg)	2	2	2.2	2	1	2	2	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	INTRODUCTION	12
Security trends, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography- Foundations of modern cryptography: perfect security – Cryptanalysis.		
UNIT II	**SYMMETRIC KEY CRYPTOGRAPHY**	**12**
Mathematics of Symmetric Key Cryptography: Algebraic structures - Modular arithmetic- Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- Symmetric Key Ciphers: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.		
UNIT III	**PUBLIC KEY CRYPTOGRAPHY**	**12**
Mathematics of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - Asymmetric Key Ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.		
UNIT IV	**MESSAGE AUTHENTICATION AND INTEGRITY**	**12**
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509		
UNIT V	**SECURITY PRACTICE AND SYSTEM SECURITY**	**12**
Security – PGP, S/MIME – IP security – Web Security - System Security: Intruders – Malicious software – viruses – Firewalls.		

Reference (s)

1	Atul Kahate, Cryptography and Network Security, Tata McGraw Hill, Third Edition , 2017
2	Prakash C. Gupta, Cryptography and Network Security,PHI Learning,2015
3	William Stallings, Cryptography and Network Security - Principles and Practice, Pearson Paperback, Seventh Edition, June 2017
4	Ajay Kumar, S. Bose, Cryptography and Network Security, Pearson Education India, Second Edition, 2016



Regulations 2020		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	20PCAP201L	MOBILE APPLICATION DEVELOPMENT LABORATORY	0	0	4	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Know the components and structure of mobile application development frameworks like Android /windows /ios
2	Understand how to work with various mobile application development frameworks
3	Learn the basic and important design concepts and issues of development of mobile applications
4	Understand the capabilities and limitations of mobile devices
5	Write applications for the platforms used, simulate them, and test them on the mobile hardware where possible

Course Outcome (s) (Cos):

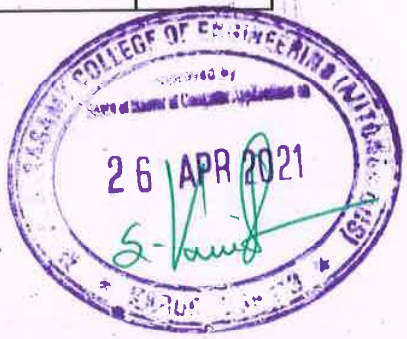
At the end of this course, learners will be able to:

CO1	Install and configure Android application development tools
CO2	Demonstrate the anatomy of an android application
CO3	Apply Java programming concepts to Android application development
CO4	Design and implement various mobile applications
CO5	Deploy applications to handheld devices

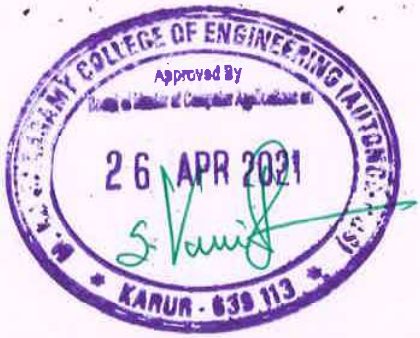
CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	2	2	1	2	2	3	2
CO2	3	2	2	1	2	2	3	2
CO3	3	2	2	1	2	2	3	2
CO4	3	2	2	1	2	2	3	2
CO5	3	2	2	1	2	2	3	2
CO (Avg)	3	2	2	1	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



List of Experiments	
1.	Develop an application that uses Layout Managers.
2.	Develop an application that uses event listeners.
3.	Develop an application that uses Adapters, Toast..
4.	Develop an application that makes use of database.
5.	Develop an application that makes use of RSS Feed.
6.	Implement an application that implements Multi-threading.
7.	Develop a native application that uses GPS location information.
8.	Implement an application that writes data to the SD card.
9.	Implement an application that creates an alert upon receiving a message.
10.	Develop a game application



Regulations 2020		Semester IV	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	20PCAP202L	DATA WAREHOUSING AND DATA MINING LABORATORY	0	0	4	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Understand dataset and pre-processing
2	Demonstrate the various algorithms for the data mining tasks
3	Exercise the data mining techniques with varied input values for different parameters
4	Obtain practical experience with real data sets
5	Practical exposure on well-known data mining tasks

Course Outcome (s) (Cos):

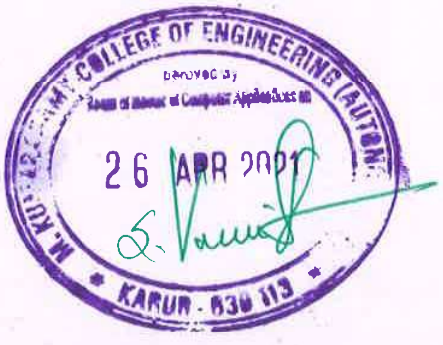
At the end of this course, learners will be able to:

CO1	Understand the various kinds of tools
CO2	Apply the association, classification algorithms to a given data set
CO3	Apply the clustering techniques to a given data set
CO4	Analyze the various data mining techniques
CO5	Use appropriate techniques for the given data set

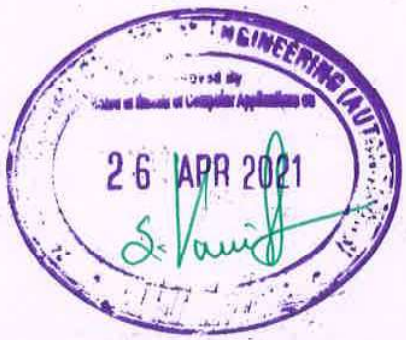
CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	1	1	2	3	2
CO2	2	2	2	1	1	2	3	2
CO3	2	2	2	1	1	2	3	2
CO4	2	2	2	1	1	2	3	2
CO5	2	2	2	1	1	2	3	2
CO (Avg)	2	2	2	1	1	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



List of Experiments
1. Create a data set and perform the preprocessing using statistical analysis of data 2. Prediction of stock price using python 3. Time series analysis of climate data using python 4. Multi-dimensional data model using SQL queries. E.g. Star, snowflake and Fact constellation schemas 5. OLAP operations such slice, dice, roll up, drill up, pivot etc. 6. Association rule mining using Apriori algorithm and FP Growth Algorithm 7. Classification by decision tree 8. Classification by Bayesian classification 9. Cluster analysis by k-means method 10. Extracting the knowledge on a particular data set



Regulations 2020		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	20PCAP203L	CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY	0	0	4	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To learn different cipher techniques
2	To implement the algorithms DES, RSA,MD5,SHA-1
3	To use network security tools and vulnerability assessment tools

Course Outcome (s) (Cos):

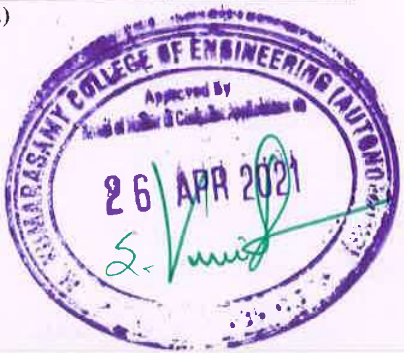
At the end of this course, learners will be able to:

CO1	Develop code for classical Encryption Techniques to solve the problems.
CO2	Build cryptosystems by applying symmetric and public key encryption algorithms.
CO3	Construct code for authentication algorithms.
CO4	Develop a signature scheme using Digital signature standard.
CO5	Demonstrate the network security system using open source tools

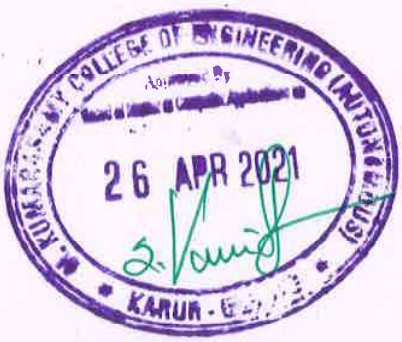
CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	1	3	2	1	1	2	1
CO2	2	1	3	2	1	1	2	1
CO3	2	1	3	2	1	1	2	1
CO4	2	1	3	2	1	1	2	1
CO5	2	1	3	2	1	1	2	1
CO (Avg)	2	1	3	2	1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



List of Experiments
1. Write a Java program to perform encryption and decryption 3 using the following algorithms: a) Ceaser Cipher b) Substitution Cipher c) Hill 2. Write a Java program to implement the DES algorithm logic 3. Write a Java program to implement RSA Algorithm 4. Implement the Diffie-Hellman Key Exchange algorithm for a given problem. 5. Write a java program to implement the Blowfish algorithm. 6. Calculate the message digest of a text using the SHA-1 algorithm. 7. Analyse Network traffic using Wireshark tool. 8. Analyse the Network Traffic using Cisco packer racer. 9. Establish Peer-to-Peer Network using Cisco packer racer. 10. Configure Windows Firewall 11. Introduction to White Hacking. 12. Write a Python Program to implement White Hacking.



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE101T	SOFTWARE TESTING AND QUALITY ASSURANCE	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To know the behavior of the testing techniques and to design test cases to detect the errors in the software
2	To get insight into the levels of testing in the user environment
3	To understand testing environment to check the occurrence of defects and its removal
4	To learn the functionality of automated testing tools to apply in the specialized environment
5	To understand the models and metrics of software quality and reliability

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Able to test the software by applying various testing techniques.
CO2	Able to debug the project and to test the entire computer based systems at all levels.
CO3	Able to test the applications in the specialized environment using various automation tools.
CO4	Able to understand the selecting and installing software testing tools
CO5	Able to apply quality and reliability metrics to ensure the performance of the software.

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	1	2	2	2	2
CO2	2	2	2	1	2	2	2	2
CO3	2	2	2	1	2	2	3	2
CO4	2	2	3	1	2	2	2	2
CO5	2	2	2	2	2	3	2	2
CO (Avg)	2	2	2.2	1.2	2	2.2	2.2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	TESTING TECHNIQUES & TEST CASE DESIGN	9
Using White Box Approach to Test design - Test Adequacy Criteria –Test Case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis –Decision tables – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Error guessing – Compatibility testing – User documentation testing – Domain testing – Case study for Control Flow Graph and State based Testing.		
UNIT II	**LEVELS OF TESTING**	**9**
The Need for Levels of Testing- Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording Results – Integration Tests – Designing Integration Tests- Scenario Testing – Defect Bash Elimination. System Testing – Acceptance testing – Performance testing – Regression Testing - Internationalization testing - Ad-hoc testing – Alpha, Beta Tests- Testing OO systems – Usability and Accessibility Testing – Configuration Testing - Compatibility Testing –Website Testing		
UNIT III	**TESTING FOR SPECIALIZED ENVIRONMENT**	**9**
Definitions - Reason for software standards - Benefits - Establishing standards - Guidelines - Types of reviews - Inspection of objectives - Basic inspection principles - The conduct of inspection - Inspection training.		
UNIT IV	**TEST AUTOMATION**	**9**
Selecting and Installing Software Testing Tools – Selenium-Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.		
UNIT V	**SOFTWARE TESTING AND QUALITY METRICS**	**9**
Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics		
Reference (s)		
1	Stephan Goericke, The Future of Software Quality Assurance, Springer Publication, Paperback, First Edition, 2020	
2	Ajay Kumar Jena, Himansu Das, Durga Prasad Mohapatra, Automated Software Testing: Foundations Applications and Challenges (Services and Business Process Reengineering), Springer Publication, First Edition, 2020	
3	Rex Black, Erik van Veenendaal, Dorothy Graham , Foundations of Software Testing ISTQB Certification Paperback, Fourth Edition , 2020	

Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE102T	ARTIFICIAL INTELLIGENCE	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To understand the various characteristics of Intelligent agents
2	To learn about the different search strategies in AI
3	To understand solving AI problems
4	To understand the different ways of designing software agents
5	To know about the various applications of AI

Course Outcome (s) (Cos):

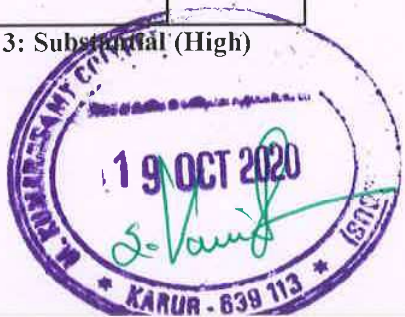
At the end of this course, learners will be able to:

CO1	Describe the fundamentals in AI
CO2	Utilize various problem solving methods in AI
CO3	Illustrate various knowledge representation techniques in AI
CO4	Analyze the different ways of designing a software agents
CO5	Summarize the various applications of AI

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	2	3	1	2	2	3	2
CO2	3	2	3	1	2	2	3	2
CO3	3	2	3	1	2	2	3	2
CO4	3	2	3	1	2	2	3	2
CO5	3	2	3	1	2	2	3	2
CO (Avg)	3	2	3	1	2	2	3	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTRODUCTION	7
Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.		
UNIT II	**PROBLEM SOLVING METHODS**	**10**
Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search		
UNIT III	**KNOWLEDGE REPRESENTATION**	**10**
First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects		
UNIT IV	**SOFTWARE AGENTS**	**10**
Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.		
UNIT V	**APPLICATIONS**	**8**
AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving-Introduction: Expert Systems -Case based Reasoning		

Reference (s)

1	Stuart J.Russel Peter Norvig, Artificial Intelligence A Modern Approach, Fourth Edition, Pearson Education,2020
2	I. Bratko, —Prolog: Programming for Artificial Intelligencell, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011
3	M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science), First Edition, Jones and Bartlett Publishers, 2009
4	William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2012
5	David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010

Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE103T	BLOCKCHAIN TECHNOLOGY	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	To understand the importance of block chain and abstract model of block chain and crypto currencies
2	understand the difference of centralization and decentralization
3	To familiarize with the consensus mechanism and consensus protocols
4	To make familiar with the other crypto currencies in block chain
5	To understand the hyper ledger fabric

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Describe the basic concepts and technology used for block chain
CO2	Describe about the role of distributed consensus in the decentralized network
CO3	Demonstrate the working principle of consensus mechanism and the consensus protocols available in block chain
CO4	Differentiate the different types of crypto currencies and interaction between bit coin and alternate coins (Ethereum, Smart Contract)
CO5	Discuss about the importance of hyper ledger fabric in block chain technology

CO-PO Mapping

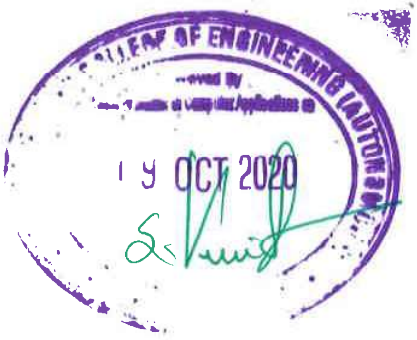
	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	-	-	-	2	2	2
CO2	2	2	2	-	-	2	2	2
CO3	2	2	3	-	-	2	2	2
CO4	2	2	2	-	-	2	2	2
CO5	2	2	2	-	-	2	2	2
CO (Avg)	2	2	1.8	-	-	2	2	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	INTRODUCTION	9
Introduction – basic ideas behind block chain , how it is changing the landscape of digitalization – Banking, Land Record, Supply chain and provenance – Bit coin and other cryptocurrencies – Trust Model – Digital Currency Ideas – Basic Concepts of Cryptography – Cryptographic Hash Functions – Hash Pointers and Data Structures – Digital Signatures – Public Keys as Identities		
UNIT II	**CENTRALIZATION VS DECENTRALIZATION**	**9**
Create your own block chain – Centralization vs Decentralization – Decentralization in Block chain – Decentralization in Bit coin - Distributed Consensus		
UNIT III	**CONSENSUS**	**9**
Consensus without identity : Block chain – Simple Consensus Algorithm – Incentives and Proof of Work – Bit coin Transactions – Bit coin Scripts – Applications of Bit coin Scripts		
UNIT IV	**BITCOIN AND ALTERNATIVE COINS**	**9**
Bit coin blocks – The Bit coin Network – Limitations and Improvements – Introduction to Ethereum and Smart Contracts		
UNIT V	**HYPERLEDGER FABRIC**	**9**
Evolution of Block chain Technology – Order-execute paradigm – Other issues with other block chains – Hyper ledger Fabric – Order-execute paradigm : block chains, PoW, Limitations – State Machine Replication Model : Requirements, Implementation, Implementation of Client Generated ID and Replica Generated ID – Fault Tolerance – Byzantine Tolerance – Smart Contract in Fabric – Endorsement Policy – Fabric Transaction Flow - Case Study : Electronic Health Record application using hyper ledger fabric		

Reference (s)

1	Prof. Sandeep Shukla, 'Introduction to Blockchain Technology & Applications', NPTEL Lecture Series [Unit – Lecture Series : 1 – (1,2), 2- (3,4,5), 3- (6,7,8,9,10), 4- (11,12,13,14,15), 5- (21,22,23,24,28)]
2	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Bitcoin and Cryptocurrency Technologies : A Comprehensive Introduction, Princeton University Press, 2016 (Chapter 1,2,3)



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE104T	AGILE METHGODOLOGIES FOR SOFTWARE DEVELOPMENT	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To learn about Agile terminology and its basic concepts.
2	To gain knowledge in the area of various Agile Methodologies.
3	To know the principles and values of Agility.
4	To Bringing development and operations teams together.
5	To learn about Lean Software Development.

Course Outcome (s) (Cos):

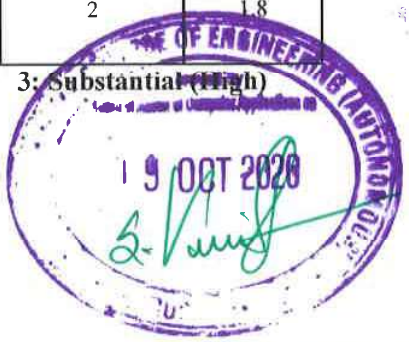
At the end of this course, learners will be able to: .

CO1	Understand Agile Methodologies and Develop tools.
CO2	Apply software process management concepts in real time applications.
CO3	Understand Scrum agile principles and values.
CO4	Understanding the DevOps movement and DevOps lifecycle.
CO5	Devise a plan for delivering a quality product using Lean Software

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	2	1	2	1	1
CO2	2	2	2	2	1	2	2	2
CO3	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	2	2	2
CO5	2	2	2	2	1	2	2	2
CO (Avg)	2	2	2	2	1.6	2	2	1.8

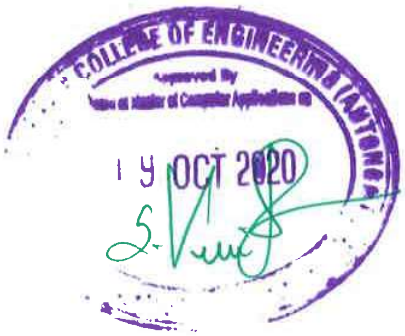
1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTRODUCTION	9
Foundations: Background – The Software Process Ecosystem – Historical Overview – Terminology and Basic Concepts. Software Process in the Software Product Life Cycle: Introduction – Basic Software Development Life Cycle Models – Methodology – Driven Cycle and Process Models – Detailed combined Software Life Cycle and Process Models.		
UNIT II	**AGILE PROCESSES**	**9**
Agile : Introduction – Core Attitudes of Agile – Learning through Example. The need for Agile Methodologies – Principles of Agile Project Management – Introduction to Scrum – Scrum Principles – Sprint Planning, Execution and Reviewing – Becoming a better Scrum Master - Introduction to kanban – The work in progress.		
UNIT III	**SCRUM**	**9**
Scrum: Agile Principles and Values- Scrum: Development Teams – Scrum Master – Planning – Sprint Review – Sprint Retrospective. Three Scrum Artifacts – Sprint Cycle – Scrum Estimation – Scrum Planning and Roadmaps – The daily Scrum –Scrum case studies and findings.		
UNIT IV	**AGILITY AND KNOWLEDGE MANAGEMENT**	**9**
DevOps Concepts, Tools, and Technologies: Understanding the DevOps movement - The DevOps lifecycle - Tools and technologies: Code Repositories – GIT - Build Tools – Maven – Continuous Integration Tools – Jenkins – Configuration Management tools – Chef – Container Technology – Docker – Monitoring Tools. Installing and Configuring Docker.		
UNIT V	**LEAN SOFTWARE DEVELOPMENT**	**9**
Introduction to Lean : Lean Thinking Tools. Design Thinking, Lean and Agile: Introduction – Actionable Strategy – Act to Learn – Leading teams to win- Delivery: Devops and Continuous Delivery – Evolutionary Architecture and Emergent Design.		

Reference (s)

1	Ralf Kneuper , Software Processes and Life Cycle Models, Springer, 2018
2	James Edge, Agile: An Essential Guide to Agile Project Management, the Kanban Process and Lean Thinking, Create Space Independent Publishing, 2018
3	Jonny Schneider , Understanding Design thinking, Lean and Agile, First Edition, O'Reilly Publishing, 2017



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE105T	MACHINE LEARNING	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Recognize definition, goals and applications of Machine Learning techniques.
2	Understand the concepts of Descriptive Statistics
3	Recognize various machine learning techniques such as Supervised and Unsupervised Learning Concepts, Classification, Regression etc.
4	Understand the fundamentals of Neural Networks and Data Science.
5	Understand the fundamentals of R language and its usage for statistical computing

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Explain the fundamentals of Machine Learning.
CO2	Demonstrate various concepts of Descriptive Statistics
CO3	Apply Machine Learning techniques such as classification, regression
CO4	Outline the basics of neural networks, data science and Deep Learning.
CO5	Constructs the concepts of R programming

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	1	2	2	2	2
CO2	2	2	2	1	1	2	2	2
CO3	2	2	2	1	1	2	2	2
CO4	2	3	2	1	1	1	2	2
CO5	2	2	2	2	2	2	2	2
CO (Avg)	2	2.2	2	1.2	1.4	1.8	2	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	INTRODUCTION OF MACHINE LEARNING	9
Definition, Goals and Applications of Machine Learning - Types of Learning Techniques: Supervised ,Unsupervised and Semi-supervised, Reinforcement Learning - Aspects of Developing a Learning System:Training Data, Concept Representation, Function Approximation - Examples of Machine Learning Problems-Structure of Learning versus Designing-Training versus Testing- Characteristics of Machine Learning Tasks- Predictive and Descriptive Tasks.		
UNIT II	**DESCRIPTIVE STATISTICS**	**9**
Central tendency: Mean, Median, Mode- Measures of Dispersion: Variance, Standard Deviation-Measures of Shape : Skewnes , kurtosis, Percentile, Five number summary-Data Visualization: Box plot, Histogram, Bar Chart, Pie Chart, Scatter plot- Association Analysis: Covariance, Correlation, Types of Correlation :Pearson Correlation, Spearman Correlation, Kendall Correlation, Two Way Tables, Chi-Squared Test for Two Way Tables.		
UNIT III	**SUPERVISED AND UNSUPERVISED LEARNING**	**9**
Supervised Learning: Regression, Simple Linear Regression, Multiple Linear Regression, Logistic Regression- Classification, Decision Tree, k-Nearest Neighbors, Support Vector Machine (SVM).Unsupervised Learning: Clustering, Introduction, Distance Measure, Clustering Methods: Density Based Clustering, DBSCAN, Grid Based Clustering-Cluster Tendency Assessment-Applications of Clustering.		
UNIT IV	**NEURAL NETWORKS AND INTRODUCTION TO DATA SCIENCE**	**9**
Introduction to Neural Networks-Activation Functions -Learning Rate-Stochastic Gradient Descent-Feed forward-Back Propagation-Basics of Deep Learning Networks-Introduction to Data Science-Digital Data- Data Science and its components.		
UNIT V	**OBJECTS AND HANDS-ON LAB USING R**	**9**
Introduction to R, R Objects and Classes : Class, Object, Vector, List, Factor, Matrix, Array, Data Frame,Manipulating Objects, Input/output-R constructs-R Advantages-Hands on-Experiments for: Data Description,Data Visualization, Correlation analysis, Clustering, Regression, Classification, Neural networks.		

Reference (s)

1	Ethem Alpaydin, Introduction to Machine Learning , Third Edition, MIT Press, 2014
2	Jason Bell, Machine learning -Hands on for Developers and Technical Professionals, First Edition, Wiley, 2014
3	Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
4	Stephen Marsland, Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE106T	CYBER SECURITY AND LAW	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Exhibit knowledge to Cyber Threats.
2	Practice with an expertise in academics to design and implement security solutions.
3	Understand Security Considerations and Challenges.
4	Examine secure software development practices.
5	Understand cyber security strategies and policies .

Course Outcome (s) (Cos):

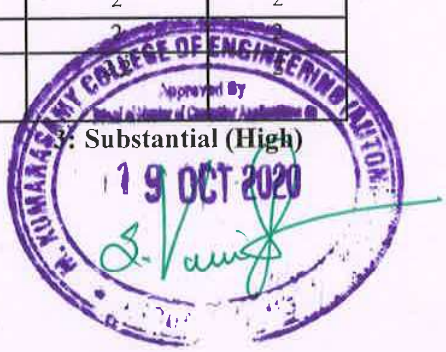
At the end of this course, learners will be able to:

CO1	Analyze and evaluate the cyber security needs of an organization.
CO2	Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
CO3	Understand Secure Web Application Services.
CO4	Identification of cyber security Malware infection, Intrusion detection and Prevention Techniques
CO5	Design operational and strategic cyber security strategies and policies.

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	2	2	2	1	2	2	2
CO2	3	2	2	2	1	2	2	2
CO3	3	2	2	2	1	2	3	2
CO4	3	2	3	2	1	2	2	2
CO5	3	2	2	2	1	3	2	
CO (Avg)	3	2	2.2	2	1	2.2		

: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	INTRODUCTION TO CYBER SECURITY	9
Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.		
UNIT II	**CYBER SECURITY VULNERABILITIES AND CYBER SECURITY SAFEGUARDS**	**9**
Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.		
UNIT III	**SECURING WEB APPLICATION, SERVICES AND SERVERS**	**9**
Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges		
UNIT IV	**INTRUSION DETECTION AND PREVENTION**	**9**
Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.		
UNIT V	**CYBERSPACE AND THE LAW**	**9**
Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.		
Reference (s)		
1	Nilakshi Jain , Ramesh Menon, Cyber Security and Cyber Laws, Wiley Publication , 2020	
2	Kosseff, Jeff, Cyber Security Law, Second Edition, Wiley Publication 2019.	

Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE107T	BIO INFORMATICS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Exposed to the need for Bioinformatics technologies
2	Be familiar with the modeling techniques
3	Learn microarray analysis
4	Exposed to Pattern Matching and Visualization
5	Examine Microarray Analysis technology

Course Outcome (s) (Cos):

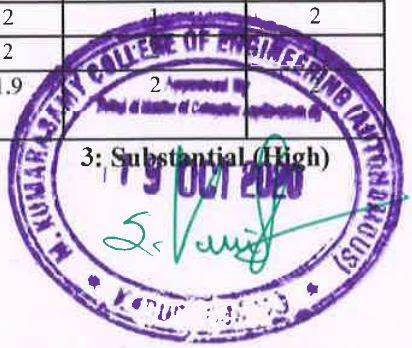
At the end of this course, learners will be able to:

CO1	Able to Develop models for biological data.
CO2	Apply pattern matching techniques to bioinformatics data – protein data genomic data.
CO3	Apply modeling for bioinformatics.
CO4	Apply pattern matching and visualization
CO5	Apply micro array technology for genomic expression study

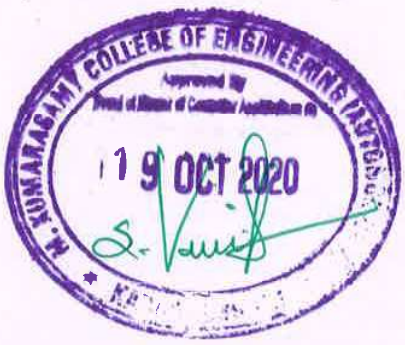
CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	3	1	2.5	1.5	2	2
CO2	3	3	2	2	2	2	2	1
CO3	3	2	2	2	2	2	2	2
CO4	2	2	1	2	2	2	1	2
CO5	2	2	2	2	2	2	2	2
CO (Avg)	2.4	2.2	2	1.8	2.1	1.9	2	2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTRODUCTION	9
Need for Bioinformatics technologies - Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics - Biological Data Integration System.		
UNIT II	**DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS**	**9**
Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.		
UNIT III	**MODELING FOR BIOINFORMATICS**	**9**
Hidden Markov modeling for biological data analysis – Sequence identification – Sequence classification – multiple alignment generation – Comparative modeling –Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.		
UNIT IV	**PATTERN MATCHING AND VISUALIZATION**	**9**
Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.		
UNIT V	**MICROARRAY ANALYSIS**	**9**
Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.		
Reference (s)		
1	Yi-Ping Phoebe Chen (Ed), BioInformatics Technologies, First Indian Reprint, Springer Verlag, 2007.	
2	Bryan Bergeron, Bio Informatics Computing, Second Edition, Pearson Education, 2015.	



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE108T	DATA SCIENCE	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To know the fundamental concepts of data science and analytics
2	To understand the different data analysis methods
3	To learn various data mining techniques
4	To learn the functionality of data streams
5	To understand the reality of Frameworks and Visualization

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

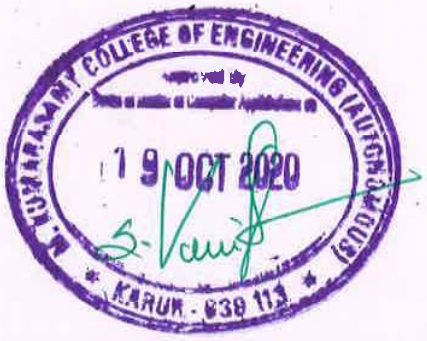
CO1	Work with big data platform and its analysis techniques.
CO2	Model a framework for Human Activity Recognition
CO3	Design efficient algorithms for mining the data from large volumes
CO4	Apply the Data stream concepts
CO5	Model a framework for Human Activity Recognition

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	2	2	1	-	2	3	2
CO2	3	2	2	1	-	2	3	2
CO3	3	2	2	1	-	2	3	2
CO4	3	2	3	1	-	2	3	2
CO5	3	2	2	2	-	3	3	
CO (Avg)	3	2	2.2	1.2	-	2.2	3	

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	INTRODUCTION TO DATA SCIENCE AND BIG DATA	9
Introduction to Data Science – Applications - Data Science Process – Exploratory Data analysis – Collection of data – Graphical presentation of data – Classification of data – Storage and retrieval of data – Big data – Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.		
UNIT II	**DATA ANALYSIS**	**9**
Correlation – Regression – Probability – Conditional Probability – Random Variables – Analysis using Mean, Median, Model, Standard Deviation, Skewness, Kurtosis- Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics		
UNIT III	**DATA MINING TECHNIQUES**	**9**
Rule Induction - Neural Networks: Learning and Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods- Neuro-Fuzzy Modelling – Association rule mining – Clustering – Outlier Analysis – Sequential Pattern Mining – Temporal mining – Spatial mining – Web mining.		
UNIT IV	**MINING DATA STREAMS**	**9**
Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions		
UNIT V	**FRAMEWORKS AND VISUALIZATION**	**9**
Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – Cloud databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques – Social Network Analysis – Collective Inferencing – Egonets - Systems and Applications.		
Reference (s)		
1	Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014	
2	Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.	



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE109T	PREDICTIVE ANALYSIS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To learn about Mining on various kinds of data and Applications of Data Mining
2	To understand about Data and the preparation of Data.
3	To learn, how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models
4	To know the use of the binary classifier and numeric predictor nodes to automate model Selection.
5	To understand the framework and Visualization.

Course Outcome (s) (Cos):

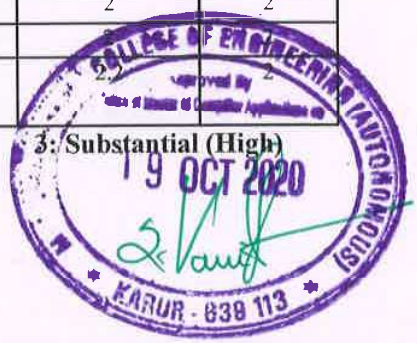
At the end of this course, learners will be able to:

CO1	Understand the process of formulating business objectives.
CO2	To design the data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business application
CO3	Compare the underlying predictive modelling techniques.
CO4	Select appropriate predictive modelling approaches to identify cases to progress with models.
CO5	Analyze Visual data technique and Social Network.

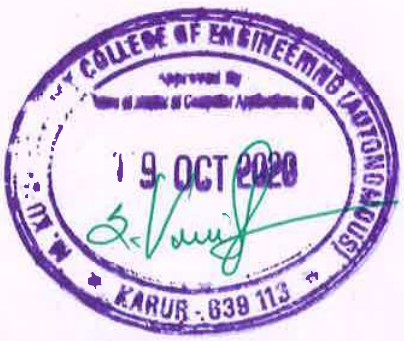
CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	-	-	1	2	2
CO2	2	2	2	-	-	2	2	2
CO3	2	3	3	-	-	2	3	2
CO4	2	2	3	-	-	2	2	2
CO5	2	2	2	-	-	2		
CO (Avg)	2	2.2	2.4	-	-		2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	INTRODUCTION	9
Introduction to Data Mining Introduction, what is Data Mining? Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining.		
UNIT II	**DATA PREPARATION**	**9**
Data Understanding and Preparation Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.		
UNIT III	**MODEL DEVELOPMENT**	**9**
Model development & techniques Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.		
UNIT IV	**MODEL EVALUATION**	**9**
Model Evaluation and Deployment Introduction, Model Validation, Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, MetaLevel Modeling, Deploying Model, Assessing Model Performance, Updating a Model.		
UNIT V	**FRAMEWORKS AND VISUALIZATION**	**9**
Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – Cloud databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques – Social Network Analysis – Collective Inferencing – Egonets - Systems and Applications.		
Reference (s)		
1	John D. Kelleher , Brian Mac Namee and Aoife D'Arcy ,Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies,Second Edition ,MIT Press,2015	
2	Eric Siegel,Predictive Analytics: The Power to Predict Who Will Click Lie, or Die,Second Edition, 2016	
3	Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.	



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE110T	ADVANCED DATABASES	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To know about the Parallel and Distributed Databases
2	To understand the fundamentals of Object Relational Databases
3	To understand a way to store and retrieve Database information in XML Databases
4	To have an introductory knowledge about Mobile Databases
5	To Apply the emerging trends in Multimedia Databases

Course Outcome (s) (Cos):

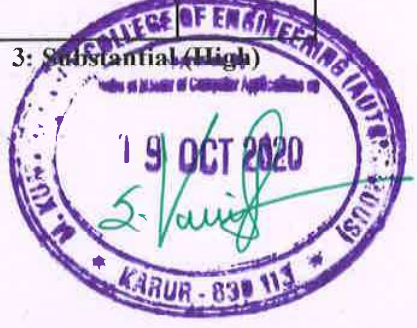
At the end of this course, learners will be able to:

CO1	Ability to Design of database for any given problem
CO2	Ability to understand the practical problems of Concurrency control and its solutions
CO3	Apply query evaluation techniques and query optimization techniques.
CO4	Develop transaction processing systems with concurrency control.
CO5	Design and develop a database application system as part of a team.

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	2	2	2	2	2	1	2
CO2	2	3	2	2	2	2	2	1
CO3	2	2	1	2	2	2	2	2
CO4	2	2	1	1	1	1	2	2
CO5	2	2	2	2	2	2	2	2
CO (Avg)	2	2.2	1.6	1.8	1.8	1.8	1.8	1.8

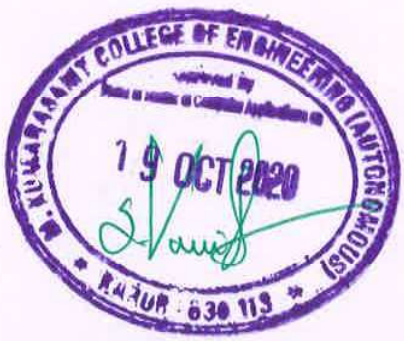
1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	PARALLEL AND DISTRIBUTED DATABASES	9
Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture-Case Studies.		
UNIT II	**OBJECT AND OBJECT RELATIONAL DATABASES**	**9**
Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational feature sin SQL/Oracle –Case Studies.		
UNIT III	**XML DATABASES**	**9**
XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC – Information Retrieval – Data Warehousing – Data Mining		
UNIT IV	**MOBILE DATABASES**	**9**
Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes		
UNIT V	**MULTIMEDIA DATABASES**	**9**
Multidimensional Data Structures – Image Databases – Text/Document Databases- Video Databases – Audio Databases – Multimedia Database Design.		

Reference (s)

1	Subramanian V. S., "Principles of Multimedia Database Systems", Elsevier Publishers, Reprint 2011
2	A. Silberschatz, H. F. Korth and S. Sudarshan, Database System Concepts, Seventh Edition, Tata McGraw hill, 2021.



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE111T	BIG DATA ANALYTICS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Explore the fundamental concepts of big data analytics
2	Analyze the big data using intelligent techniques.
3	Understand the various search methods and visualization techniques.
4	Use various techniques for mining data stream
5	Understand the application using Map Reduce Concepts

Course Outcome (s) (Cos):

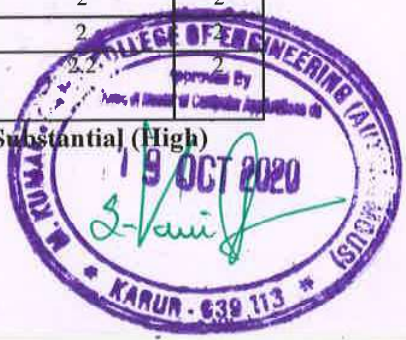
At the end of this course, learners will be able to:

CO1	Work with big data platform and Understand the fundamentals of various big data analysis techniques
CO2	Analyze the big data analytic techniques for useful business applications
CO3	Analyze the Hadoop and Map Reduce technologies associated with big data analytics.
CO4	Design efficient algorithms for mining the data from large volumes.
CO5	Explore the applications of Big Data

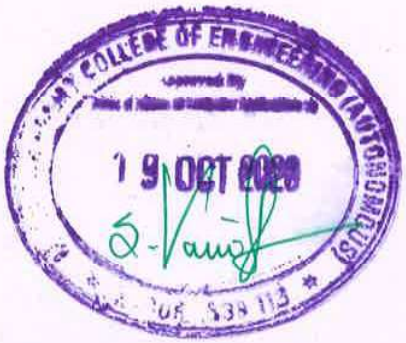
CO-PO Mapping

COS	Pos						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	2	2	2	1	2	2	2
CO2	3	2	2	2	1	2	2	2
CO3	3	3	3	2	1	2	3	2
CO4	3	2	3	2	1	2	2	2
CO5	3	2	2	2	1	2	2	2
CO (Avg)	3	2.2	2.4	2	1	2	2.2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	INTRODUCTION TO BIG DATA	9
Introduction to BigData Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error		
UNIT II	**MINING DATA STREAMS**	**9**
Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – EstimatingMoments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP)Applications – Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.		
UNIT III	**HADOOP ENVIRONMENT**	**9**
History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Hadoop filesystems-Java interfaces to HDFS- Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features - Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration-Security in Hadoop		
UNIT IV	**DATA ANALYSIS AND VISUALIZATION**	**9**
Link Analysis – PageRank - Efficient Computation of PageRank- Topic-Sensitive PageRank – Link Spam- Recommendation Systems- A Model for Recommendation Systems- Content-Based Recommendations - Collaborative Filtering- Dimensionality Reduction- Visualizations - Visual data analysis techniques-interaction techniques- Systems and applications.		
UNIT V	**FRAMEWORKS AND APPLICATIONS**	**9**
IBM for Big Data –Framework - Hive – Sharding – NoSQL Databases –Mango DB-Casandra-Hbase – Impala – Analyzing big data with twitter – Big data for Ecommerce – Big data for blogs.		
Reference (s)		
1	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014	
2	Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding BigData: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012	
3	Chivukula, A., Mogadala, A., Ghosh, R., Livingston, Prabhu, C.S.R., Sreevallabh L.M.J, Big Data Analytics: Systems, Algorithms, Applications,Springer Publication, 2019	



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE112T	SOCIAL NETWORK ANALYSIS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	To understand the key concept of the semantic web and web based network
2	To model and visualize the social network.
3	To mine the users in the social network.
4	To understand the evolution of the social network.
5	To know the applications in real time systems.

Course Outcome (s) (Cos):

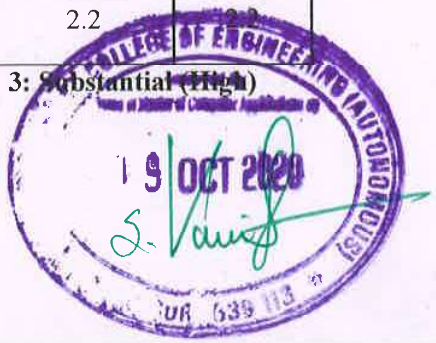
At the end of this course, learners will be able to:

CO1	Work on the internals components of the semantic web and web based network
CO2	Model and visualize the social network
CO3	Mine the behavior of the users in the social network
CO4	Predict the possible next outcome of the social network
CO5	Apply social network in real time applications

CO-PO Mapping

	Pos						PSOs	
COS	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	2	1	1	1	2	2	2	2
CO2	2	2	1	1	1	2	2	2
CO3	2	2	1	2	2	2	2	2
CO4	2	2	1	1	1	1	3	2
CO5	2	2	2	2	2	2	2	3
CO (Avg)	2	1.8	1.2	1.4	1.6	1.8	2.2	2.2

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTRODUCTION	9
Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.		
UNIT II	**MODELING AND VISUALIZATION**	**9**
Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.		
UNIT III	**MINING COMMUNITIES**	**9**
Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities -- Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.		
UNIT IV	**EVOLUTION**	**9**
Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.		
UNIT V	**APPLICATIONS**	**9**
A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection		
Reference (s)		
1	Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, —Computational Social Network Analysis: Trends, Tools and Research Advances, Springer, 2012	
2	Borko Furht, —Handbook of Social Network Technologies and Applicationsl, Springer, First edition, 2011	
3	Charu C. Aggarwal, —Social Network Data Analytics, Springer; 2014	
4	Giles, Mark Smith, John Yen, —Advances in Social Network Mining and Analysisl, Springer, 2010.	

Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PBAE113T	CUSTOMER RELATIONSHIP MANAGEMENT	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is t

1	Able to learn Customer Relationship Management concepts, techniques and strategies.
2	Able to understand how to build strong relationship with customers and learn how to retain the same

Course Outcome (s) (Cos):

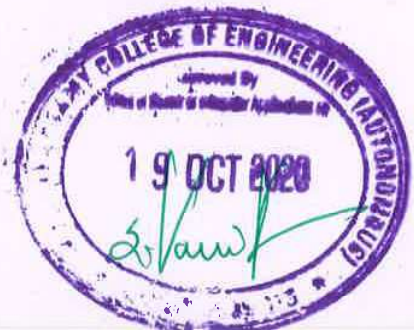
At the end of this course, learners will be able to:

CO1	To acquire knowledge on how to use CRM as a strategic marketing tool and develop CRM strategy.
CO2	To gain knowledge on methods of selecting profitable customer segments.
CO3	To understand how to acquire and retain customers.
CO4	To understand the strategy to generate sales leads.
CO5	To gain knowledge on basic concepts of data warehousing, data mining and other CRM software packages.

CO-PO Mapping

	Pos						PSOs	
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO 1**	**PSO 2**
CO1	2	1.5	1	2	2	2	1	2
CO2	1	3	1	2	2	1	2	1
CO3	2	2	1.5	2	2	2	2	1
CO4	1	2	1	2	2	2	1	2
CO5	2	2	2	2	2	2	2	1
CO (Avg)	1.6	2.1	1.5	2	2	1.8	1.6	1.4

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTRODUCTION	9
Definitions - Concepts and Context of Relationship Management – Evolution - Transactional Vs Relationship Approach – CRM as a Strategic Marketing Tool – CRM Significance to the Stakeholders.		
UNIT II	**UNDERSTANDING CUSTOMERS**	**9**
Customer Information Database – Customer Profile Analysis - Customer Perception, Expectations Analysis– Customer Behavior in Relationship Perspectives- Individual and Group Customer's - Customer Life Time Value – Selection of Profitable Customer Segments.		
UNIT III	**MANAGING CUSTOMER RELATIONSHIPS**	**9**
Creating and Managing Networks- Creating Value for Customers- Zone of Tolerance- Managing the Customer Lifecycle: Customer Acquisition- Strategies for Profitable Dialog with Customers- Customer Retention and Development- Customer Loyalty and Involvement- Role of CRM Managers.		
UNIT IV	**DEVELOPING CRM STRATEGY**	**9**
Sales-force Automation-Marketing Automation-Service Automation - Call Center Management- Big Data Analysis- Management of Big Data - Sales force.com-Lead Generations Strategy.		
UNIT V	**TRENDS IN CRM**	**9**
e-CRM Solutions – Data Warehousing – Design Considerations, Approaches, Architecture- Data Mining for CRM – Techniques, Tools & Platform, Data Mining Best Practices- Click Stream Analysis- An Introduction to CRM Software Packages- Siebel, Oracle, People soft, My SAPCRM.		

Reference (s)

1	Buttle, F. (2014), Customer Relationship Management (Concept and Tools), Elsevier Butterworth- Heinemann, Oxford, UK
2	G.Shainesh, Jagdish, N.Sheth, Customer Relationships Management- Strategic Perspective, Mac millan, 2013.
3	H.Peeru Mohamed and A.Sahadevan, Customer Relations Management, Vikas Publishing, 2014.
4	Francis Buttle, Customer Relationship Management: Concepts & Tools, Elsevier, 2012.
5	Anil Maheswari, Data Analytics, Mc Graw Hill Education (India) Private Limited, 2014.

Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PBAE114T	ENTERPRISE RESOURCE PLANNING	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is t

1	To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
2	To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach
3	To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth
4	To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Course Outcome (s) (Cos):

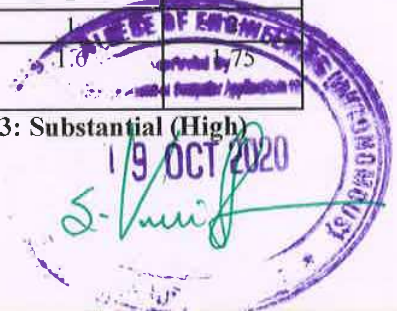
At the end of this course, learners will be able to:

CO1	Analyze the important business functions provided by typical business software such as enterprise resource planning and customer relationship management
CO2	Describe basic concepts of ERP systems for manufacturing or service companies
CO3	Analyze the technical aspect of telecommunication systems, internet and their roles in business environment
CO4	Able to develop skills necessary for building and managing relationships with customers, and stakeholders
CO5	Able to apply ERP in IT business engineering

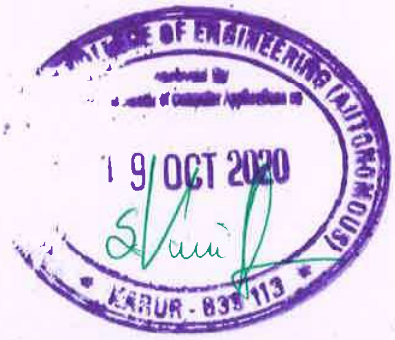
CO-PO Mapping

	Pos						PSOs	
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO 1**	**PSO 2**
CO1	2	2	1.5	2	2	2	1	-
CO2	1	2	2	1	2	2	2	2
CO3	2	2	2	1	1	2	2	2
CO4	1	2	1	1.3	1.5	2	2	1
CO5	1	2	1	1.5	1	2	1	1
CO (Avg)	1.4	2	1.5	1.45	1.5	2	1.6	1.75

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	INTRODUCTION ERP	7
Overview, Accommodating variety, Integrated management information, integration, Supply chain and resource management, Integrated data model scope, Technology and benefits of ERP & the modern enterprise.		
UNIT II	**ERP IMPLEMENTATION**	**10**
Overview, Role of consultants, Vendors and Users, Customization, Precautions, Post implementation options, ERP implementation methodology and guidelines for ERP implementation, Mercedes Benz, Kee Hin Industries, Bull Electronics Angers Plant manufactures, Twentieth Century companies, Ameritech, Essar steel, Jindal Iron and steel company Ltd., Goderej soaps and associate companies, IREDA, Comparison and Conclusions		
UNIT III	**CALL CENTERS MEAN CUSTOMER INTERACTION**	**10**
The functionality, Technological implementation, what is ACD (automatic call distribution), IVR (interactive voice response), CTI (computer telephony integration), Web enabling the call center, Automated intelligent call routing, Logging & Monitoring		
UNIT IV	**INTRODUCTION TO CRM & AUTOMATION**	**10**
Definition of CRM technology, CRM technology components, Customer life style, customer interaction, Introduction to eCRM: difference between CRM & eCRM, features of eCRM. Sales Force Automation (SFA) : Definition & need of SFA, Barriers to successful SFA, SFA functionality, technological aspect of SFA: data synchronization, flexibility & performance, Reporting tools		
UNIT V	**BUSINESS MODELLING OF ERP**	**8**
Overview, Concept, Significance and principles of business engineering, BRP, ERP and IT business engineering with IT, ERP and management concerns, Building an MIS, Business as a system, Core process in a manufacturing company, Entities for data model in a manufacturing company, Extended ERP		
Reference (s)		
1	Vinod Kumar Garg, N. K. Venkita Krishna, Enterprise resource planning, 2nd Edition , PHI, 2003	
2	Paul Greenberg, CRM at the Speed of Light: Social CRM Strategies, Tools, and Technologies for Engaging Your Customer, 4th Edition, McGraw Hill, 2009	
3	Alexis Leon, Enterprise resource planning, 2nd Edition, McGraw Hill, 2009	



Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE115T	WASTE TO ENERGY	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	Enable students to understand of the concept of Waste to Energy
CO2	Link legal, technical and management principles for production of energy form waste
CO3	Learn about the best available technologies for waste to energy
CO4	Analyze of case studies for understanding success and failures
CO5	Facilitate the students in developing skills in the decision-making process.

Course Outcome (s) (Cos):

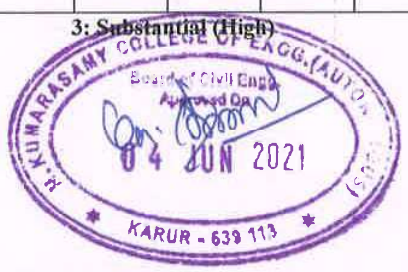
At the end of this course, learners will be able to:

CO1	Apply the knowledge about the operations of Waste to Energy Plants.
CO2	Analyse the various aspects of Waste to Energy Management Systems
CO3	Carry out Techno-economic feasibility for Waste to Energy Plants
CO4	Apply the knowledge in planning and operations of Waste to Energy plants.
CO5	Take decision regarding the environmental issues

CO PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	2	2	1	1	-	2	2	1
CO2	3	2	3	2	2	2	2	1	1	1	-	1	2	1
CO3	2	2	3	2	2	2	2	1	1	1	-	2	2	1
CO4	3	2	3	2	2	2	2	2	1	1	-	2	3	1
CO5	2	2	2	2	-	2	2	1	1	1	-	1	1	1
CO (Avg)	2.60	2.20	2.60	2.00	2.00	2.00	2.00	1.40	1.00	1.00	0.00	1.60	2.00	1.00

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	INTRODUCTION	9
The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.		
UNIT II	**WASTE SOURCES & CHARACTERIZATION**	**9**
Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.		
UNIT III	**TECHNOLOGIES FOR WASTE TO ENERGY**	**9**
Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.		
UNIT IV	**WASTE TO ENERGY OPTIONS**	**9**
Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to fuel resources for other useful energy applications.		
UNIT V	**WASTE TO ENERGY & ENVIRONMENTAL IMPLICATIONS**	**9**
Environmental standards for Waste to Energy Plant operations and gas clean-up – Savings on non-renewable fuel resources – Sustainable Materials Carbon Credits: Carbon foot calculations and carbon credits transfer mechanisms – Case Studies		

Reference (s)

1	Poonia, M.P.,Sharma, S.C., "Environmental Engineering", Khanna Publishers, 2018.
2	Garg, S.K., "Environmental Engineering Vol. I", 24th Edition, New Delhi, Khanna Publishers, 2018.
3	Garg, S.K., "Environmental Engineering Vol. II", 24th Edition, New Delhi, Khanna Publishers, 2018
4	Punmia, B.C., Jain, A.K., and Jain.A., "Environmental Engineering, Vol.II", Lakshmi Publications, 2015.
5	Duggal K.N., "Elements of Environmental Engineering" S.Chand and Co. Ltd., New Delhi, 2014.
6	M.M. EL-Halwagi, "Biogas Technology- Transfer and diffusion", Elsevier Applied Science Publisher, New York, 2016.
7	D.O Hall and R.P. Overend, "Biomass – Regenerable Energy", John Willy and Sons Ltd. New York. 1987.

Regulations 2020		Semester II/III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	20PCAE116T	DISASTER MANAGEMENT	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	Provide students an exposure to disasters, their significance and types.
CO2	Gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
CO3	Ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
CO4	Learn about people involved in disaster management for both sudden-onset natural disasters.
CO5	Develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Differentiate the types of disasters, causes and their impact on environment and society.
CO2	Assess vulnerability and various methods of risk reduction measures as well as mitigation.
CO3	Disaster damage assessment and management.
CO4	Differentiate various Natural Disasters.
CO5	Apply the Case Studies.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	1	-	-	-	-	-	1	-	-
CO2	3	2	2	-	-	1	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	1	-	-	-	-	-	1	-	-
CO4	3	2	-	-	-	1	-	-	-	-	-	1	-	-
CO5	3	2	-	-	-	1	-	-	-	-	-	1	-	-
CO (Avg)	3.00	2.00	2.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO DISASTERS	9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters, Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts – Global trends in disasters: urban disasters, pandemics, complex emergencies,		
UNIT II	**NATURAL AND MAN-MADE DISASTERS**	**9**
Climate change: Wind related- Cyclone, Storm, Storm surge, Tidal waves, Heat and cold Waves- Climatic Change- Global warming- Sea Level rise – Ozone Depletion – Man Made Disasters – Do's and Don'ts during various types of disasters – Possible remedies.		
UNIT III	**INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**	**9**
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.		
UNIT IV	**APPROACHES TO DISASTER RISK REDUCTION**	**9**
Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- non-structural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) - National Disaster Management Authority (NDMA)– Early Warning System – Advisories from Appropriate Agencies.		
UNIT V	**CASE STUDIES AND FIELD WORKS**	**9**
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.		

Reference (s)

1	Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2	Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3	Gupta Anil K, Sreeja S. Nair. "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011
4	Kapur Anu "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi.