



Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AIC301J	MACHINE LEARNING AND AI SERVICES	2	0	2	3

Prerequisite Course (s)

Advance Python

Course Objective (s):

The purpose of learning this course is to:

1	To understand the basic theory underlying machine learning.
2	To be able to formulate machine learning problems corresponding to different applications
3	To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
4	To Understand the basic principles, techniques, and applications of Artificial Intelligence.
5	Investigate applications of AI techniques in expert systems, artificial neural networks and other machine learning models.

Course Outcome (s) (COs):

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

CO1	Understand a very broad collection of machine learning algorithms and problems
CO2	Apply structured thinking to unstructured problems
CO3	Develop an appreciation for what is involved in learning from data.
CO4	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO5	Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	1	-	-	-	-	-	2	3	1
CO2	3	3	2	2	2	-	-	-	-	-	-	1	3	1
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	1
CO4	3	2	2	1	1	2	-	-	-	-	-	1	3	1
CO5	3	2	3	2	2	1	-	-	-	-	-	1	3	1
CO (Avg)	3	2.6	2.2	1.6	1.6	0.8	-	-	-	-	-	1	3	1

1: Slight (Low)

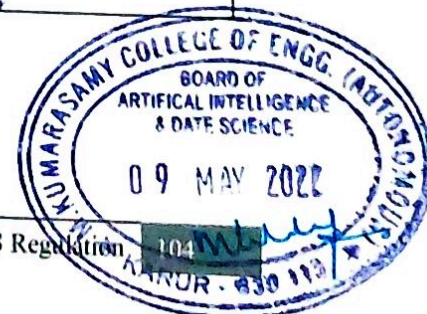
2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION TO MACHINE LEARNING	6
Machine learning Introduction - Types of Machine learning - Supervised, Unsupervised and reinforcement - Over fitting and Linear Regression – Classification - Parametric vs non Parametric models - Linear models		
UNIT II	CLUSTERING AND REGRESSION MODELS	6
Hierarchical clustering - K-Means clustering - Logistic Regression - Bayesian Classifier - Support Vector Machines - Model evaluation Methods - Maximum Likelihood estimation (least squares) - Measuring (dis)similarity - Evaluating the output of clustering method		
UNIT III	TREE LEARNING	6
Directed and Undirected trees - Decision tree representation-Basic decision tree learning algorithm - Issues in decision tree - Classification and regression trees(CART) - Random forest - Multivariate adaptive regression trees(MART)		
UNIT IV	MACHINE LEARNING USING WATSON	6
Introduction to Watson - Prebuilt Watson application - Watson API's - Watson Solutions – Watson Studio – Watson Studio Components - Watson knowledge studio and catalog - Watson Discovery Services - Watson Auto AI - Watson OpenScale		
UNIT V	NATURAL LANGUAGE PROCESSING	6
NLP Introduction - Natural language Understanding (NLU) - Conversational AI - Building blocks of chatbot - Watson Assistant - Speech to Text - Text to speech		
Case Study : <i>“Multi-lingual voice Translator”</i>		
LIST OF EXPERIMENTS		15
<ol style="list-style-type: none"> 1. Group the similar data items using the ML algorithm. 2. Implement k-Nearest Neighbour algorithm to classify the iris data set. 3. Construct a Bayesian network considering student data. 4. Implement a K-Means Clustering 5. Create a chat bot for student help center college. 6. Create a model to Convert Audio note to Text by using Watson API. 7. Analyse the Airbnb(client review) Data using Watson Discovery 		
Text Book (s)		
1	IBM Course ware	
Reference (s)		
1	Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.	
2	Tom Mitchell, "Machine Learning", McGraw-Hill, 2013.	
3	AI as a Service ,Peter Elger, Eóin Shanaghy, Manning Publications, 2020.	



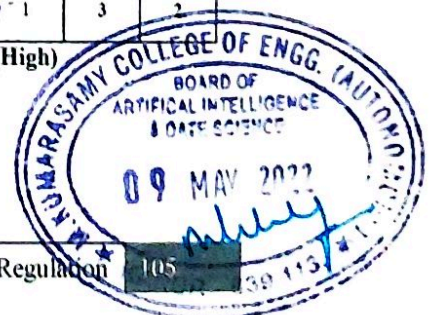


Regulation 2018		Semester V			Total Hours			45						
Category	Course Code	Course Name	Hours / Week			C								
			L	T	P									
C	18AIC302J	DATA ANALYTICS AND BUSINESS INTELLIGENCE	2	0	2	3								
Prerequisite Course (s)														
Python and any reporting tool														
Course Objective (s): The purpose of learning this course is to:														
1	Understand Data analytics in the real world.													
2	Apply data Analysis concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.													
3	Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity.													
4	Identify, model and solve decision problems in different settings.													
5	Create viable solutions to decision making problems													
Course Outcome (s) (COs): At the end of this course, learners will be able to:														
CO1	Describe the concepts and components of Data Analytics.													
CO2	Develop the ability to build and assess data-based models.													
CO3	Understand and use the technologies and tools that make up BI (e.g., Data warehousing, Data reporting and use of Online analytical processing (OLAP)).													
CO4	Understand and design the technological architecture that underpins BI systems.													
CO5	Plan the implementation of a BI system.													
CO-PO Mapping														
Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	1	-	-	-	-	-	1	3	2
CO2	3	2	2	2	2	-	-	-	-	-	-	1	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	1	3	2
CO4	3	2	2	1	1	1	-	-	-	-	2	1	3	2
CO5	3	2	3	2	2	1	-	-	-	-	-	1	3	2
CO (Avg)	3	2.4	2.2	1.6	1.6	0.6	-	-	-	-	0.4	1	3	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





UNIT I	OVERVIEW OF ANALYTICS AND DECISION SUPPORT	6
Introduction to Data Analytics-Ways to use Data Analytics-Process steps-Data Analytics Tools-Applications-Types of Analytics-Case study- Phases of the Decision, Making Process -Decision Support Systems: Capabilities, Classification, components.		
UNIT II	DATA ANALYTICS USING PYTHON	6
Python Libraries for Data Analytics -Numpy for N-Dimensional arrays-Pandas for Mathematical operation and manipulate data -Matplotlib for Plotting Data - Scipy for scientific computing-Scikit-Learn for build analytics model.		
UNIT III	OVERVIEW OF IBM COGNOS BI	6
Introduction to the reporting application-examine report studio and its interface- explore- format-group and sort list reports- options for aggregating data- report with repeated data		
UNIT IV	FOCUS REPORTS USING FILTERS, CROSTAB AND GRAPHS	6
Filters to narrow the focus of reports-detail and summary filters- filters on aggregate data-format and sort crosstab reports- list to a crosstab-crosstabs using unrelated data items-complex crosstabs using drag and drop functionality-charts containing peer and nested items-present data using different chart type -add context - Create and reuse custom chart palettes.		
UNIT V	CALCULATION AND CONDITIONAL FORMATTING	6
Calculations based on data - add run-time information - expressions using functions- highlight exceptional data-show and hide data- conditionally render objects in reports-conditionally format one crosstab measure - multilingual reports-highlight exceptional data-conditionally rendered column-conditionally format one crosstab measure based on another		
LIST OF EXPERIMENTS		15
<ol style="list-style-type: none"> 1. To Perform exploratory data analysis using Pandas and Matplotlib library functions to manipulate and visualize the data and find insights. 2. Explore IBM Cognos BI and Create List Reports. 3. Focus Reports using Filters . 4. Create Crosstab Reports . 5. Present Data Graphically. 6. Focus Reports using Prompts. 7. Extend Reports using Calculations. 		
Text Book (s)		
1	IBM Course ware	
Reference (s)		
1	Foster Provost, Tom Fawcett-Data Science for Business-August 2013	
2	Sangeeta Gautam - IBM Cognos Business Intelligence v10: The Complete Guide (IBM Press) 1st Edition (2012).	
3	Dan Volitich and Gerard Ruppert - IBM Cognos Business Intelligence 10: The Official Guide (India) Private Ltd, 2012	





Regulation 2018		Semester V	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AIC303J	COMPUTER NETWORKS	3	0	2	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

- To develop an understanding of computer networking basics.
- To introduce the basic taxonomy and terminology of computer networking.
- To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
- To build an understanding of the fundamental concepts of computer networking.
- To introduce advanced networking concepts.

Course Outcome (s) (Cos):

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

- CO1 Explain data communication system, components and the purpose of layered architecture.
- CO2 Illustrate the functionality of each layer of OSI and TCP/IP reference model.
- CO3 Explain the data link layer and network layer protocols.
- CO4 Outline the functions of transport layer protocols.
- CO5 Summarize application layer protocols.

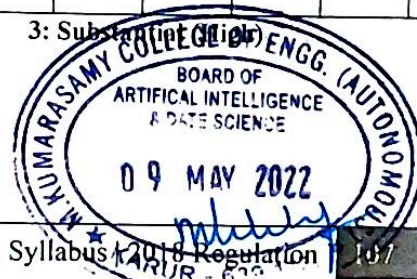
CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	1	1	3	1
CO2	3	3	3	3	3	-	-	-	-	-	1	1	3	1
CO3	3	3	3	3	3	-	-	3	-	-	1	1	3	2
CO4	3	3	3	3	3	-	-	-	-	-	1	1	2	3
CO5	3	3	3	3	3	-	-	-	-	1	1	1	3	3
CO (Avg)	3	3	3	3	3	-	-	0.6	-	0.2	1	1	3	2

1: Slight (Low)

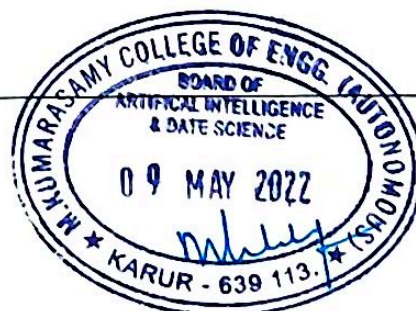
2: Moderate (Medium)

3: Substantial (High)



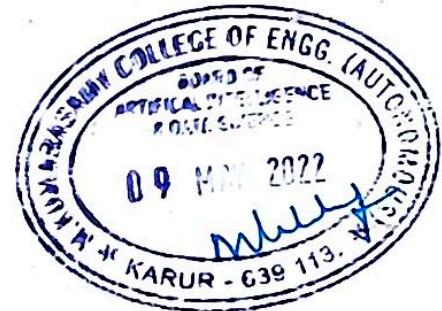


UNIT I	DATA COMMUNICATIONS	9
Data Communication- Networks-The OSI Model- Layers in the OSI Model – TCP/IP Protocol Suite – Addressing – Transmission Media.		
UNIT II	DATA LINK LAYER	9
Link and Medium Access protocols – Framing – Error Detection – Reliable Transmission – IEEE 802 Standards – Ethernet – Token Rings – Wireless LANs.		
UNIT III	NETWORK LAYER	9
Circuit Switching – Packet Switching – Switching and Forwarding – Bridges and LAN Switches – Cell Switching – Internetworking – Routing Techniques: Distance vector (RIP) – Link state (OSPF) – Subnetting – CIDR- BGP - IPv6.		
UNIT IV	TRANSPORT LAYER	9
UDP – TCP – Congestion Control and Resource Allocation –TCP Congestion Control – Congestion Avoidance Mechanisms – Quality of Service- Integrated Services – Differentiated Services.		
UNIT V	APPLICATION LAYER	9
Domain Name System – Electronic Mail – File Transfer- WWW and HTTP-Network Management System – Simple Network Management Protocol.		
LIST OF EXPERIMENTS		15
<ol style="list-style-type: none"> 1. Implementation of Stop and Wait Protocol and Sliding Window Protocol 2. Study of Socket Programming and Client – Server model 3. Write a code simulating ARP /RARP protocols. 4. Write a code simulating PING and TRACEROUTE commands 5. Write a program to implement RPC (Remote Procedure Call) 6. Implementation of Subnetting 7. Applications using TCP Sockets like <ol style="list-style-type: none"> a. Echo client and echo server b. Chat c. File Transfer 8. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. <ol style="list-style-type: none"> a. Link State routing b. Flooding c. Distance vector 		





Text Books	
1	Larry Peterson, Bruce Davie, "Computer Networks: A Systems Approach", Elsevier, Online Edition, 2019.
2	William Stallings, Data and Computer Communications, Tenth Edition, Prentice Hall, 2014.
Reference (s)	
1	James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Pearson Education, Seventh Edition, 2017.
2	Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, Second Edition, 2015.
3	Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
4	Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition, McGraw Hill Education (India) Private Limited, 2013.
Web References	
1	http://nptel.ac.in/courses/106105081





Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AIC304T	EMBEDDED SYSTEMS WITH AI	3	0	0	3

Prerequisite Course (s)

- Basic concepts of Digital and Logical Circuits and AI

Course Objective (s):

The purpose of learning this course is to:

1	Understand how engineering processes can be applied in the real world.
2	Rely on AI powered computer vision for safely interacting with their environment.
3	Understanding Embedded AI Applications & Implementation over it
4	Detect vulnerabilities in programs is what makes advances in machine learning so special
5	Have a basic understanding of some of the more advanced topics of AI

Course Outcome (s) (COs):

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

CO1	Understand the concepts of embedded systems and its design processes
CO2	Aware about the embedded platforms, architectures and its functionalities
CO3	Apply and analyse the Embedded Programming Strategies & aspects
CO4	Identify and apply the strategies followed on embedded systems into the AI applications
CO5	Identify and apply various AI designing applications in real world applications

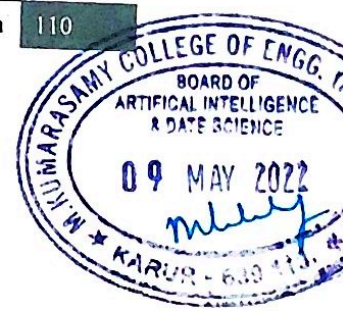
CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	-	-	-	2	-	1	1	2	2
CO2	3	2	2	2	2	-	-	-	2	-	1	1	2	2
CO3	3	3	2	2	3	-	-	-	2	-	2	2	2	2
CO4	3	3	3	3	3	-	-	-	3	-	2	2	3	3
CO5	3	3	3	3	3	-	-	-	3	-	2	2	3	3
CO (Avg)	3	2.8	2.4	2.6	2.6	-	-	-	2.4	-	1.2	1.6	2.4	2.4

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION TO EMBEDDED SYSTEMS	9
Introduction – Overview - Design Process - Embedded System Architecture - Instruction Set Architecture - Basic Embedded Processor/Microcontroller Architecture - Memory System Architecture - I/O Sub-system - Co-processors and Hardware Accelerators - Processor Performance Enhancement - CPU Power Consumption		
UNIT II	DESIGNING EMBEDDED COMPUTING PLATFORM	9
CPU Bus - Memory Devices and their Characteristics - I/O Devices - Component Interfacing - Designing with Processors – Implementation - Development Environment - Debugging Techniques - Manufacturing and Testing - Design Examples		
UNIT III	PROGRAMMING EMBEDDED SYSTEMS	9
Program Design - Programming Languages - Multi-tasking and Task Scheduling - Timing Specifications - Run-time Exception handling - Use of High-Level Languages - Programming and Run-time Environment - Basic Compilation Techniques - Analysis and Optimization of Execution Time, Energy and Power, Program Size - Program Validation and Testing		
UNIT IV	EMBEDDED ARTIFICIAL INTELLIGENCE: SYSTEMS AND APPLICATIONS	9
Artificial Intelligence, Machine Learning, Deep learning and Convolution Neural Network Processing of ML, DL, CNN and RNN in Embedded AI – Edge AI & Cloud AI - Embedded AI hardware and software development – Embedded AI Applications		
UNIT V	DESIGNING OF AI APPLIANCES	9
AI Robotics: Communicating between robots – Program modelling and programming in RTOS - Applications of Embedded systems in RFID and Finger Scan (Case Study) – Case study of Mobile phone software for Key inputs		

Text Book (s)

1	Raj Kamal "Embedded Systems - SoC, IoT, AI and Real-Time Systems", Tata McGraw Hill Education Private Limited, 4th Edition, 2020.
2	Lyla B Das, "Embedded Systems", Pearson Education, 1st Edition, 2012.

Reference (s)

1	Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons, 3rd Edition, 2006.
2	David E. Simon, "An Embedded Software Primer", Addison-Wesley, 1st Edition, 1999.
3	Wayne Wolf, "Computers as Components, Principles of Embedded Computing Systems Design", Elsevier, 2nd Edition, 2009.
4	Shibu K.V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition, 2009.





Regulation 2018		Semester V	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
P	18AIP301L	MINOR PROJECT – III(AI and DS using Python)	0	0	2	1

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

Identify the suitable idea and methods to develop the project idea into demonstrative or to explain the concepts in standard procedure and to prepare report.

Course Outcome (s) (COs):

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

CO1 Identify the requirement and develop the concepts or models through standard procedures and preparation of report.

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	1	1	1	1	3	3	3	3
CO (Avg)	3	3	3	3	3	1	1	1	1	1	3	3	3	3

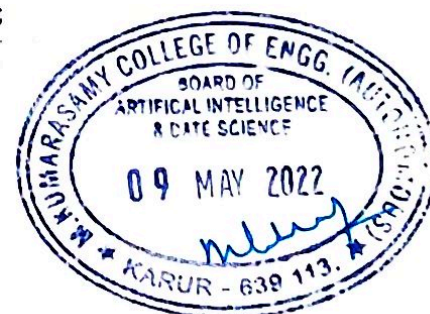
1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Strategy(s)

- The Student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a project report after completing the work to the satisfaction.
- The student will be evaluated through continuous assessment by a panel formed under the approval of head of the department.





Regulation 2018		Semester V	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM301L	ANALYTICAL AND LOGICAL THINKING SKILLS	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	Sharpen problem solving skills and to improve thinking capability of the students
2	Drive the students to use language with great commitment and cooperation
3	Expertise the creative thinking and presentation skills to meet the company needs

Course Outcome (s) (Cos):

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

CO1	Solve both analytical and logical problems in a fruitful manner
CO2	Organize and convey the information in such an incomparable way
CO3	Improve their presentation skills

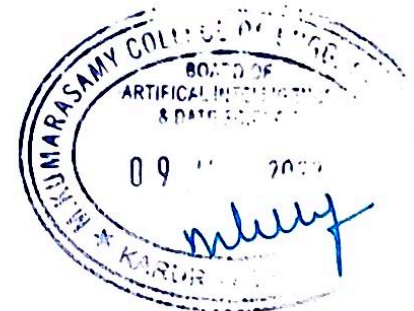
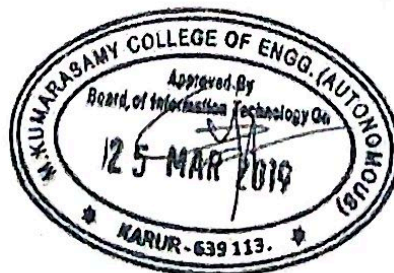
CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	2	-	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	2.00	2.00	-	-			

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





UNIT I	Module - 1	6
<p>Aptitude: Alligations or Mixtures - Blood Relations. Communication: How to set Goals - Interpersonal Relationships - JOHARI Window - Work & Business Etiquette</p>		
UNIT II	Module - 2	6
<p>Aptitude: Partnership - Statement and Assumptions. Communication: Transition to Corporate World - Career opportunities in Various Sectors and know your industry.</p>		
UNIT III	Module - 3	6
<p>Aptitude: Arithmetic and Geometric Progressions - Syllogisms. Communication: Time Management - Anger and Stress Management - Conflict Management.</p>		
UNIT IV	Module - 4	6
<p>Aptitude: Permutations and Combinations - Statements & Conclusions. Communication: Launch a Product - Telephonic Etiquette.</p>		
UNIT V	Module - 5	6
<p>Aptitude: Geometric Problems. Communication: Presentation Skills - Oral presentation and public speaking skills, Business presentations.</p>		
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	



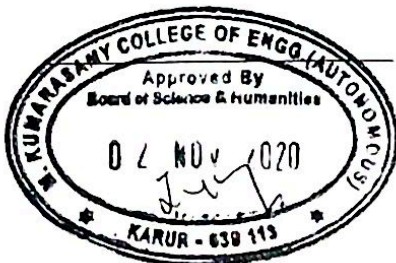


Regulation 2018		Semester V/ VI		Total Hours			15								
Category	Course Code	Course Name	Hours / Week			C									
			L	T	P										
M	18LEM301T	INDIAN ART FORMS (Common to all UG Programmes)	1	0	0	-									
Prerequisite Course (s)															
NIL															
Course Objective (s): The purpose of learning this course is to:															
CLR-1	Introduce the learners to various art forms and whet their aesthetics sense.														
CLR-2	Improve learners' knowledge on history of theatre and drama and draw connections between theatrical practices and social contexts in both modern and pre modern periods..														
CLR-3	Enable the learners to identify and understanding various types of dance and music concepts														
CLR-4	Make learners explore the diversity of Architecture, Sculpture, Painting and its intersection with community, culture and society.														
CLR-5	Make students to get familiarized with the formal, historical, and theoretical aspects of literary arts.														
Course Outcome (s) (COs): At the end of this course, learners will be able to:															
CO1	Identify aesthetics traits found throughout Indian art.														
CO2	Demonstrate understanding of the social and artistic movements that have shaped theatre and dance.														
CO3	Recognize different concepts involved in music and dance.														
CO4	Identify and appreciate the salient features and various styles of Indian Architecture, Sculpture and Painting at different times.														
CO5	Demonstrate a broad understanding of Indian literary arts and appreciate the role that historical context plays in the creation and interpretation of literary works														
CO-PO Mapping															
COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	1	1	2	2	1	-	2	-	-	-
CO3	-	-	-	-	-	1	1	2	2	1	-	2	-	-	-
CO4	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO5	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO (Avg)	-	-	-	-	-	1	1	2	2	1.6	-	2	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





UNIT I	INDIAN ARTS	3
Introduction to art (aesthetics, taste)- fine arts - applied arts –Terminology - Subject matter -Art as propaganda - Purposes/uses of art.		
UNIT II	THEATRE & DRAMA	3
History of Theatre and Drama- Traditional Theatre forms- Modern Theatre and its characteristics- Puppetry –different forms and elements of drama.		
UNIT III	MUSIC AND DANCES	3
Origin of Music and Dance- Classical music and Carnatic Music- Regional Music -Musical Instruments-Regional Classical Dances.		
UNIT IV	ARCHITECTURE, SCULPTURE, PAINTING	3
History of architecture, sculpture, painting -Indo-Islamic Architecture- Temple Architecture–different types of Sculptures and its characteristics-Painting and its different styles.		
UNIT V	LITERARY ARTS	3
Ancient Indian Literature- Early Dravidian Literature- Medieval Literature- Modern Indian Literature-Contemporary Literature.		
Text Book (s)		
NIL		
Reference (s)		
1	Dhar, Parul Pandya, ed., 2011, Indian Art History Changing Perspectives, New Delhi: D.K. Print world and National Museum Institute (Introduction).	
2	Guha-Thakurta, Tapati, The making of a new modern Indian art: Aesthetics and nationalism in Bengal, 1850-1920, Cambridge University Press, 1992	
3	Huntington, Susan, The Art of Ancient India: Hindu, Buddhist, Jain, Weatherhill, 1985	
4	Mitter, Partha, Indian Art, Oxford History of Art series, Oxford University Press, 2001	





Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AIC305J	PREDICTIVE MODELLING AND ANALYTICS	2	0	2	3

Prerequisite Course (s)

Advance Analytics

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

1	To define and understand the business problem and the predictive analytics goals.
2	To understand and apply predictive modelling technique.
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 advice on when and how to use each model. Also learn how to combine two or more models to improve prediction.

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

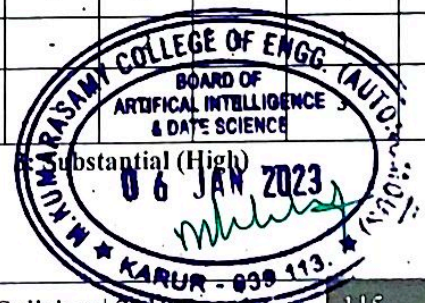
CO1	Understand design, build, evaluate and implement predictive models for various business applications.
CO2	Compare the underlying predictive modelling techniques.
CO3	Select appropriate predictive modelling approaches.
CO4	Apply predictive modelling approaches using a suitable package such as SPSS Modeler.
CO5	To advice on when and how to use each model. Also learn how to combine two or more models to improve prediction

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	1	-	-	-	2	1	3	3
CO2	3	2	2	2	3	1	-	-	-	-	2	1	3	2
CO3	3	3	3	3	3	1	-	-	-	-	2	1	3	2
CO4	3	3	3	3	3	1	-	-	-	-	2	1	3	2
CO5	3	3	3	3	3	1	-	-	-	-	-	-	-	2
CO (Avg)	3	2.8	2.8	2.8	3	1.2	0.2	-	-	-	-	-	-	2.2

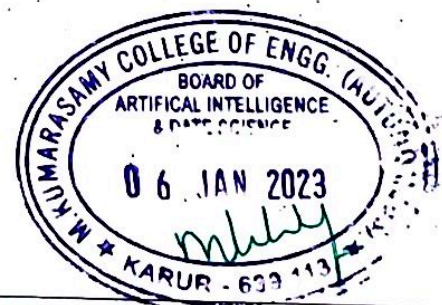
1: Slight (Low)

2: Moderate (Medium)





UNIT I	INTRODUCTION TO PREDICTIVE MODELLING	6
What is Predictive Analytics? - What does a predictive model do? - Descriptive v/s Predictive v/s Prescriptive Analytics - The need for a methodology CRISP-DM		
UNIT II	INTRODUCTION TO SPSS MODELER	6
IBM SPSS Modeler (Nodes, Streams), Manager Pane and Project Pane-collecting Initial Data-Understand data- Set the unit of Analysis (DISTINCT, AGGREGATE, SETTOFLAG)- Integrate data (APPEND, MERGE), Relationship between a categorical and continuous field, Relationship between two continuous fields.		
UNIT III	USING FUNCTIONS IN SPSS	6
Date and Time Functions-Conversion Functions-String Functions-Statistical Functions, Measure of Central Tendency, Measures of Variability-Missing Value Functions, Undefined and Blank Values Function.		
UNIT IV	DATA FIELD TRANSFORMATION	6
Field transformation- Additional Field Transformation-Sequence, Data-Sampling- balancing- partitioning data, Derive, Binning, Reclassify, Control Language for Expression Manipulation (CLEM), Filler, Transform, Sequence Functions, Restructure Data.		
UNIT V	INTRODUCTION TO MODEL	6
Modelling Algorithms-Supervised Models- Partition the data- Segmentation Models-Creating a model in IBM SPSS Modeler-Introduction to Linear Regression-Introduction to Logistic Regression-Introduction to Neural Networks-Multilayer Perceptron (MLP)-Radial Basis Function (RBF).		
LIST OF EXPERIMENTS		15
<ol style="list-style-type: none"> 1. Collect initial data for the telecom firm 2. Understand the telecommunications data 3. Set the unit of analysis for the data <ol style="list-style-type: none"> a) Remove duplicate records b) Aggregate transactional data c) Create flag fields and aggregate the data 4. Identify relationships in the data <ol style="list-style-type: none"> a) Examine the relationship between categorical fields b) Examine the relationship between a categorical and continuous field 5. Predict customer churn in telecom dataset <ol style="list-style-type: none"> a) Build Model using CHAID b) Examine the CHAID Model c) Apply the model to new data 6. Create a Segmentation Model <ol style="list-style-type: none"> a) Create homogeneous groups (clusters) of customers based on usage patterns. 7. Using functions in IBM SPSS Modeler <ol style="list-style-type: none"> a) Date and Time Functions b) String Functions c) Statistical Functions d) Missing Value Function 8. Add fields to the data <ol style="list-style-type: none"> a) Derive fields as formula b) Derive fields as flag or nominal 		





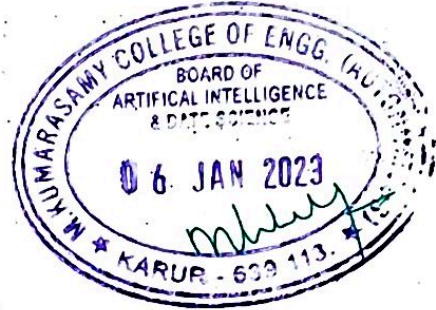
- c)Reclassify categorical fields
- d)Bin a continuous field into a categorical field with equal counts
- 9. Create a Linear Regression Model to Predict Employee Salaries
- 1. Use Logistic Regression to Predict Response to a Charity Promotion Campaign

Text Book (s)

1	IBM Course ware
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Reference (s)

- | | |
|---|---|
| 1 | IBM SPSS Modeler Essentials ,by Jesus Salcedo, Keith McCormick |
| 2 | Fundamentals of Machine Learning for Predictive Data Analytic, by john D Kelleher |
| 3 | Applied Predictive Modelling, by Max Kuhn |





Regulation 2018		Semester VI	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18AIC306J	ANALYTICS IN CLOUD COMPUTING	3	0	2	4

Prerequisite Course (s)

Computer Networks

Course Objective (s):

The purpose of learning this course is to:

1	Understand the protocols and mechanisms necessary to support cloud computing.
2	Understand the architecture and features of different cloud models.
3	Analyze the basic concepts of virtualization technology to derive the best practice model for deploying cloud-based applications.

Course Outcome (s) (Cos):

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

CO1	Understand the different types of cloud models and services for building an efficient cloud computing environment.
CO2	Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud.
CO3	Analyze the key concepts of cloud storage for load balancing in cloud architecture.
CO4	Understand the concept web services in cloud applications
CO5	Explore the cloud security concerns and examine the risks involved in cloud security.

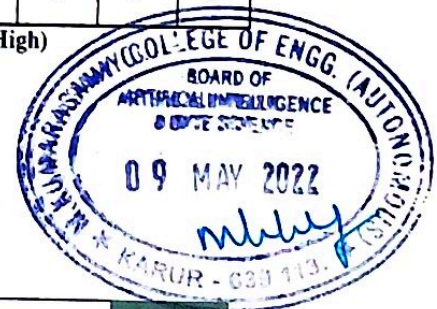
CO-PO Mapping

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

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)



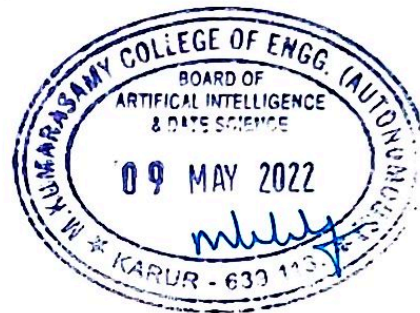


UNIT I	INTRODUCTION TO CLOUD COMPUTING	9
Introduction to Cloud Computing - The NIST Cloud Reference Model- Architectural Design Challenges- Deployment Models-Service Models-Essential Characteristics - Benefits - Measuring Cloud Computing Costs.		
UNIT II	CLOUD ENABLING TECHNOLOGIES	9
Service Oriented Architecture - REST and Systems of Systems - Web Services - Publish Subscribe Model – Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU - Memory - Network- I/O Devices- Application - Virtualization Support - Disaster Recovery		
UNIT III	ANALYTICS IN CLOUD	9
Introduction to Cloud Analytics - Working with Models - Benefits – Challenges - Analytics as a service. Analytical Tools in Cloud: Google Web Services (BigQuery, DataPrep, Data Proc) - Amazon web services(Athena, Cloud Search, Kinesis) - Microsoft Azure services(Synapse, Databricks).		
UNIT IV	VISUALIZATION IN CLOUD	9
Data Visualization- Types- Methods- Benefits-Challenges – Introduction to Google Charts, Tableau, Whatagraph, Sisense, Wrapper, Infogram, Chartblocks.		
UNIT V	TOOLS IN CLOUD FOR REAL TIME SIMULATIONS	9
Introduction to Cloud Simulator - CloudSim Architecture (User code, CloudSim, GridSim, SimJava) - Understanding Working platform for CloudSim - Introduction to GreenCloud - Cloud APIs		
FOR FURTHER READING		
Cloud evolution- Data center requirements- VMware virtualization- Google Infrastructure- Google Cloud Security. Case study on Amazon, Google and IBM cloud services		
List of Experiments		
<ol style="list-style-type: none"> 1. Install VirtualBox/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8. Install a C compiler in the virtual machine and execute a sample program. 2. Install Bare Metal Hypervisor and create different VMs loaded with different flavours of OS on top of Baremetal Hypervisor. 3. Configure internetworking Components. 4. Setting up Google Cloud & Big Query Environment and Create a project on Google Cloud Platform's one of the Analytics services named as Big Query. 5. Install and configure MySQL Server/MariaDB in the virtual machine and Access/Connect the database through SQLYOG. 6. Install Google App Engine. Create hello world app and other simple web applications using python/java 7. Show the virtual machine migration from one node to the other. 8. Write a program to use the API of Hadoop to interact with it. 9. Install and configure two different visualization tools in cloud and Visualize using different data sets. 10. Study and Install Cloud Sim. create different nodes and VMs. Perform VM Migration between the hosts. 		





Text Books	
1	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009., CRC Press, 2017
2	Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
References	
3	Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2014.
4	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
5	Ronald L.Krutz and Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2013.
Web References	
1	https://www.edureka.co/blog/hadoop-tutorial/
2	https://www.simplilearn.com/tutorials/hadoop-tutorial
3	https://www.pragimtech.com/blog/cloud/cloud-tutorial-for-beginners/





Regulation 2018		Semester VI			Total Hours			45						
Category	Course Code	Course Name	Hours / Week			C								
			L	T	P									
C	18AIC307T	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3								
Prerequisite Course (s)														
Computer Networks														
Course Objective (s):														
The purpose of learning this course is to:														
1	To understand the difference between stream ciphers & block ciphers, explain the encryption and decryption, present an overview of DES, Triple DES, Blowfish, IDEA													
2	Presents the basic principles of public key cryptography, distinct uses of public key cryptosystems.													
3	Know the overview of the basic structure of cryptographic functions, Message Authentication Codes, Understand the operation of SHA-512, HMAC, Digital Signature													
4	To learn an overview of techniques for remote user authentication, Kerberos, Summarize Web Security threats and Web traffic security approaches,													
5	Provide an overview of IP Security, concept of security association, Intrusion Detection Techniques													
Course Outcome (s) (Cos):														
At the end of this course, learners will be able to:														
CO1	Explain various classical encryption techniques.													
CO2	Understand block ciphers and write Symmetric key cryptographic algorithms.													
CO3	Apply Cryptographic Hash Functions & and verify messages using well known signature generation and verification algorithms.													
CO4	Discuss User Authentication, Transport Layer Security & Email Security													
CO5	Describe IP Security & Intrusion Detection Systems													
CO-PO Mapping														
Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	2	-	-	1	2	3	2
CO2	3	3	3	3	3	-	-	2	-	-	1	2	3	2
CO3	3	3	3	3	3	-	-	1	-	-	1	2	3	2
CO4	2	3	3	3	3	-	-	3	-	-	1	2	3	2
CO5	2	3	3	3	3	-	-	2	-	-	1	2	3	2
CO (Avg)	2.6	3	3	3	3	-	-	2	-	-	1	2	3	2
		1: Slight (Low)			2: Moderate (Medium)			3: Substantial (High)						





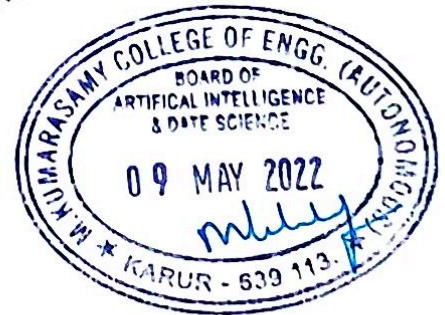
UNIT I	Classical Encryption Techniques	9
Introduction: Security attacks, services & mechanisms, Symmetric Cipher Model, Substitution Techniques, Transportation Techniques, Cyber threats and their defense(Phishing Defensive measures, web based attacks, SQL injection & Defense techniques), Buffer overflow & format string vulnerabilities, TCP session hijacking(ARP attacks, route table modification) UDP hijacking (man-in-the-middle attacks).		
UNIT II	Block Ciphers & Symmetric Key Cryptography	9
Traditional Block Cipher Structure, DES, Block Cipher Design Principles, AES-Structure, Transformation functions, Key Expansion, Blowfish, CAST-128, IDEA, Block Cipher Modes of Operations		
UNIT III	Number Theory & Asymmetric Key Cryptography	9
Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder theorem, Discrete logarithms. Public Key Cryptography: Principles, public key cryptography algorithms, RSA Algorithms, Diffie Hellman Key Exchange, Elgamal encryption & decryption, Elliptic Curve Cryptography.		
UNIT IV	Cryptographic Hash Functions & Digital Signatures	9
Application of Cryptographic hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. Digital Signatures, NIST Digital Signature Algorithm. Key management & distribution.		
UNIT V	IP Security & Intrusion Detection Systems	9
IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. Intrusion detection: Overview, Approaches for IDS/IPS, Signature based IDS, Host based IDS/IPS.		
Text Books		
1	Cryptography & Network Security: Principles and Practice, William Stallings, Pearson, Seventh edition, 2017.	
2	Introduction to Computer Networks & Cyber Security, Chwan Hwa Wu, J.David Irwin, CRC press, 2016	
3	Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech, Second Edition, 2002.	
Reference (s)		
1	Everyday Cryptography, Fundamental Principles & Applications, Keith Martin, Oxford Publication, 2017	
2	Network Security & Cryptography, Bernard Menezes, Cengage, 2010	
Web References		
1	https://www.geeksforgeeks.org/cryptography-and-its-types/	
2	https://nptel.ac.in/courses/106105031	





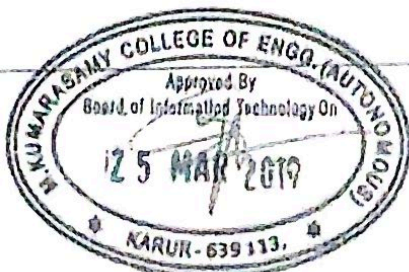
Regulation 2018		Semester VI		Total Hours			30							
Category	Course Code	Course Name	Hours / Week			C								
			L	T	P									
P	18AIP302L	MINOR PROJECT – IV	0	0	2	1								
Prerequisite Course (s)														
NIL														
Course Objective (s):														
The purpose of learning this course is to:														
Identify the suitable idea and methods to develop the project idea into demonstrative or to explain the concepts in standard procedure and to prepare report.														
Course Outcome (s) (COs):														
At the end of this course, learners will be able to:														
CO1	Identify the requirement and develop the concepts or models through standard procedures and preparation of report.													
CO-PO Mapping														
Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	1	1	1	1	3	3	3	3
CO (Avg)	3	3	3	3	3	1	1	1	1	1	3	3	3	3
			1: Slight (Low)				2: Moderate (Medium)			3: Substantial (High)				

Strategy(s)	
<ul style="list-style-type: none"> The Student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a project report after completing the work to the satisfaction. The student will be evaluated through continuous assessment by a panel formed under the approval of head of the department. 	





Regulation 2018		Semester VI	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM302L	EMPLOYABILITY SKILLS AND PRACTICES	0	0	2	1
Course Objective (s): The purpose of learning this course is to:						
1	Learn the application of mathematical or statistical models to different real-world contexts					
2	Focus on writing & speaking skills through vigorous practices.					
3	Enhance soft skills and analytical ability of students					
4	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	Solve both analytical and logical problems in a productive manner					
CO2	Launch their ability of comprising and delivering the information					
CO3	Upgrade their communication quality in near future					
UNIT I	Module - 1					6
Aptitude: Time and Distance (Speed, Streams) - Problems on Trains - Arrangements and Blood Relations. Communication: Job Application – Cover letter, Bio-data, Resume & CV building.						
UNIT II	Module - 2					6
Aptitude: Time and Work - Pipes & Cisterns - Situation Reaction Test & Data Interpretations. Communication: Writing practices on circulars, notices, memos, Agenda preparation and Minutes of meeting.						
UNIT III	Module - 3					6
Aptitude: Ages - Averages - Probability - Profit and Loss. Communication: Email Etiquette -Essay writing						
UNIT IV	Module - 4					6
Aptitude: Mensuration - SI & CI - Cause and Effect Analysis - Statement, Assumptions & Conclusions. Communication: Group Discussion and guidelines.						
UNIT V	Module - 5					6
Aptitude: Permutation and Combinations - Partnership - Alligations or Mixtures. Communication: Interview skills - General instructions, Review of interview questions, Mock Interviews.						
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.					





Regulation 2018		Semester V/VI	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	ISLEM302T	SELF DEVELOPMENT AND ENTREPRENEURSHIP	1	0	0	Nil

Prerequisite Course (s)

Nil

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

1	Develop entrepreneurship and self-employment abilities to start any venture plan, use, and monitor and control resources optimally and economically.
2	Know the Micro, small and medium industries Registration Process.
3	Study about product selection and development.
4	Learn about the Project report preparation.
5	Analysis the Enterprise risk management.

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

CO1	Identify entrepreneurial quality.
CO2	Know the entrepreneurial support agencies.
CO3	Prepare project setup planning and project report
CO4	Select appropriate agencies for technical and financial support.
CO5	Explain SWOT analysis and strategies to achieve goals.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	1	1	1	1	-	-
CO2	-	1	-	-	-	2	1	1	1	2	2	1	-	-
CO3	1	3	-	-	-	-	2	1	1	1	2	1	-	-
CO4	-	1	-	-	-	1	2	1	1	1	2	1	-	-
CO5	2	1	-	-	-	-	1	-	1	1	-	-	-	-
CO (Avg)	1.50	1.50	-	-	-	1.33	1.50	1.00	1.00	1.20	-	-	-	-

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





M.KUMARASAMY

COLLEGE OF ENGINEERING

NAAC Accredited Autonomous Institution

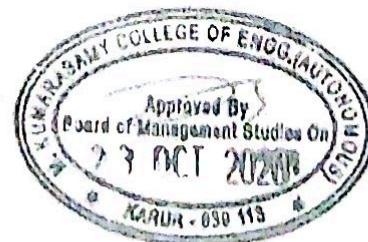
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ISO 9001:2015 Certified Institution

Thalavupalayam, Karur, Tamilnadu.



UNIT I	INTRODUCTION TO SELF-EMPLOYMENT AND ENTREPRENEURSHIP DEVELOPMENT	6
Introduction of self-employment – Characteristics- Creativity. Entrepreneurship development-Qualities of entrepreneur and Characteristics of Diploma holder as a self-employer like developing networking and personal contacts, importance of productivity, quality, cost consciousness and customers' satisfaction. Types of enterprise-Sole partnership -Partnership firm- Joint stock company- Co-operative society.		
UNIT II	ENTREPRENEURIAL SUPPORT AGENCIES	6
Definition – Micro, small and medium industries- Registration process of an enterprise with Government agencies-Name, type and role of state and national level support agencies. Current state & National Level Promotional Schemes for establishment of new.		
UNIT III	PROJECT SET UP PLANNING	6
Product Selection: importance- Product development stages. Process Selection: Factors affecting process selection - Technology lifecycle. Process Conversion-Capacity Planning: Basic method to assess / estimate capacity. Selection of location and layouts: Factors affecting selection of location - Objectives and types of plant layout.		
UNIT IV	PROJECT PROPOSAL PLANNING	6
7-M resources- Marketing- definition, need for enterprise, 4Ps channels- Market survey. Methods - Project report preparation for mechanical feature based product: Meaning of project planning and report: Feasibility study. Details required for preparing project plan. Project cost estimation.		
UNIT V	ENTERPRISE AND RISK MANAGEMENT	6
Concept of risk in the context of enterprise/ project-Uncertainty and certainty of project elements- Decision making under risk-Methods of risk management-Strength, Weakness, Opportunity and Threat (SWOT) analysis.		
Reference (s)		
1	Entrepreneurship & Venture Management, Clifford and Bombak, Joseph R. Momanso.	
2	Small Industries management – Karmakar.M.B.	
3	Creativity –Pradeep Khandwala	
4	Entrepreneurship development and Management, R.K.Singal, S.K.Kataria Sons.	





PROFESSIONAL ELECTIVES

Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE001T	R PROGRAMMING FOR MACHINE LEARNING	3	0	0	3

Prerequisite Course (s)

Basic concepts of programming language

Course Objective (s):

The purpose of learning this course is to:

1	Learn to run/execute the code without any compiler
2	Perform calculations with the applications of R vectors
3	Perform import and export operations of web library files
4	Develop web apps which would be more beneficial for data visualization
5	Enhance the learning through industrial standards and research

Course Outcome (s) (COs):

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

CO1	Understand about the importance of R Programming
CO2	Enforce the various data types into R applications
CO3	Import and manipulate the data using web files
CO4	Study about the use of conditional statements & functions and applying concepts
CO5	Visualize and model the data using statistical analysis

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	2	1	-	-	-	-	1	1	2	1
CO2	2	2	2	2	2	1	-	-	-	-	1	1	2	1
CO3	3	3	3	3	3	1	-	-	-	-	1	1	3	2
CO4	3	3	3	3	3	1	-	-	-	-	1	1	3	2
CO5	3	3	3	3	3	1	-	-	-	-	1	1	3	2
CO (Avg)	2.6	2.6	2.6	2.4	2.6	1	-	-	-	-	1	1	2.6	2.6

1: Slight (Low)

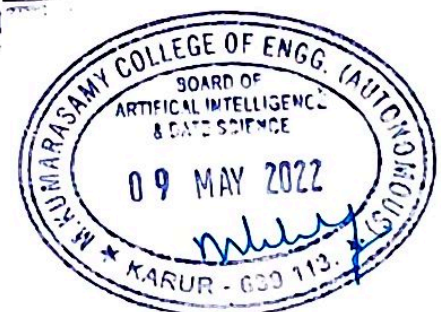
2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION	9
Data Analysis, Data Analytics and Data Science - Business Decisions - Case study of Walmart - Various analytics tools – Descriptive – Predictive - Web Analytics - Google Analytics - R and features - Evolution of R - Big data Hadoop and R		
UNIT II	DATA TYPES	9
R & R Studio Installation – Scalar – Vectors – Matrix – List - Data frames – Factors - Handling data in R - Conversion of data types - Operators in R		
UNIT III	IMPORTING & MANIPULATING DATA	9
CSV files - Database data (Oracle) - XML files - JSON files - Reading & Writing PDF files - Reading & Writing JPEG files - Saving Data in R – Cbind – Rbind – Sorting – Aggregating - dplyr		
UNIT IV	CONDITIONAL STATEMENTS AND FUNCTIONS, STATISTICAL CONCEPTS	9
If ... else - For loop - While loop - Repeat loop - Apply() - sApply() - rApply() – tApply Descriptive Statistics - Inferential Statistics - Central Tendency (Mean, Mode, Median) - Hypothesis Testing – Probability – tTest – zTest - Chi Square test – Correlation – Covariance - Anova		
UNIT V	PREDICTIVE MODELLING & DATA VISUALISATION IN R USING GGLOT	9
Linear Regression - Normal distribution – Density - Box Plot – Histograms - Scatter Plotter - Line chart - Bar Chart - Heat maps - Text Mining - Exploratory Data Analysis - Machine Learning with R		
Text Book (s)		
1	Reema Thareja, "Data Science and Machine Learning with R", Tata McGraw Hill, 1 st Edition, 2021	
Reference (s)		
1.	Richard cotton, "Learning R", O'Reilly Media, Inc, 3 rd Edition, 2017	
2	Robin Evans, "R Programming", Michaelmas, 2014.	
3	Michael J. Crawley, "The R Book", John Wiley & Sons, Ltd, 1 st Edition, 2013	





Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE002T	AI TECHNIQUES IN DATA MINING	3	0	0	3

Prerequisite Course (s)

- Database Management Systems
- Knowledge of probability and statistics

Course Objective (s):

The purpose of learning this course is to:

- 1 Understand the methods for mining frequent patterns, associations, and correlations.
- 2 Describes methods for data classification and prediction, and data-clustering approaches.
- 3 It covers mining various types of data stores such as spatial, textual, multimedia, streams.

Course Outcome (s) (COs):

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

- CO1 Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
- CO2 Extract interesting patterns from large amounts of data.
- CO3 Discover the role played by data mining in various fields.
- CO4 Choose and employ suitable data mining algorithms to build analytical applications
- CO5 Evaluate the accuracy of supervised and unsupervised models and algorithms.

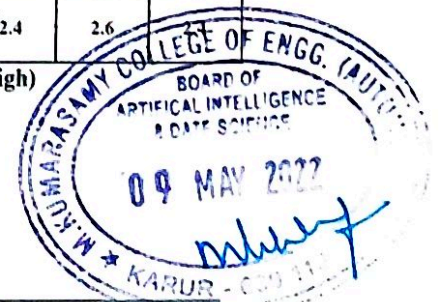
CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	2	2	1	-	-	-	-	-	2	2	1
CO2	3	3	2	2	2	1	-	-	-	-	-	2	2	2
CO3	3	3	2	2	2	1	-	-	-	-	-	3	3	3
CO4	2	3	3	2	2	1	-	-	-	-	-	3	3	3
CO5	1	2	2	2	2	1	-	-	-	-	-	2	3	3
CO (Avg)	2	2.6	2	2	2	1	-	-	-	-	-	2.4	2.6	

1: Slight (Low)

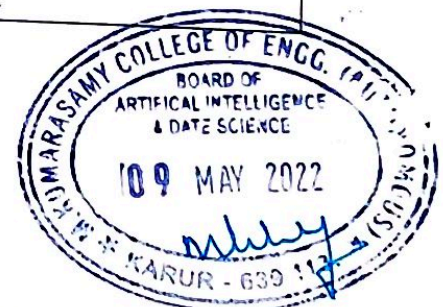
2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION	9
Data–Types of Data–, Data Mining Functionalities– Interestingness Patterns– Classification of Data Mining systems– Data mining Task primitives –Integration of Data mining system with a Data warehouse–Major issues in Data Mining – Data Pre-processing : Dimensionality reduction, Missing values, Normalization & standardization, Noise and outlier detection		
UNIT II	ASSOCIATION RULE MINING	9
Associations and correlations – Frequent item set mining, Apriori and its optimizations, FPGrowth , Efficient Rule generation, Other measures (lift, interest etc), correlation, Hierarchy based Frequent item set mining - Mining Methods– Mining Various kinds of Association Rules– Correlation Analysis– Constraint based Association mining - Graph Pattern Mining.		
UNIT III	CLASSIFICATION	9
Classification and Prediction – Basic concepts – Decision tree, Decision tree induction , K-nearest neighbors, Naive Bayesian classifiers, Rule based classifiers, Lazy learner, Support vector machine, Underfitting/overfitting, Ensemble classifiers, Classification evaluation and model selection.		
UNIT IV	CLUSTERING	9
Cluster analysis–Types of Data in Cluster Analysis–Categorization of Major Clustering Methods : k-means, k-mediod (PAM) algorithms, Hierarchical clustering algorithms, Agglomerative algorithms--s-link, complete link, average link etc, Divisive algorithms,– Partitioning Methods, Hierarchical Methods–Density–Based Methods, Grid–Based Methods, Cluster evaluation.		
UNIT V	ADVANCED CONCEPTS	9
Basic concepts in Mining data streams–Mining Time–series data–Mining sequence patterns in Transactional databases– Mining Object– Spatial– Multimedia–Text and Web data – Spatial Data mining–Multimedia Data mining–Text Mining– Mining the World Wide Web.		
Text Book (s)		
1	Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier, 2016.	
2	Data Mining Introductory and Advanced topics – Margaret H Dunham, Pearson Education, 2014.	
Reference (s)		
1	Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005.	





Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE003T	AGILE METHODOLOGIES	3	0	0	3

Prerequisite Course (s)

- Software Engineering

Course Objective (s):

The purpose of learning this course is to:

1	To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
2	To provide a good understanding of software design and a set of software technologies and APIs.
3	To do a detailed examination and demonstration of Agile development and testing techniques
4	To understand the benefits and pitfalls of working in an Agile team.
5	To understand Agile development and testing.

Course Outcome (s) (COs):

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

CO1	Realize the importance of interacting with business stakeholders in determining the requirements for a software system
CO2	Perform iterative software development processes: how to plan them, how to execute them.
CO3	Point out the impact of social aspects on software development success.
CO4	Develop techniques and tools for improving team collaboration and software quality.
CO5	Perform Software process improvement as an ongoing task for development teams.

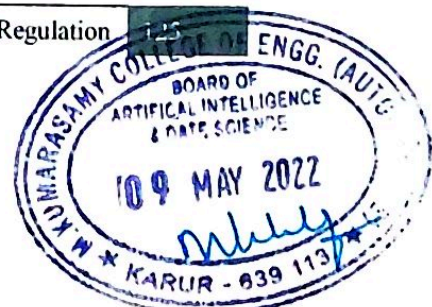
CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	2	3	1	1	1	-	-	-	-	-	2	1	1	1
CO3	2	2	2	-	1	2	-	-	-	-	2	1	2	1
CO4	2	2	2	1	2	-	-	-	-	-	-	1	2	1
CO5	2	2	1	-	1	-	-	-	-	-	-	1	1	1
CO (Avg)	2	2	1.6	0.6	1.2	0.6	-	-	-	-	0.8	1	1.8	1

1: Slight (Low)

2: Moderate (Medium)

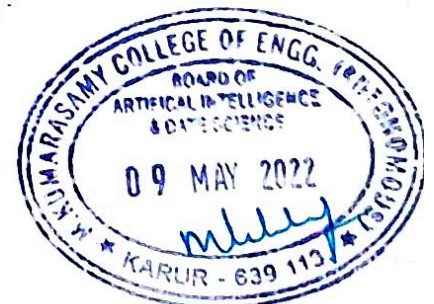
3: Substantial (High)





UNIT I	AGILE METHODOLOGY	9
Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Benefits Vs Constraints Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values		
UNIT II	AGILE PROCESSES	9
Distributed Embedded Architectures - Networks for Embedded Systems - Network-Based Design - Internet-Enabled Systems - Vehicles as Networks - Sensor Networks - Design Example: Elevator Controller -How to use Agile practices in your project		
UNIT III	AGILITY AND KNOWLEDGE MANAGEMENT	9
Firmware Bootloader – Example: Sandstone - Embedded Firmware Design Approaches and Development Languages. Distinguishing between KM Agile and Traditional KM – KM Agile Principles and Practices		
UNIT IV	AGILITY AND REQUIREMENTS ENGINEERING	9
Artificial Intelligence, Machine Learning, Deep learning and Convolution Neural Network Processing of ML, DL, CNN and RNN in Embedded AI – Edge AI & Cloud AI - Embedded AI hardware and software development – Embedded AI Applications Requirement Engineering in Agile Practices. How can it be achieved?		
UNIT V	AGILITY AND QUALITY ASSURANCE	9
AI Robotics: Communicating between robots – Program modelling and programming in RTOS - Applications of Embedded systems in RFID and Finger Scan (Case Study) – Case study of Mobile phone software for Key inputs		

Text Book (s)	
1	Wesley Clark “Agile Methodology: A Beginner's Guide to Agile Method and Principles”, Pearson Education Private Limited, 1 st Edition, 2019.
2	Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.
Reference (s)	
1	Craig Larman, —Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.
2	Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.
3	David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.





Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE004T	GPU PROGRAMMING	3	0	0	3

Prerequisite Course (s)

Computer Architecture

Course Objective (s):

The purpose of learning this course is to:

- 1 To learn the basics of GPU architectures.
- 2 To write programs for massively parallel processors
- 3 To understand the issues in mapping algorithms.
- 4 To interpret different GPU programming models.
- 5 To familiarize various algorithms for GPU programming.

Course Outcome (s) (COs):

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

- CO1 Understand the theoretical concepts of automata and equivalence of automata
- CO2 Remember the automata in applying to obtain regular expressions and languages
- CO3 Apply the normalization in context free grammar to obtain optimized CFG
- CO4 Understand PDA and turing machines and apply for making mathematical models
- CO5 Understand the decidability and tractability problems and apply for developed models

CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	2	1	1	1	1	-	2.2	1	1	1
CO2	2	2	1	-	2	1	2	-	-	-	2	2	1	1
CO3	3	3	1	-	3	-	1	-	-	-	3	1	2	3
CO4	2	3	-	-	2	1	1	1	-	-	2	2	2	3
CO5	2	2	2	2	3	-	1	2	-	-	3	3	3	3
CO (Avg)	2.4	2.4	1.0	2.0	2.4	0.6	1.2	0.8	0.2	-	2.0	1.8	2.0	2.0

1: Slight (Low)

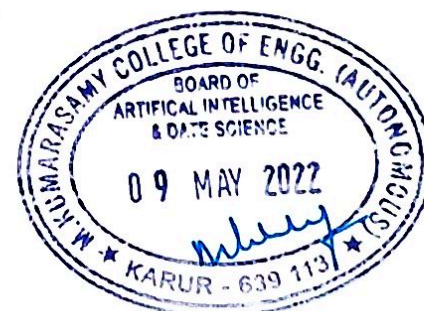
2: Moderate (Medium)

3: Substantial (High)





UNIT I	GPU ARCHITECTURE	9
Evolution of GPU architectures – Understanding Parallelism with GPU – Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory		
UNIT II	PROGRAMMING ISSUES	9
Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.		
UNIT III	OPENCL BASICS	9
OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.		
UNIT IV	ALGORITHMS ON GPU	9
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.		
UNIT V	CUDA PROGRAMMING	9
Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.		
Text Book (s)		
1	David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors – A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.	
2	David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, - Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.	
Reference (s)		
1	Shane Cook, CUDA Programming: —A Developer’s Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.	
2	Nicholas Wilt, —CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison – Wesley, 2013	
3	Jason Sanders, Edward Kandrot, —CUDA by Example: An Introduction to General Purpose GPU Programming, Addison – Wesley, 2010	





Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE005T	THEORY OF COMPUTATION	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

- 1 To understand the basic concepts of automata theory and finite automaton
- 2 To extend the concepts of automata theory in regular languages and expressions
- 3 To learn about context free grammars and the normalizations of CFG
- 4 To acquire the importance of push down automata with representations and various models of Turing machines with its applications
- 5 To discover the facts in decidability and tractability and to study the complexity classes

Course Outcome (s) (COs):

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

- CO1 Understand the theoretical concepts of automata and equivalence of automata
- CO2 Remember the automata in applying to obtain regular expressions and languages
- CO3 Apply the normalization in context free grammar to obtain optimized CFG
- CO4 Understand PDA and Turing machines and apply for making mathematical models
- CO5 Understand the decidability and tractability problems and apply for developed models

CO-PO Mapping

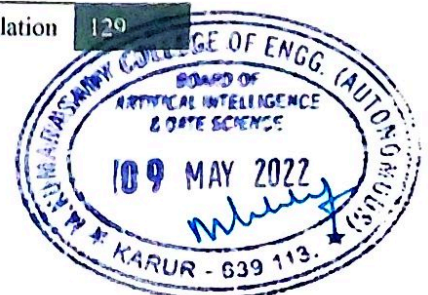
Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	-	-	-	-	-	-	-	2	1
CO2	3	3	2	1	2	-	-	-	-	-	-	-	2	1
CO3	3	3	2	1	2	-	-	-	-	-	-	-	2	1
CO4	3	3	2	1	2	-	-	-	-	-	-	-	2	1
CO5	3	3	2	1	2	-	-	-	-	-	-	-	2	1
CO (Avg)	3	3	2	1	2	-	-	-	-	-	-	-	2	1

1: Slight (Low)

2: Moderate (Medium)

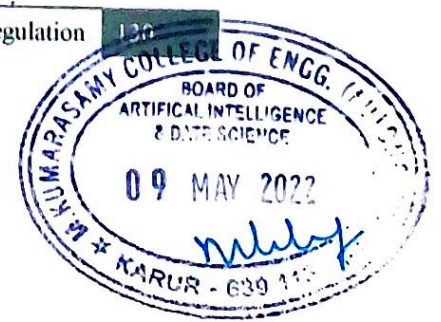
3: Substantial (High)

UNIT I	INTRODUCTION TO AUTOMATA THEORY	9
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Introduction-Need of automata theory-Formal proof- Additional Forms of Proof-Inductive Proofs-Central Concepts of Automata Theory-DFA and NDFA-Finite Automaton with ϵ - Transitions-Equivalence of DFA and NFA-Case Study: Finite Automata for Artificial Intelligence, Compilers, Probability		
UNIT II	REGULAR EXPRESSIONS	9
Regular Languages-Regular Expressions-Equivalence of finite Automaton and regular expressions-Minimization of DFA-Closure Properties and Decision Properties of Regular Languages-Problems based on Pumping LemmaCase Study: Regular Expressions for NLP, Pattern matching, Data extraction		
UNIT III	CONTEXT FREE GRAMMARS	9
Chomsky hierarchy of languages-Context-Free Grammar (CFG)-Parse Trees - Ambiguity in grammars and languages-Normal forms for CFG-Chomsky Normal Form (CNF)-Greibach Normal Form (GNF)-Pumping Lemma for Context Free Language (CFL)-Applications of Context Free Grammar. Case Study: Context Free Grammars in GCC compiler and in XML DTD		
UNIT IV	PUSHDOWN AUTOMATA AND TURING MACHINES	9
Definition of the Pushdown automata-Types of PDA-Languages of a Pushdown Automata - Equivalence of PDA and CFG-Definitions of Turing machines-Models-Computable languages and functions-Techniques for Turing machine construction-Multi head and Multi tape Turing Machines. Turing machines for machine learning and high performance computing applications		
UNIT V	UNDECIDABILITY	9
The Halting problem – Partial Solvability- Undecidability- Decidable and undecidable problems- Post correspondence problem and Undecidability of PCP-Basic Definition and properties of Recursive (RL) and Recursively enumerable (REL) languages. Intractable Problems- the Class P and NPIntroduction to NP-Hardness and NP-Completeness		
Text Book (s)		
1	Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2016.	
2	John C Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011	
Reference (s)		
1	Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", Third Edition, Prentice Hall of India, 2016	
2	Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation", Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2015.	
3	Peter Linz, "An Introduction to Formal Language and Automata", Sixth Edition, Jones & Bartlett Learning, 2016	





Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE006T	COMPUTER VISION	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	To review image processing techniques for computer vision.
2	To understand various features and recognition techniques.
3	To learn about histogram and binary vision.
4	Apply three-dimensional image analysis techniques.
5	Study real world applications of computer vision algorithms.

Course Outcome (s) (Cos):

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

CO1	Explain low level processing of image and transformation techniques applied to images.
CO2	Explain the feature extraction, segmentation and object recognition methods.
CO3	Apply Histogram transform for detection of geometric shapes like line, ellipse and objects.
CO4	Illustrate 3D vision process and motion estimation techniques.
CO5	Apply vision techniques to real time applications.

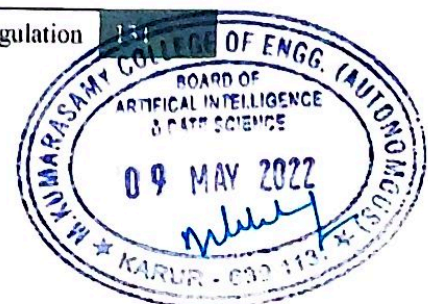
CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	3	3	2	-	-	-	-	3	1	1	1
CO2	1	-	-	3	3	2	-	-	-	-	3	2	1	1
CO3	2	3	3	3	3	2	-	-	-	-	3	1	3	2
CO4	2	3	3	3	3	2	-	-	-	-	3	2	3	1
CO5	2	3	3	3	3	2	-	-	-	-	3	2	2	2
CO (Avg)	1.6	1.8	1.8	3	3	2	-	-	-	-	3	1.6	2	1.2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION	9
What is Computer Vision - Low-level, Mid-level, High-level - Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.		
UNIT II	IMAGES, HISTOGRAMS, BINARY VISION	9
Simple pinhole camera model – Sampling – Quantisation – Colour images – Noise – Smoothing – 1D and 3D histograms - Histogram/Image Equalisation - Histogram Comparison - Back-projection - k-means Clustering – Thresholding - Threshold Detection Methods - Variations on Thresholding - Mathematical Morphology – Connectivity.		
UNIT III	FEATURE EXTRACTION AND SEGMENTATION	9
Feature Extraction -Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Image Segmentation -Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation.		
UNIT IV	3D VISION AND MOTION	9
Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion–spline-based motion–optical flow – layered motion.		
UNIT V	APPLICATIONS	9
Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Virtual Reality and Augmented Reality.		
Text Books		
1/	D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2012.	
2/	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.	
Reference (s)		
1	Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.	
2	Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.	
3	E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press. 5. Concise Computer Vision: An Introduction into Theory and Algorithms, by Reinhard Klette, 2014	





Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE007T	IOT AND ITS APPLICATIONS	3	0	0	3

Prerequisite Course (s)

Computer Networks & Digital Logic & Design

Course Objective (s):

The purpose of learning this course is to:

1	Understand the fundamentals of Internet of Things
2	Analyze the different IoT Architecture in the real world scenario.
3	Learn about the basics of various IOT protocols
4	Build a simple low cost IoT Systems using Arduino and Raspberry Pi
5	Demonstrate IoT infrastructure of different popular IOT Platforms

Course Outcome (s) (Cos):

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

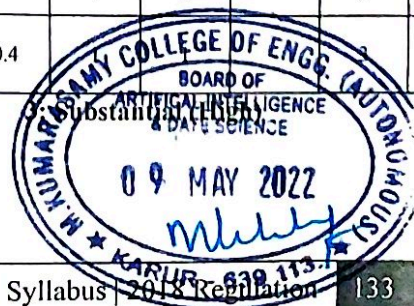
CO1	Explain the concepts of IoT
CO2	Apply the different IoT Architecture in the real world scenario
CO3	Identify suitable protocols for different applications of IoT
CO4	Design a portable IoT applications using Arduino/Raspberry Pi
CO5	Summarize different applications of IoT in real time scenario

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	-	-	-	1	-	-	3	1
CO2	3	3	3	3	2	2	1	-	-	1	-	-	3	1
CO3	3	3	3	3	3	2	1	-	1	1	1	-	3	2
CO4	3	3	3	3	3	2	1	-	1	1	2	-	3	3
CO5	3	3	3	3	3	2	1	-	-	1	2	-	3	3
CO (Avg)	3	3	3	2.8	2.6	2	0.8	-	0.4					2

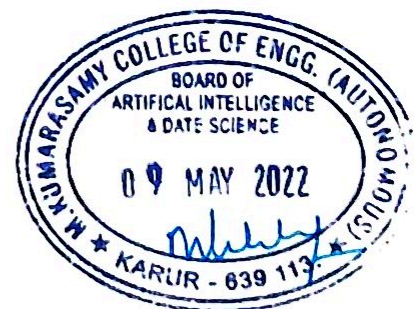
1: Slight (Low)

2: Moderate (Medium)



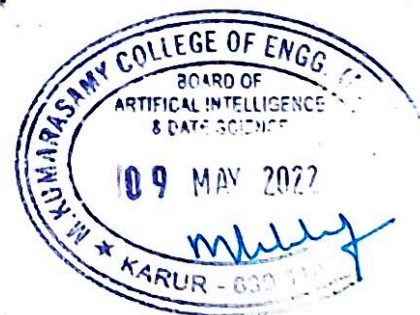


UNIT I	INTRODUCTION TO IoT	9
Internet of Things Overview - Evolution of Internet of Things – Characteristics - Challenges, Application areas - IoT ecosystem - Things in IoT - Functional building blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects – Simplified IoT Architecture - Web and core IoT Functional stack - Physical Design - Logical Design - IoT Enabling Technologies - IoT Levels - Domain Specific IoTs - IoT Platforms Design Methodology.		
UNIT II	IoT ARCHITECTURE	9
IoT Architectures: oneM2M, IoT World Forum (IoTWF)- M2M high-level ETSI Architecture - IETF Architecture For IoT - OGC Architecture - IoT Reference Model - Domain Model - Information Model - Functional Model - Communication Model- Basics of IoT System Management with NETCOZF and YANG.		
UNIT III	IoT PROTOCOLS	9
Protocol Standardization for IoT – Efforts – M2M - IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture - IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and LoRaWAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, 6LoWPAN, Application Transport Methods: SCADA- Application Layer Protocols: CoAP and MQTT.		
UNIT IV	BUILDING IOT APPLICATIONS	9
Arduino. Arduino : Architecture, Arduino Board details, IDE programming, Interfaces, Programming using python and Applications - Raspberry Pi : Architecture, Interfaces, Programming Raspberry Pi with Python and Applications.		
UNIT V	CASE STUDIES AND REAL-WORLD APPLICATIONS	9
Cisco IoT system - IBM Watson IoT platform- Amazon Web Services for IoT- Google Cloud IoT Core- Real World Design Constraints - Applications: Asset Management, Industrial Automation, Smart Grid, Commercial Building Automation, Smart Cities, Smart Lighting, Smart Parking and Smart Traffic Control.		





Text Books	
1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017
2	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
Reference (s)	
1	Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.
2	Jan Ho" ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
3	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
4	Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.
5	Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
Web References	
1	https://myvuniversity.teachable.com/p/embedded-systems-internet-of-things-310252
2	https://www.arduino.cc/
3	https://www.ibm.com/smarterplanet/us/en/?ca=v-smarterplanet





Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE008T	WEB DEVELOPMENT	3	0	0	3

Prerequisite Course (s)

Basic Programming Concepts

Course Objective (s):

The purpose of learning this course is to:

- | | |
|---|--|
| 1 | To understand and practice Embedded Dynamic Client-side Scripting. |
| 2 | To understand Server-side Programming Language. |
| 3 | To implement manipulation of DOM events. |
| 4 | To learn basic architecture of Angular and React JS. |

Course Outcome (s) (COs):

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

- | | |
|-----|---|
| CO1 | Design and implement dynamic web page with validation and event handling by applying Java Script. |
| CO2 | Design and implement Server-side Programming using Servlet. |
| CO3 | Design and implement Server-side Programming using PHP. |
| CO4 | Design and implement client side webpage using jQuery. |
| CO5 | Learn and design web application using Angular and React JS. |

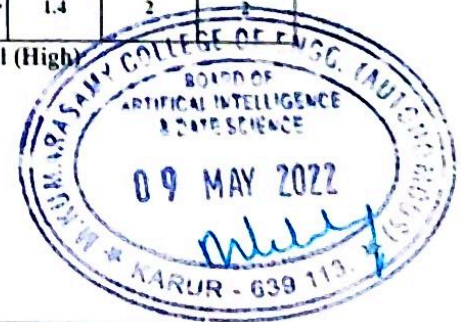
CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	3	2	-	-	-	-	1	1	2	2
CO2	3	3	3	3	3	2	-	-	-	-	1	1	2	2
CO3	3	3	3	3	3	2	-	-	-	-	1	1	2	2
CO4	3	3	3	3	3	2	-	-	-	-	1	2	2	2
CO5	3	3	3	3	3	2	-	-	-	-	1	2	2	2
CO (Avg)	2.8	3	3	3	3	2	-	-	-	-	1	1.4	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





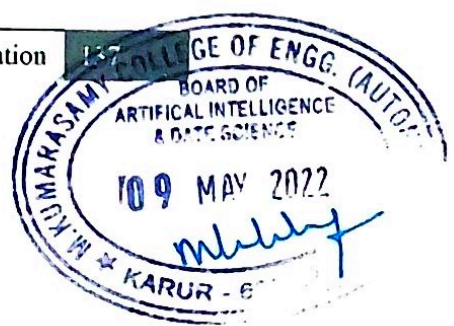
UNIT I	WWW and JAVASCRIPT	9
WWW: Internet technologies Overview – Internet Standards & Protocols - HTTP. JAVASCRIPT: Introduction to Scripting - Data types and Variables - Operators, Expressions and Statements - Functions - Arrays - Objects - Document Object Model - Event Handling – JSON.		
UNIT II	SERVLETS	9
Servlets: Java Servlet Architecture - Servlet Life Cycle - Form GET and POST actions- Session Handling - Understanding Cookies - Database Connectivity - JDBC.		
UNIT III	PHP	9
PHP: Variables – Conditions, Branches, Loops - Arrays & Strings - Regular Expressions - Date and Time Functions - Integer and Float Functions - User-Defined Functions - Program control - Form Processing - Cookies - Database Connectivity.		
UNIT IV	JQUERY	9
JQUERY: Introduction to jQuery – Selectors – Elements: Manipulations, Changing and Setting elements – Event Models: Event handlers – Animations & Effects – Functions – Plugins.		
UNIT V	ANGULAR and REACTJS	9
ANGULAR: TypeScript – Node.js - Angular Web Application - Components - Data Binding - Directives - Pipes - Service - Event Binding – Forms. REACTJS : React Features- ReactJS Vs React native-React JSX - Components - state-props-lifecycle-events-forms-router-animation-table.		

Text Book (s)

1	Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web - How To Program”, Fifth Edition, Pearson Education, 2011.
2	Nate Murray, Felipe Coury, Ari Lerner, and Carlos, ng-book The Complete Guide to Angular, Fullstack.io, 2020.
3	Adam Freeman, Pro React 16, Apress, 2019.
4	Nln Lnc, Susan Fitzgerald, “React js: Hands-On full stack web development using React js”, 2nd Edition, 2020.

Reference (s)

1	Jeffrey C and Jackson, —Web Technologies A Computer Science Perspective, Pearson Education, 2011.
2	Bear Bibeault and Yehuda Katz, jQuery in Action, 2008.
3	Gopalan N.P. and Akilandeswari J., Web Technology, Prentice Hall of India, 2011.
4	UttamK.Roy, Web Technologies, Oxford University Press, 2011.





Regulation 2018		Semester VI	Total Hours			45									
Category	Course Code	Course Name	Hours / Week			C									
			L	T	P										
E	18AIE009T	STATISTICAL ANALYSIS USING R	3	0	0	3									
Prerequisite Course (s)															
<ul style="list-style-type: none"> Basic concepts of programming language Basic knowledge of regression, analysis and statistical models 															
Course Objective (s):															
The purpose of learning this course is to:															
1	Learn to run/execute the code without any compiler														
2	Perform calculations with the various R packages														
3	Accomplish various regression, distribution and analysis models with necessary library files														
4	Develop/generate the statistical model for various probability features and variable generators														
5	Enhance the learning through industrial standards and research														
Course Outcome (s) (COs):															
At the end of this course, learners will be able to:															
CO1	Understand about the overviews of learning R														
CO2	Apply the concepts of R packages and files														
CO3	Explain about the various models of regression, distribution & analysis														
CO4	Study & apply the usage of probability and statistics for review and generating random values														
CO5	Visualize the integration, variance & Inference of statistical analysis with R														
CO-PO Mapping															
Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	2	2	1	2	-	-	-	-	-	-	1	2	2	
CO2	2	2	2	2	2	-	-	-	-	-	-	1	2	2	
CO3	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
CO4	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
CO5	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
CO (Avg)	2.6	2.6	2.6	2.4	2.6	-	-	-	-	-	-	1	2.6	2.6	
			1: Slight (Low)			2: Moderate (Medium)			3: Substantial (High)						





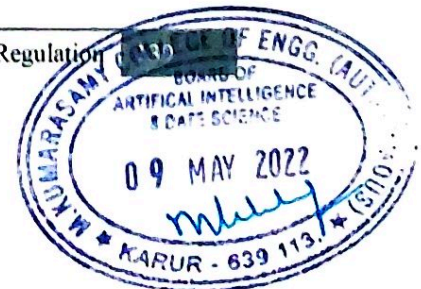
UNIT I	R – OVERVIEW	9
Evolution Of R - Features of R - Environment Setup - Basic Syntax, Data Types, Variables, Operators, Decision Making, Loops, Function, Strings. Vectors - Lists - Matrices - Arrays - Factors - Data Frames		
UNIT II	R – PACKAGES & FILES	9
R – Packages - Data Reshaping - Csv Files - Excel File - Binary Files - Xml Files - Json File - Web Data - Databases - Pie Charts - Bar Charts - Boxplots - Histograms - Line Graphs - Scatterplots - Mean, Median & Mode		
UNIT III	REGRESSION, DISTRIBUTION & ANALYSIS	9
R – Linear Regression - Multiple Regression - Logistic Regression - Normal Distribution - Binomial Distribution - Poisson Regression - Analysis of Covariance - Time Series Analysis - Nonlinear Least Square Decision Tree - Random Forest - Survival Analysis - Chi Square Test		
UNIT IV	PROBABILITY AND STATISTICS REVIEW & METHODS FOR GENERATING RANDOM VARIABLES	9
Random Variables and Probability - Some Discrete & Continuous Distributions - Multivariate Normal Distribution - Limit Theorems – Statistics - Bayes’ Theorem and Bayesian Statistics - Markov Chains - The Inverse Transform Method - The Acceptance-Rejection Method - Transformation Methods - Sums and Mixtures - Multivariate Distributions - Stochastic Processes		
UNIT V	VISUALIZATION OF MULTIVARIATE DATA MONTE CARLO INTEGRATION, VARIANCE REDUCTION & INFERENCE	9
Monte Carlo Integration - Variance Reduction - Antithetic Variables - Control Variates - Importance Sampling - Stratified Sampling - Stratified Importance Sampling - Monte Carlo Methods for Estimation - Monte Carlo Methods for Hypothesis Tests – Application - The Metropolis-Hastings Algorithm - The Gibbs Sampler - Monitoring Convergence – Application		

Text Book (s)

1	Garrett Grolemond, Hadley Wickham. “R for Data Science”, O’Reilly Media, 1 st Edition, 2017
2	Michael J. Crawley, “The R Book”, John Wiley & Sons, Ltd, 1 st Edition, 2013

Reference (s)

1	Brian S. Everitt and Torsten Hothorn , “A Handbook of Statistical Analyses Using R”, London and Erlangen, December 2005
2	Norman Matloff, “THE ART OF R PROGRAMMING”, No Starch Press, Inc. 2 nd Edition, 2011
3	Maria L.Rizzo, “ Statistical Computing with R”, Chapman & Hall/CRC, Taylor & Francis Group, 2 nd Edition. 2008





Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE010T	WEB & SOCIAL MEDIA MINING	3	0	0	3

Prerequisite Course (s)

Basic Programming Concepts and Data Mining

Course Objective (s):

The purpose of learning this course is to:

1	To understand the components of web based social networks
2	To learn knowledge representation using ontology
3	To mine the users community in social networks
4	To understand the evolution of social networks through various models
5	To mine the opinions of the users in social networks

Course Outcome (s) (COs):

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

CO1	Work on the internals components of social networks
CO2	Represent Knowledge using Ontology
CO3	Mine the behaviour of the users in social networks
CO4	Predict the possible next outcome of social networks
CO5	Mine the opinions of the user social networks

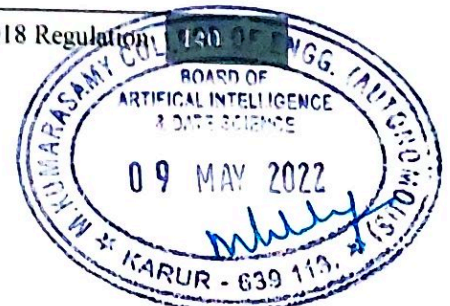
CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2	-	-	-	-	1	1	2	3	1
CO2	3	2	1	1	1	-	-	-	-	1	1	2	2	1
CO3	3	1	1	-	-	-	-	-	-	1	1	2	3	2
CO4	3	2	2	2	2	-	-	-	-	1	1	2	1	2
CO5	3	2	1	1	-	-	-	-	-	1	1	2	1	2
CO (Avg)	3	2	1.4	1.4	1	-	-	-	-	1	1	2	2	1.6

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)





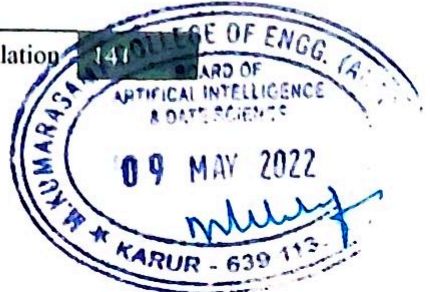
UNIT I	INTRODUCTION	9
Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks - Development of Social Network Analysis - Key concepts and measures in network analysis – Electronic sources for network analysis - Discussion networks - Blogs and online communities - Web-based networks-Applications of Social Network Analysis		
UNIT II	MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION	9
Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.		
UNIT III	MINING COMMUNITIES AND SOCIAL MEDIA MINING	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 – Social Media Mining-Classification- Challenges- Research issues –Applications.		
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		
UNIT V	TEXT, OPINION AND MULTIMEDIA DATA MINING CASE STUDIES	9
Text Mining in Social Networks -Opinion extraction – Sentiment classification and clustering - Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis, Case Studies: Multimedia Data Mining		

Text Book (s)

1	Charu C. Aggarwal, "Social Network Data Analytics", Springer: 2011
2	Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition, 2007.
3	Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2010.

Reference (s)

	Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st edition, 2011.
	Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 2010
	Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, "Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2009.
	Toby Segaran, "Programming Collective Intelligence", O'Reilly, 2012





Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE011T	CLEAN CODING AND DEVOPS	3	0	0	3

Prerequisite Course (s)

Basic Programming Concepts

Course Objective (s):

The purpose of learning this course is to:

1	Understand about the clean code.
2	Explain the importance of naming conventions
3	Understand the importance of comments in the applications
4	Understand and install different tools used in DevOps stack
5	Explain the benefits of DevOps and how various industries are benefitting

Course Outcome (s) (COs):

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

CO1	Study the concepts of coding principles.
CO2	Illustrate the importance of formatting and comments in the applications
CO3	Outline the principles, need and tools of DevOps.
CO4	Study the advanced DevOps concepts.
CO5	Explain why DevOps on cloud and various DevOps services available on IBM Cloud

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	1	-	-	-	-	-	-	-	2	-
CO2	2	1	1	-	1	-	-	-	-	-	-	-	2	-
CO3	2	1	1	-	2	-	-	-	-	-	-	-	2	-
CO4	1	2	1	2	-	-	-	-	-	-	-	-	2	-
CO5	2	2	1	2	1	-	-	-	-	-	-	-	2	-
CO (Avg)	2	1.4	1	0.8	1	-	-	-	-	-	-	-	2	-

1: Slight (Low)

2: Moderate (Medium)

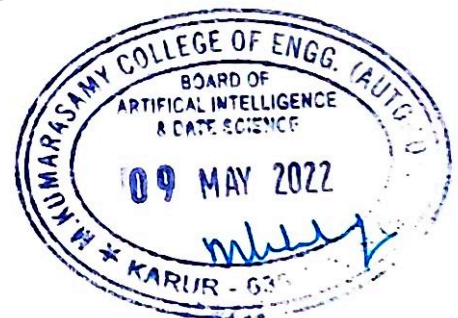
3: Substantial (High)





UNIT I	INTRODUCTION TO CLEANCODING	9
Coding principles introduction-Bad and Good code-marshalling and unmarshalling - Names and Functions-distinct names-Defining meaningful context-Usage of domain and function names-Usage of exceptions and its error code names/descriptions. Exercise to implement JAXB.		
UNIT II	COMMENTS, FORMATTING AND OBJECTS	9
Right comments and types of formatting- Clean and bad comments-Vertical and horizontal formatting-Objects and data structures-Data abstraction-Data and object antisymmetric-Data transfer objects – Defining meaningful names and functions. Hands on: “How to Write a clean, testable and high quality code in Python”		
UNIT III	INTRODUCTION TO DEV-OPS	9
An overview about DevOps - Why it is needed? How it is different from traditional IT and Agile - DevOps Principles - DevOps Lifecycle - An overview about CI/CD pipeline and various tools - setup a complete CI/CD pipeline from scratch using DevOps tools - How DevOps is used in various technologies/industries.		
UNIT IV	ADVANCED DEV-OPS	9
An overview of advanced DevOps concepts - Automatic Rollback and Provisioning, Scalability, Clustering and Infrastructure as Code. Case Study: “How to Adapt DevOps to Cognitive and AI Systems”		
UNIT V	DEV-OPS ON CLOUD	9
An overview of Cloud computing - Introduction to IBM Cloud - Why DevOps on cloud - IBM Cloud services - Setup a CI/CD pipeline in IBM Cloud. Install tools in DevOps Stack- Build, Test and Deliver applications in IBM Cloud using DevOps Practices		

Text Book (s)	
1	Ingo M.Weber, Len Bass, and Liming Zhu, “DevOps: A Software Architect's Perspective”, 2015.
2	Robert C Martin, “Clean Code: A Hand Book of Agile Software Craftsmanship”, 2008.





Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE012T	AI FOR GAME PROGRAMMING	3	0	0	3

Prerequisite Course (s)

Basic Programming Concepts

Course Objective (s):

The purpose of learning this course is to:

1	To learn the fundamentals of Game programming.
2	To understand the 3D Graphics, vertex and pixel shader.scenes.
3	To learn the various PyGame Development process and its design attributes.
4	To interpret working knowledge in various game platforms.
5	To familiarize various games using reinforcement learning.

Course Outcome (s) (COs):

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

CO1	Explain the need for Game programming.
CO2	Integrate various concepts and techniques of 3D Game design.
CO3	Design and model interactive game.
CO4	Explain the need for advanced game development platforms.
CO5	Design and develop games using reinforcement learning.

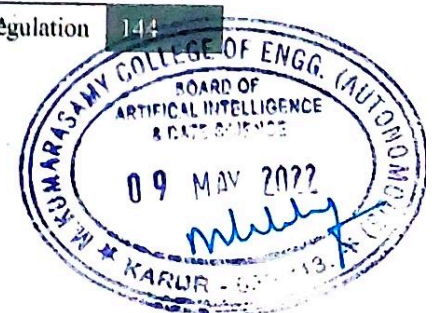
CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	2	2	-	-	-	-	-	-	-	1	1
CO2	2	2	3	2	2	-	-	-	-	-	-	-	1	1
CO3	2	2	2	3	3	-	-	-	-	-	2	-	3	3
CO4	2	2	3	3	3	-	-	-	-	-	2	-	3	3
CO5	2	2	3	3	3	-	-	-	-	-	2	-	3	3
CO (Avg)	1.8	2	2.8	2.6	2.6	-	-	-	-	-	1.2	-	2.4	2.4

1: Slight (Low)

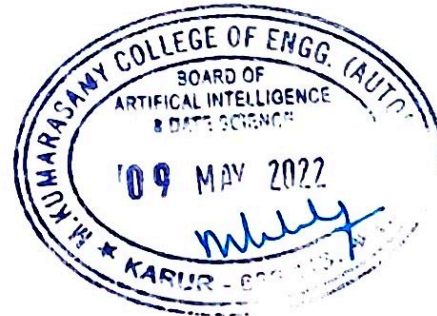
2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION	9
Elements of Game-Game Architecture-Application Layer-Game Logic-Game View for the Human Player-Game View for AI agents-Networked Game Architecture-Remote Game View-Remote Game Logic		
UNIT II	3D GRAPHICS	9
3D Graphics Basics- Pipeline-3D MATH 101-Vector Classes-Matrix Mathematics-Quaternion Mathematics. 3D Vertex and Pixel Shader : Vertex Shader Syntax-Compiling the vertex shader-The pixel shader-Rendering the shader Helper Classes. 3D Scenes: Graph Basics-Special Scene Graph Nodes.		
UNIT III	PYGAME AND 3D AND PYPLATFORMERS	9
Installing Packages-Getting started with OpenGL-Adding the Pygame Library-Drawing the openGL-Basic Collision Detection Game-An introduction to Game Design-Introducing Pymunk-Building a Game Framework-Developing Pyplatformers.		
UNIT IV	AUGMENTING A BOARD GAME WITH COMPUTER VISION	9
Planning the checker application-setting up OpenCV and Other dependencies-Supporting multiple version of Open CV-Configuring Cameras-Working With Colors-Building the analyser-Converting OpenCV images for wxPythonBuilding the GUI Application-Troubleshooting the project.		
UNIT V	REINFORCEMENT LEARNING AND GAMES	9
Intelligence and Games- Reinforcement Learning - Heuristic Planning - Adaptive Sampling-Deep Supervised Learning-Deep Reinforcement Learning		
Text Book (s)		
1	Learning to Play (Springer),Reinforcement Learning and Games by Aske Plaat, 2020.	
2	Mike "MrMike" McShaffry and David "Rez" Graham, "Game Coding Complete, Fourth Edition", Course Technology PTR, A part of Cengage Learning.	
Reference (s)		
1	Jeremy Gibson, "Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#", Addison-Wesley Professional, 2 nd edition, 2016.	
2	Jorge Palacios, "Unity 5.x Game AI Programming Cookbook", Packt Publishing Limited, 1 st edition, 2016.	
3	John Horton, "Learning Java by Building Android Games", Packt Publishing Limited, 1 st edition, 2015.	





Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE013T	NATURAL LANGUAGE PROCESSING	3	0	0	3

Prerequisite Course (s)

Theory of Computation

Course Objective (s):

The purpose of learning this course is to:

1	Provide basic mathematical models and methods used in NLP applications to formulate computational solutions.
2	Understand the syntax and semantics of natural languages. How they work and how machine can convert from one natural language to another.
3	Acquire the knowledge on designing procedures for natural language resource annotation and the use of related tools for text analysis and hands-on experience of using such tools.

Course Outcome (s) (COs):

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

CO1	Understand the fundamental mathematical models and algorithms in the field of NLP.
CO2	Apply the mathematical models and algorithms in the applications of software.
CO3	Implement a rule-based system to tackle morphology/syntax of a language.
CO4	Analyze the design and implementation issues in various NLP applications such as information retrieval and information extraction.
CO5	Apply the principles of language resource annotation and its use in machine learning applications.

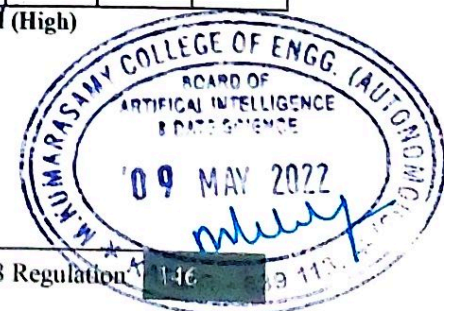
CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	1	-	-	-	-	-	-	-	-	2	2
CO2	2	2	2	2	2	-	-	-	-	-	-	1	2	2
CO3	2	2	2	2	2	-	-	-	-	-	-	1	3	2
CO4	2	2	2	1	2	-	-	-	-	-	-	-	3	2
CO5	1	2	2	1	2	-	-	-	-	-	-	1	3	2
CO (Avg)	1.6	2	2	1.4	1.6	-	-	-	-	-	-	0.6	2.6	2

1: Slight (Low)

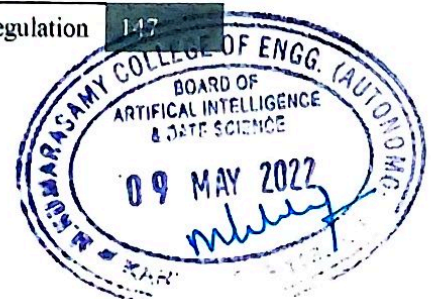
2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION	9
Introduction - Mathematical Foundations - Elementary Probability Theory - Essential Information Theory - Linguistic Essentials- Parts of Speech and Morphology- Phrase Structure- Semantics and Pragmatics - Regular Expressions, Text Normalization, Edit Distance - N-gram Language Models		
UNIT II	SENTIMENT CLASSIFICATION AND LOGISTIC REGRESSION	9
Naive Bayes Classification and Sentiment - Logistic Regression- Vector Semantics -Neural Nets and Neural Language Models - Sequence Labelling for Parts of Speech- Deep Learning-Architectures for Sequence Processing		
UNIT III	SYNTACTIC PARSING	9
Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar- Ambiguity – Cocke Kasami Younger (CKY) algorithm - Partial Parsing - Statistical Parsing- Dependency Parsing- Dependency Formalisms-Treebanks- Transition-Based Dependency Parsing- Graph-Based Dependency Parsing.		
UNIT IV	COMPUTATIONAL SEMANTICS AND SEMANTIC PARSING	9
Computational Desiderata for Representations- Model-Theoretic Semantics- First-Order Logic - Event and State Representations- Logics -Relation Extraction- Relation Extraction Algorithms- Word Senses - Relations between Senses- WordNet: A Database of Lexical Relations- Disambiguation- Alternate WSD Algorithms and Tasks -Semantic Role Labelling		
UNIT V	DISCOURSE COHERENCE AND COREFERENCE RESOLUTION	9
Lexicons for Sentiment, Affect, and Connotation, Discourse Coherence -Coherence Relations- Discourse Structure Parsing- Centering and Entity-Based Coherence- Representation learning models for local coherence- Co reference Resolution- Co reference Tasks and Datasets- Architectures for Co reference Algorithms- A neural mention-ranking algorithm		
Text Book (s)		
1	Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.	
2	Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schuetze, MIT Press, 2018	
Reference (s)		
1	Breck Baldwin, —Language processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.	
2	Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media, 1 st edition, 2009	
3	Richard M Reese, —Natural Language Processing with Javal, O'Reilly Media, 2015.	
4	Nitin Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.	





Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE014T	AUGMENTED REALITY	3	0	0	3

Prerequisite Course (s)

Computer Vision

Course Objective (s):

The purpose of learning this course is to:

CO1	To Understand the concept of augmented reality
CO2	To effectively design and benefits of AR
CO3	To Incorporate of Geo-location with AR
CO4	To Apply AR for real-time applications
CO5	To acquire knowledge about augmented reality and to realize its benefits and features in various fields

Course Outcome (s) (COs):

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

CO1	Demonstrate understanding and perspective on the AR landscape; past, present and future
CO2	Demonstrate understanding of fundamental computer vision, computer graphics and human-computer interaction techniques related to AR
CO3	Demonstrate insights to key application areas for AR
CO4	Demonstrate the ability to design and implement AR experiences
CO5	Implement the Applications using various AR Methodologies

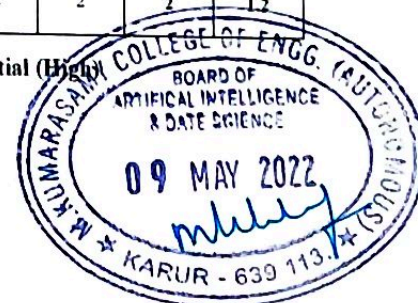
CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	2	2	-	-	-	-	-	2	2	1	1
CO2	1	-	-	2	2	-	-	-	-	-	2	2	1	1
CO3	2	3	3	2	2	-	-	-	-	-	2	2	3	2
CO4	2	3	3	2	2	-	-	-	-	-	2	2	3	1
CO5	2	3	3	2	2	-	-	-	-	-	2	2	2	2
CO (Avg)	1.6	1.8	1.8	2	2	-	-	-	-	-	2	2	2	1.2

1: Slight (Low)

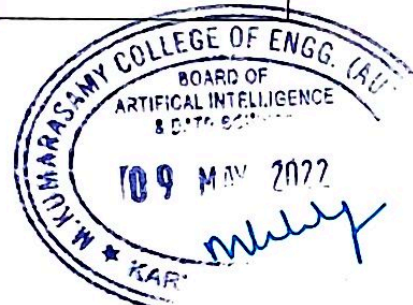
2: Moderate (Medium)

3: Substantial (High)





UNIT I	INTRODUCTION TO AUGMENTED REALITY	9
Augmented Reality History-Definition of Augmented Reality- Augmented Reality features - Mixed Reality continuum-MAR Market , Actors and Value Chain- MAR System Architecture – mobile AR for android and iOS- Application vs. Browser.		
UNIT II	AUGMENTED REALITY CONCEPTS AND HARDWARE	9
Two-Step Process of Augmented Reality Applications- Augmented Reality Hardware- Sensor Roles of Sensors- Tracking- processor- Processor System Architectures -display- Stationary visual displays-Visual displays that move with the participant's head-Visual displays that move with the participant's hand or other parts of his or her body - other sensory displays-Haptics Smell (Olfaction)- Other Senses- Stereo Displays- Display - Characteristics of Displays Techniques. Computer Graphics – Dimensionality - Depth Cues - Registration and Latency		
UNIT III	AUGMENTED REALITY DIMENSION AND INTERACTION	9
Introduction to 3D objects in ARAF-advanced 3D modeling technique -Vuforia Overview: Interface, Navigation, Terminology, Image Targeting, Custom Images-Recognition process with Vuforia- Use of Vuforia descriptor in ARAF -Real World-Manipulation-Navigation-Mobile Augmented Reality.		
UNIT IV	AUGMENTED REALITY WITH GEOLOCATION	9
Create an AR Quiz using the authoring tool - Geolocation in ARAF- A basic example: Image PROTO-Enriching a prototype: add user interaction- Map PROTO- MapMarker PROTOMapOverlay PROTO-MapPlayer PROTO- An example of a functional map in ARAF.		
UNIT V	APPLICATION	9
Pokemon GO and its effect on AR & Augmented Reality Gaming - Survey of Current AR Games - ARKit GPS Template- Augmented Reality Wearable Survey of Augmented Reality Wearables, AR for Medical and Psychotherapy Bio-sensing and AR with the server - The future of augmented reality.		
Text Book (s)		
1	Augmented Reality: Principles & Practice – 12 Oct 2016 by Schmalstieg / Hollerer	
2	Steve Aukstakalnis, Practical Augmented Reality, A guide to technologies applications and human factors for AR and VR (usability), Addison-Wesley Professional, 1st Edition, 2016.	
3	Augmented Reality a Practical Guide Paperback – 2008	
Reference (s)		
	http://www.creativecrash.com/ http://www.cgsociety.org/	
	http://www.11secondclub.com/ http://www.learning-maya.com/	
	http://www.3Dlinks.com/tutorials_maya.cfm http://www.3D-tutorial.com/	
	http://www.thegnomonworkshop.com/tutorials.html	





Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18AIE015T	AUTONOMOUS SYSTEMS AND DRONES	3	0	0	3

Prerequisite Course (s)

Basic concepts of programming language

Course Objective (s):

The purpose of learning this course is to:

- 1 Learn classifications of drones (UAVs) according to technology focus and use.
- 2 Gain an understanding of the commercial and research capabilities of drones
- 3 Develop a crucial systems view of drones with hardware and software
- 4 Establish expertise in risk factors and counter technologies
- 5 Apply insights to forecasting, command and control, disaster relief operations, structural analysis, recovery

Course Outcome (s) (COs):

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

- CO1 Understand about the technologies & measures in autonomous systems
- CO2 Classify and aware about the various creative applications of drones
- CO3 Categorize and understand the designing process of autonomous vehicles
- CO4 Recognize and apply the concepts of networks in vehicle systems
- CO5 Identify and model the drones based on control platform

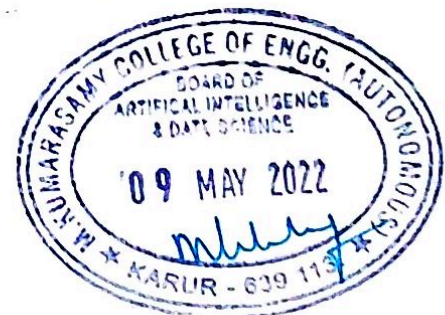
CO-PO Mapping

Cos	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	1	3	-	-	1	-	2	2
CO2	3	3	2	2	2	2	2	2	-	-	1	-	2	2
CO3	3	3	3	3	3	3	3	2	2	-	2	3	2	3
CO4	3	3	3	3	3	3	3	-	2	-	3	3	2	3
CO5	3	3	3	3	3	3	3	1	2	-	3	3	2	3
CO (Avg)	3	3	2.6	2.6	2.6	2.6	2.4	1.6	1.2	-	2	1.8	2	2.6

1: Slight (Low)

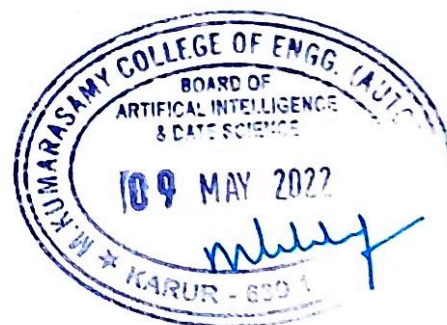
2: Moderate (Medium)

3: Substantial (High)





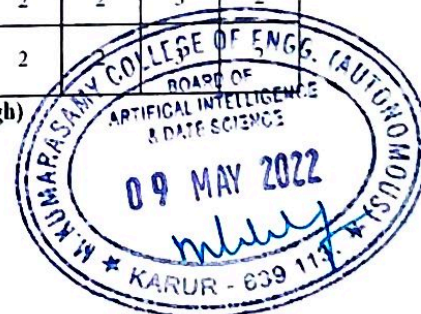
UNIT I	DRONES AND AUTONOMOUS SYSTEMS I: FUNDAMENTALS	9
History and Introduction - Fundamentals of Drones and Autonomous Systems - Critical Technologies and Requirements - Technical Performance - Regulatory Framework (including Risk, Safety, Security, Policy) - Future of Drone Systems		
UNIT II	DRONES AND AUTONOMOUS SYSTEMS 2	9
Introduction to hazards, disasters and drone applications - Global natural disasters and drone applications - Man-made disasters and drone applications - Future drone applications		
UNIT III	AUTONOMOUS VEHICLES AND DRONES I	9
Fundamental Principles of Embedded Systems - ARM architecture – ROS - Performance characterization and power consumption optimization - Motion and positioning sensors - Introduction to positioning navigation (Dead Reckoning)		
UNIT IV	AUTONOMOUS VEHICLES AND DRONES II	9
Introduction to control systems - PID control - Machine Learning through Neural Networks - Anatomy of autonomous vehicles - Interrupt mechanisms		
UNIT V	DRONE ANATOMY & APPLICATIONS	9
Drone Anatomy - Embedded Drone Control Platform - Design of autonomous vehicles - Unmanned aerial vehicles programming - Unmanned aerial vehicles based on models – Drone Applications: Disaster Management - Military Reconnaissance & Combat Uses - Search and Rescue - Agricultural Application		
Text Book (s)		
1	Diego Galar, Uday Kumar, Dammika Seneviratne “Robots, Drones, UAVs and UGVs for Operation and Maintenance” CRC Press, 2020	
Reference (s)		
1	John Baichtal, “Building Your Own Drones - A Beginner’s Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016	
2	Plamen Angelov “Autonomous Learning Systems: From Data Streams to Knowledge in Real-time”, John Wiley & Sons, Ltd, 1 st Edition, 2013	
3	David Allen Blubaugh, Benjamin Sears, Steven D. Harbour, <u>Michael J. Findler</u> “Intelligent Autonomous Drones with Cognitive Deep Learning: Build AI-Enabled Land Drones with the Raspberry Pi 4”, First Edition, 2022.	





Regulation 2018		Semester VI			Total Hours			45						
Category	Course Code	Course Name	Hours / Week			C								
			L	T	P									
E	18AIE016T	XML AND WEB SERVICES	3	0	0	3								
Prerequisite Course (s)														
NIL														
Course Objective (s):														
The purpose of learning this course is to:														
<ul style="list-style-type: none"> Construct the web page using XML and service oriented architecture Implement the real time applications using XML technologies Analyze the design principles and applications of SOAP based Web Services Use the key technologies in web services. Evaluate the security issues in XML. 														
Course Outcome (s) (COs):														
At the end of this course, learners will be able to:														
CO1	Construct the web page using XML and service oriented architecture													
CO2	Implement the real time applications using XML technologies.													
CO3	Analyze the design principles and applications of SOAP based Web Services.													
CO4	Use the key technologies in web services													
CO5	Evaluate the security issues in XML													
CO-PO Mapping														
COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	2	-	-	-	-	2	2	3	2
CO2	2	2	2	2	2	2	-	-	-	-	2	2	3	2
CO3	2	3	3	2	3	2	-	-	-	-	2	2	3	2
CO4	2	2	2	2	2	2	-	-	-	-	2	2	3	2
CO5	2	2	2	2	2	2	-	-	-	-	2	2	3	2
CO (Avg)	2	2.2	2.2	2	2.2	2	-	-	-	-	2	2	3	2

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





UNIT I	INTRODUCTION	8
Role of XML - XML and the Web - XML Language Basics - SOAP - Web Services - Revolutions of XML - Service Oriented Architecture (SOA)		
UNIT II	XML TECHNOLOGY	9
XML - Name Spaces - Structuring with Schemas and DTD - Presentation Techniques - Transformation.		
UNIT III	SOAP SERVICES	9
Overview of SOAP - HTTP - XML - RPC - SOAP: Protocol - Message Structure - Intermediaries - Actors - Design Patterns and Faults - SOAP with Attachments.		
UNIT IV	WEB SERVICES	10
Overview - Architecture - Key Technologies - UDDI - WSDL - ebXML - SOAP and Web Services in ECom - Overview of .NET and J2EE.		
UNIT V	XML SECURITY	9
Security Overview - Canonicalization - XML Security Framework - XML Encryption - XML Digital Signature - XKMS Structure - Guidelines for Signing XML Documents - XML in Practice.		
Text Book (s)		
1	Frank. P. Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2017.	
2	David Hunter, Jeff Rafter, Joe Fawcett, Eric Van der Vlist, Danny Ayers, Jon Duckett, Andrew Watt, Linda McKinnon, Begining XML , Fourth Edition, Wrox publication.	
Reference (s)		
1	Deitel H M, Deitel P J, Nirto T R, Lin T M, XML How to Program, Pearson Edition, 2011	

