1.1.2 Details of Courses where syllabus revision was carried out

B.Tech.- Artificial Intelligence and Data Science

R-22 Curriculum

Course Code	Course Name	% of change
22AIC12	Computer Networks	60%
22AIC13	Deep Learning	100%
22AIC14	Internet of Things and its Applications	100%
22AIP09	Deep Learning Laboratory	100%
22AIP10	Internet of Things and its Applications Laboratory	100%
22AIC15	Full Stack Development	80%
22AIC16	Big Data Analytics	100%
22AIP11	Big Data Analytics Laboratory	100%
22AIX01	Knowledge Engineering	100%
22AIX02	Recommender Systems	100%
22AIX03	Soft Computing	100%
22AIX04	Optimization Techniques	100%
22AIX05	Computer vision	100%
22AIX06	Ethics of AI	100%
22AIX07	Business Intelligence	100%
22AIX08	Robotic Process Automation	100%
22AIX11	Pattern Recognition	100%
22AIX12	Text and Speech Analytics	100%
22AIX13	Time Series Analysis and Forecasting	100%
22AIX14	Health care Analytics	100%
22AIX15	Predictive Analytics	100%
22AIX16	Image and Video Analytics	100%
22AIX17	Natural Language Processing	100%
22AIX18	Augmented Reality and Virtual Reality	70%
	Average	73%

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SEMESTER: V									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22AIC12	Computer Networks	PCC	-	3	3	0	0	3
2	22AIC13	Deep Learning	PCC	-	3	3	0	0	3
3	22AIC14	Internet of Things and its Applications	ESC	-	3	3	0	0	3
4	E1	Elective (PEC)	PEC	-	3	3	0	0	3
5	E2	Elective (PEC)	PEC	-	3	3	0	0	3
6	E3	Elective (OEC/PEC)	PEC	-	3	3	0	0	3
PRACTICAL									
7	22AIP09	Deep Learning Laboratory	PCC	-	4	0	0	4	2
8	22AIP10	Internet of Things and its Applications Laboratory	ESC	-	4	0	0	4	2
Mandatory Non-Credit Courses									
9	22MAN10R	Communication and Quantitative Reasoning**	MC	-	3	1	0	2	0
				TOTAL	**29**	**19**	**0**	**10**	**22**

** Ratified by Twelfth Academic Council

SEMESTER: VI									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22AIC15	Full Stack Development**	PCC	-	3	3	0	0	3
2	22AIC16	Big Data Analytics	PCC	-	3	3	0	0	3
3	E4	Elective (PEC)	PEC	-	3	3	0	0	3
4	E5	Elective (OEC)	OEC	-	3	3	0	0	3
5	E6	Elective (OEC/PEC)	PEC/OEC	-	3	3	0	0	3
6	E7	Elective (PEC)	PEC	-	3	3	0	0	3
PRACTICAL									
7	22AIP11	Big Data Analytics Laboratory	PCC	-	4	0	0	4	2
				TOTAL	**22**	**18**	**0**	**4**	**20**

** Ratified by Twelfth Academic Council

SEMESTER: VII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
2	EM1	Elective - Management	HSMC	-	3	3	0	0	3
3	E8	Elective (PEC)	PEC	-	3	3	0	0	3
4	E9	Elective (OEC)	OEC	-	3	3	0	0	3
5	E10	Elective (OEC)	OEC	-	3	3	0	0	3
PRACTICAL									
6	22GED02	Internship/Industrial Training	EEC	-	0	0	0	0	2
				TOTAL	**14**	**14**	**0**	**0**	**16**

SEMESTER: VIII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICAL									
1	22AID01	Project Work	EEC	-	20	0	0	20	10
				TOTAL	**20**	**0**	**0**	**20**	**10**

(C) **Programme Elective Courses (PEC)**

Vertical I : Machine Intelligence

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX01	Knowledge Engineering	PEC		3	3	0	0	3
2	22AIX02	Recommender Systems	PEC		3	3	0	0	3
3	22AIX03	Soft Computing	PEC		3	3	0	0	3
4	22AIX04	Optimization Techniques	PEC		3	3	0	0	3
5	22AIX05	Computer vision	PEC		3	3	0	0	3
6	22AIX06	Ethics of AI	PEC		3	3	0	0	3
7	22AIX07	Business Intelligence	PEC		3	3	0	0	3
8	22AIX08	Robotic Process Automation	PEC		3	3	0	0	3

Vertical II : Data Analytics

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX11	Pattern Recognition	PEC		3	3	0	0	3
2	22AIX12	Text and Speech Analytics	PEC		3	3	0	0	3
3	22AIX13	Time Series Analysis and Forecasting	PEC		3	3	0	0	3
4	22AIX14	Health care Analytics	PEC		3	3	0	0	3
5	22AIX15	Predictive Analytics	PEC		3	3	0	0	3
6	22AIX16	Image and Video Analytics	PEC		3	3	0	0	3
7	22AIX17	Natural Language Processing	PEC		3	3	0	0	3
8	22AIX18	Augmented Reality and Virtual Reality	PEC		3	3	0	0	3

Vertical III : Cyber Security

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX21	Social Network Security	PEC		3	3	0	0	3
2	22AIX22	Biometric Security	PEC		3	3	0	0	3
3	22AIX23	Cloud Security	PEC		3	3	0	0	3
4	22AIX24	Data Privacy and Protection	PEC		3	3	0	0	3
5	22AIX25	Cyber Physical Systems	PEC		3	3	0	0	3
6	22AIX26	Mobile Device Security	PEC		3	3	0	0	3
7	22AIX27	Malware Analysis	PEC		3	3	0	0	3
8	22AIX28	Digital Forensics	PEC		3	3	0	0	3

Vertical IV : IoT

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX31	Industrial and Medical IoT	PEC		3	3	0	0	3
2	22AIX32	Blockchain Technology	PEC		3	3	0	0	3
3	22AIX33	Beyond 5G and IoT Technologies	PEC		3	3	0	0	3
4	22AIX34	Programming for IoT Boards	PEC		3	3	0	0	3
5	22AIX35	Privacy and Security in IoT	PEC		3	3	0	0	3
6	22AIX36	Wearable Computing	PEC		3	3	0	0	3
7	22AIX37	Fog and Edge computing	PEC		3	3	0	0	3
8	22AIX38	Mobile Application Development for IoT	PEC		3	3	0	0	3

Vertical V : Web Development

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX41	Cloud Computing	PEC		3	3	0	0	3
2	22AIX42	UI and UX design	PEC		3	3	0	0	3
3	22AIX43	DevOps	PEC		3	3	0	0	3
4	22AIX44	Principles of Programming Languages	PEC		3	3	0	0	3
5	22AIX45	MEAN Stack Development	PEC		3	3	0	0	3
6	22AIX46	Social and Information Networks	PEC		3	3	0	0	3
7	22AIX47	Web Mining	PEC		3	3	0	0	3
8	22AIX48	Multimedia Data Compression and Storage	PEC		3	3	0	0	3

Vertical VI : Software Development Engineering

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIX51	Agile Methodologies	PEC		3	3	0	0	3
2	22AIX52	Software Defined Networks	PEC		3	3	0	0	3
3	22AIX53	Software Project Management	PEC		3	3	0	0	3
4	22AIX54	Software Testing Tools and Techniques	PEC		3	3	0	0	3
5	22AIX55	IT Operations	PEC		3	3	0	0	3
6	22AIX56	Software Quality Assurance	PEC		3	3	0	0	3
7	22AIX57	Service Oriented Architecture	PEC		3	3	0	0	3
8	22AIX58	Product Life cycle Management	PEC		3	3	0	0	3

(D) **Management Electives Courses (HSMC)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22GEA02	Principles of Management	HSMC	-	3	3	0	0	3
2	22GEA03	Total Quality Management	HSMC	-	3	3	0	0	3
3	22GEA04	Professional Ethics	HSMC	-	3	3	0	0	3

(E) **Employability Enhancement Courses (EEC)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22GED02	Internship/Industrial Training	EEC	-	0	0	0	0	2
2	22AID01	Project Work	EEC	-	20	0	0	20	10

(F) **Open Electives Courses (OEC)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIZ01	Fundamentals of Artificial Intelligence and Machine Learning	OEC	-	3	3	0	0	3
2	22AIZ02	Introduction to Business Analytics	OEC	-	3	3	0	0	3
3	22AIZ03	Fundamentals of Neural Networks	OEC	-	3	3	0	0	3
4	22AIZ04	Introduction to Robotics	OEC	-	3	3	0	0	3

(G) **Minor degree courses**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C
1	22AIM01	Introduction to Artificial Intelligence	PEC	-	3	3	0	0	3
2	22AIM02	Fundamentals of Machine Learning	PEC	-	3	3	0	0	3
3	22AIM03	Knowledge Representation and Reasoning	PEC	-	3	3	0	0	3
4	22AIM04	Neural Networks and Deep learning	PEC	-	3	3	0	0	3
5	22AIM05	Computer Vision Models	PEC	-	3	3	0	0	3
6	22AIM06	Industrial robotic technology	PEC	-	3	3	0	0	3
7	22AIM07	Virtual Reality Technology	PEC	-	3	3	0	0	3
8	22AIM08	Ethics and Social implication of AI	PEC	-	3	3	0	0	3

Semester/ Category	HSMC	BSC	PCC	ESC	EEC	PEC	OEC	Total
I	4	8		10				22
II	4	7		12				23
III		4	19					23
IV		7	18					25
V			8	5		9		22
VI			8			9	3	20
VII	5				2	3	6	16
VIII					10			10
Total	13	28	53	25	12	21	9	161
%	8.1	17.4	32.9	15.5	7.5	13.0	5.6	
AICTE Credits Recommended	16	23	59	29	15	12	9	163
AICTE MODEL CURRI %	10%	14%	36%	18%	9%	7%	6%	

TOTAL CREDITS (22+23+23+25+22+20+16+10) = 161 CREDITS

22AIC12 - COMPUTER NETWORKS
(Common to 22CSC06, 22CCC05,22CIC09 and 22ITC07)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:

- Develop expertise in networking fundamentals, protocols, security mechanisms, and network management for effective operational efficiency.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the fundamental concepts of communication in networking technologies.	Ap	30%
CO2	Analyze network performance metrics and optimize network configurations.	An	20%
CO3	Develop solutions for network routing algorithms and traffic management strategies.	Ap	30%
CO4	Manage network security protocols and evaluate their effectiveness in protecting network resources.	An	20%
CO5	Collaborate to design and deploy network infrastructures and services	C	Internal Assessment

UNIT I - INTERNET AND DATA COMMUNICATIONS	**(9)**
Internet – Network Edge – Network of Networks – Data communication Components – Data representation and Data flow –Networks – Protocols and Standards – OSI model – TCP/IP protocol suite – Physical Layer: Multiplexing – Transmission Media.	
UNIT II - DATA LINK LAYER	**(9)**
Framing – Error Control: Introduction – Block coding – Linear block codes – Cyclic codes – Checksum – Media Access Control: Random Access – CSMA/CD, CDMA/CA – Controlled Access – Wired LANs – Wireless LANs.	
UNIT III - NETWORK LAYER	**(9)**
IPV4 – IPV6 – ICMP – Transition from IPV4 to IPV6 – Routing Algorithm: Distance-Vector Routing, Link-State Routing, Path-Vector Routing – Unicast Routing protocols – Multicast Routing protocols.	
UNIT IV - TRANSPORT LAYER	**(9)**
Process to Process Communication – User Datagram Protocol – Transmission Control Protocol – SCTP – Congestion Control – Quality of Service.	
UNIT V - APPLICATION LAYER	**(9)**
Domain Name System – Standard Application: WWW and HTTP, FTP, Electronic Mail, TELNET – Firewalls – Network Management System – SNMP.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOK:

1. Behrouz A. Forouzan, "Data communication and Networking with TCP/IP Protocol Suite", 6th Edition, McGraw–Hill, 2022.

REFERENCES:

1. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2017.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson Education, 2020.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3											3	
3			3										3	
4		3	3							3				3
5					3			3				3		3
CO (W.A)	**3**	**3**	**3**		3			**3**		**3**		**3**		**3**

22AIC13 - DEEP LEARNING
(Common to 22CSX01,22ITX01,22CIX13)

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To understand and apply deep learning techniques to support real-time applications.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of neural networks and deep learning.	Ap	20%
CO2	Categorize the types of autoencoders in frameworks.	An	20%
CO3	Demonstrate the hardware support and frameworks (Keras - PyTorch) in Boltzmann machines model.	Ap	20%
CO4	Apply the concepts of CNN and RNN.	An	40%
CO5	Build the Recurrent Neural Network to model the sequence data.	C	Internal Assessment

UNIT I –NEURAL NETWORKS	**(9)**
Introduction – Basic Architecture of Neural Networks – Training Neural Network with Backpropagation – Practical Issues in Neural Network Training - Power of Function Composition – Common Neural Architectures – Neural Architectures : Binary Classification Models – Multiclass Models.Introduction to Deep Learning	
UNIT II –AUTOENCODER AND FRAMEWORKS	**(9)**
Introduction to Autoencoder – Features of Autoencoder - Types of Auto Encoder: Vanilla Autoencoder – Multilayer Autoencoder – Stacked Autoencoder – Deep Autoencoder – Denoising Autoencoder - Convolutional Autoencoder – Regularization in Autoencoder – Open Source Frameworks: SciPy – TensorFlow – Keras - PyTorch	
UNIT III – BOLTZMANN MACHINES AND HARDWARE SUPPORT	**(9)**
Boltzmann Machine: Relation to Hopfield Networks. RBM Architecture: Energy Based Model – Gibbs Distribution – Gibbs Sampler – Contrastive Divergence – Example – Types of RBM – Hardware support for Deep Learning.	
UNIT IV – CONVOLUTION NEURAL NETWORKS	**(9)**
Convolution Network – Components of CNN Architecture - Rectified Linear Unit(ReLU)Layer-Exponential Linear Unit (ELU or SELU) - Unique Propertied of CNN - Architectures of CNN – Application of CNN – Case studies: Image Classification using CNN - Visual Speech Recognition using 3D-CNN	

UNIT V – RECURRENT NEURAL NETWORKS	(9)
RNN versus CNN – Feedforward Neural Network versus RNN. - Simple Recurrent Neural Network : training an RNN – Backpropagation Through time (BPTT) – RNN Topology – Challenges with Vanishing Gradients – Bidirectional and Stateful RNNs – Long Short term memory(LSTM) – LSTM Implementation – Gated Recurrent Unit (GRU) – Deep Recurrent Neural Network.- Case studies: Stock Market Prediction Using RNN – Next Word Prediction Using RNN-LSTM.- Tamil Handwritten Character Optical Recognition Using CRNN	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Aggarwal, Charu C, "Neural Networks and Deep learning", 2ndEdition, Springer Cham, 2023.
2. Lovelyn, S., Rose, L. Ashok kumar, D. KarthikaRenuka, Deep Learning using Python, Wiley India Pvt. Ltd., First Edition, 2019.

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courvill, "Deep Learning", I st Edition, MIT Press, USA, 2018.
2. Josh Patterson and Adam Gibson,"Deep Learning–A Practitioner"s Approach",1st Edition,O"ReillySeries,August2017.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3			3									3
3	3		3		3									
4	3												3	
5					3				3	3				
CO (W.A)	3	3	3		3				3	3			3	3

22AIC14 – INTERNET OF THINGS AND ITS APPLICATIONS

(Common to 22CIC05, 22ITC16,22CSC17)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To provide an understanding of the technologies and the standards relating to the Internet of Things. • To review about IoT protocols and arduino processor with underlying technologies, limitations, and challenges.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify various characteristics and deployment levels of IoT.	Ap	40%
CO2	Analyze the concepts of M2M and IoT architecture.	An	20%
CO3	Implement Various IoT communication protocols like MQTT,CoAP, and HTTP in developing IoT applications.	Ap	20%
CO4	Analyze the functioning ofarduinoboards and various communications technologies to use with it.	An	20%
CO5	Perform in a team to build automation, agriculture and various real time applications using arduino.	Ap	Internal Assessment

UNIT I - INTRODUCTION TO INTERNET OF THINGS	**(9)**
Characteristics of IoT - Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems - Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates - Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators.	
UNIT II - M2M AND IOT ARCHITECTURE	**(9)**
Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways - Local and Wide Area Networking - Data management, Everything as a Service, M2M and IoT Analytics - Knowledge Management - IoT Reference Model.	
UNIT III - IOT PROTOCOLS	**(9)**
PHY/MAC Layer: 3GPP MTC, IEEE 802.15 - WirelessHART- Z-Wave, BLE- Zigbee - DASH7 - Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP- DCCP- Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT.	
UNIT IV - PROGRAMMING USING ARDUINO	**(9)**
Introduction to Arduino processor- General Block diagram- Working of Analog and Digital I/O pins- Serial (UART), I2C Communications and SPI communication - Arduino Boards: Mega, Due, Zero and 101 - Prototyping basics - Technical description - Setting Up Arduino IDE- Introduction to Arduino programming - Case Studies.	
UNIT V - APPLICATIONS OF IOT	**(9)**
Various Real time applications of IoT- Home Automation - Smart Parking - Environment: Weather monitoring system - Agriculture: Smart irrigation – Domain Specific applications - Case Studies.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Internet of Things, RMD SundaramShriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons, Second Edition, 2019.
2. ArshdeepBahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.
3. Veneri,Giacomo and Antonio capasso "Hands on Industrial Internet of things:create a powerful industrial IoT infrastructure using Industry 4.0, 1st edition, Packet Publishing,Ltd,2018.

REFERENCES:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3			3										3	
4					3									3
5									1		1	1		
CO (W.A)	3		3		3				1		1	1	3	3

22AIP09 - DEEP LEARNING LABORATORY

	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• To build strong practical applications using deep learning, such as image classification, natural language processing, and reinforcement learning tasks.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the MNIST dataset and its significance in the field of deep learning.	Ap
CO2	Make use of autoencoders for dimensionality reductions.	An
CO3	Demonstrate the concepts Boltzmann machines to solve real world problems.	An
CO4	Exemplify the concepts of CNN models and apply it for solving computer vision related problems.	An
CO5	Apply the concepts of RNN models for solving sequential modeling problems.	An

LIST OF EXPERIMENTS:

1. Create a multi-layer neural network and apply it to MNIST dataset.
2. Develop an application for outlier detection using Autoencoder.
3. Perform hyper parameter tuning and regularization to improve the performance of a classifier.
4. Implement a movie recommender system using RBM.
5. Solving XOR problem using Multilayer perceptron
6. Implement Speech Recognition using NLP
7. Implement Recurrent neural networks to generate new text.
8. Develop a hand written character recognition application using CNN.
9. Perform Sentiment Analysis in network graph using RNN
10. Implement Convolutional neural networks and use them to classify images

HARDWARE/SOFTWARE REQUIREMENTS

1. Understanding on Working of Colab and Transfer Learning Networks
2. High end GPU Systems (Huge Computation)

Mapping of COs with POs / PSOs														
COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2	3	3											3	
3		3	3											3
4	3			3									3	
5		3					3							
CO (W.A)	**3**	**3**	**3**	**3**			**3**						**3**	**3**

22AIP10-INTERNET OF THINGS AND ITS APPLICATIONSLABORATORY *(Common to 22CIP04, 22ITP09,22CSP11)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PRE-REQUISITE : NIL

Course Objective:	• To equip students with comprehensive knowledge and hands on experience in designing and developing IoT systems and applications.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the knowledge of controlling sensors using arduino.	Ap
CO2	Analyze the given Aduino program to build practical IoT solutions.	An
CO3	Apply arduino programming techniques to use various sesnors and actuators.	Ap
CO4	DesignIoT based system for given applicationand specifications.	An
CO5	Implement a mini-project to demonstrate the given problem using suitable sensors with Arduino development board.	C

LIST OF EXPERIMENTS :

1. Implement a program to Blink LED using Arduino.
2. Implement a program to control intensity light using Arduino.
3. Implement a program for LCD Display using Arduino.
4. Implement a program for Buzzer Indication using Arduino.
5. Implement a program for LDR using Arduino.
6. Implement a program for LM35 Sensor using Arduino.
7. Implement a program for Key Input with LED using Arduino.
8. Implement a program for Servo Motor Control using Arduino.
9. Implement a program for blinking LED using NODEMCU with Blynk.
10. Implement a program for Sensor value logging in Cloud.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2			2	2										
3														2
4					3									2
5		2			3				1				3	
CO (W.A)	**3**	**2**	**2**	**2**	**3**				**1**				**3**	**2**

22AIC15- FULL STACK DEVELOPMENT (Common to 22ITC17, 22CIC15,22CSC15)				
		L	T	P	C
		3	0	0	3
PRE-REQUISITE : NIL				
Course Objective:	To provide students with a solid foundation in the front-end and back-end web development fundamentals, integrate with databases and external services, and apply best practices in web development			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply fundamental concepts of MERN stack for Web application development.	Ap	20%
CO2	Analyze and develop web applications using bootstrap, node and Express JS focused on social and environmental issues	An	40%
CO3	Integrate front-end and back-end components effectively with databases and external services.	An	20%
CO4	Implement Full stack application through React framework.	An	20%
CO5	Demonstrate teamwork and problem-solving skills in project development.	C	Internal Assessment

UNIT I -BASICS OF MERN STACK	(9)
MERN Introduction-MERN Components - Need for MERN - Server-Less Hello World - Server Setup - nvm - Node.js npm.	

UNIT II –BOOTSTRAP AND NODE JS BASICS	(9)
Introduction to Bootstrap - Bootstrap Basics - Bootstrap Grids - Bootstrap Themes - Bootstrap CSS - Bootstrap JS. Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Node.js File system - Node Inspector - Node.js Event Emitter.	

UNIT III -NODE JS EXPRESS	(9)
Node.js Data Access - Express REST APIs - REST - Resource Based - HTTP Methods as Actions - JSON-Express - Routing - Handler Function – Middleware-Rest API.	

UNIT IV -MONGODB	(9)
MongoDB - MongoDB Basics - Documents -Collections - Query Language - Installation - The Mongo Shell - Schema Initialization - MongoDB Node.js Driver - Reading from MongoDB - Writing to MongoDB.	

UNIT V -REACT	(9)
React Introduction –State - Lifecycle methods - Hooks – useState, useEffect, useContext - Event handling - Forms – controlled components, submission, validation.	

TOTAL(L:45) = 45 PERIODS

TEXT BOOKS:

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.
2. Bradshaw, S., Brazil, E., & Chodorow, K. (2019). MongoDB: the definitive guide: powerful and scalable data storage. O'Reilly Media.
3. Mardan, A. (2014). Express. js Guide: The Comprehensive Book on Express. js. Azat Mardan.
4. Kogent Learning Solutions Inc. "HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and JQUERY", Wiley India Pvt. Limited, 2011.
5. Deitel and Deitel and Nieto, "Internet and World Wide Web – How to Program", Prentice Hall, 5th Edition, 2011.
6. Zammetti, F. (2020). Modern Full-Stack Development: Using TypeScript, React, Node. js, Webpack, and Docker. Apress.

REFERENCES:

1. Silvio Moreto, Matt Lambert, Benjamin Jakobus, Jason Marah, "Bootstrap 4–Responsive Web Design" Packt Publishing (6 July 2017)
2. Thomas Powell, "Web Design: The Complete Reference" ,Osborne / McGraw-Hill
3. https://www.w3schools.com/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				3								3	
2		3	3		3	3	3						3	
3			3		3									3
4				3	3								3	
5					3			3	3	3	3			3
CO (W.A)	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**		**3**	**3**

22AIC16 - BIG DATA ANALYTICS *(Common to 22CSX13,22ITX13,22CSX25,22CIX12)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• Acquire a deep understanding of big data and NoSQL. • Develop expertise in map reduce analytics using Hadoop and related tools • Explore the Hadoop related tools for Big Data Analytics.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Real-world datasets can be analyzed using various big data analytics tools and approaches.	An	20%
CO2	Analyze the effectiveness of numerous NoSQL databases under different loads.	An	20%
CO3	Analyze Hadoop's architecture, notably HDFS, and use this information to develop a distributed computing environment	An	20%
CO4	To address certain data processing issues, use customized mappers and reducers.	Ap	20%
CO5	Analyze data processing jobs and determine a suitable tool (Pig or Hive) based on the task criteria.	An	20%

UNIT I – UNDERSTANDING BIG DATA	**9**
Introduction To Big Data – Sudden Hype Around Big Data Analytics - Classification Of Analytics – Top Challenges Facing Big Data –Importance of Big Data Analytics - Challenges Posed By Big Data - Terminologies Used In Big Data Environments – Basically Available Soft State Eventual Consistency(BASE) – Few Top Analytics Tools	
UNIT II – NOSQL DATA MANAGEMENT	**9**
Introduction To Nosql – Types Of Nosql Database – Use Of Nosql In Industry – Nosql Vendors – SQL Vs Nosql – Newsql – Comparison Of SQL,Nosql And Newsql - Introduction To Cassandra - Features Of Cassandra – CQL Data Types – CQLSH – CRUD – Collections – Time To Live(TTL) – Alter Commands – Import And Export – Querying System Tables	
UNIT III – BASICS OF HADOOP	**9**
Hadoop – Features Of Hadoop - Versions Of Hadoop – Hadoop Distributions – Hadoop Vs SQL –Cloud Based Hadoop Solution - Hadoop Introduction – RDBMS Vs Hadoop - Hadoop Overview – Use Case Of Hadoop – Hadoop Distributions – Processing Data With Hadoop – Interacting With Hadoop Ecosystem	
UNIT IV – MAP REDUCE APPLICATIONS	**9**
Introduction To Map Reduce –The Configuration API – Setting Up The Development Environment – Writing A Unit Test With MRUnit – Running On A Cluster- – Map Reduce Workflows–How Map Reduce Works Anatomy Of Map Reduce Job Run – Failures – Shuffle And Sort – Task Execution– Map Reduce Types And Formats - Input And Output Format – Map Reduce Features	

UNIT V – HADOOP RELATED TOOLS	9
Pig – Installing And Running Pig – Comparison With Databases – Pig Latin – User Defined Functions – Data Processing Operators – Hive – HiveQL – Tables – Querying Data – User-Defined Functions –Data Analytics – Multimedia - Streaming of data - Case Study: Analyzing Social Media Data	
TOTAL (L:45):45 PERIODS	

TEXT BOOKS

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", 2nd Edition, Wiley, 2019. (Unit 1-4).
2. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, Inc., Fourth Edition, 2015. (Unit 5).

REFERENCES

1. EMC Education Services,"Data science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley and Sons, 2015.
2. Alan Gates, Programming Pig Dataflow Scripting with Hadoop, O'Reilly Media, Inc, 2011.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3		3								3	
2	3	3			3									3
3			3	3									3	
4		3		3									3	
5				3	3									3
CO (W.A)	3	3	3		3								3	3

22AIP11 - BIG DATA ANALYTICS LABORATORY				
	L	T	P	C
	0	0	4	2

PRE-REQUISITE : NIL

Course Objective:	• Gain experience in processing and transforming big data using tools like Apache Spark, MapReduce, and Apache Hive processes.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply techniques to store, retrieve, and manage large volumes of data.	Ap
CO2	Apply MongoDB to perform CRUD operations on a NoSQL database, effectively managing documents within collections.	Ap
CO3	Analyze MapReduce programs to process and real-world datasets, gaining practical experience with large-scale data processing	An
CO4	Analyze the roles of the Mapper, Reducer and the way they interact to process data in a distributed manner.	An
CO5	Create and configure components of the Hadoop ecosystem, such as HDFS, MapReduce, and various tools like Hive, Pig, and HBase, to build a complete big data processing environment	C

LIST OF EXPERIMENTS:

1. Install, configure and run Hadoop and HDFS.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB.
4. Implement a MapReduce program that processes a dataset.
5. Write a MapReduce program to count the occurrences of similar words across files.
6. Word count in Hadoop and Spark
7. Installation of Hive along with practice examples.
8. Installing and Configuring Apache PIG and HIVE
9. Installation of HBase, Installing thrift along with Practice examples

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3												3	
2	3	3		3										
3		3	3											3
4				3									3	
5				3					3				3	3
CO (W.A)	**3**	**3**	**3**						**3**				**3**	**3**

22AIX01 - KNOWLEDGE ENGINEERING *(Common to 22CSX02,22ITX02,22CCX21)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To implement various techniques for knowledge acquisition and representation.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply knowledge representation with production rules.	Ap	20%
CO2	Implement SLD derivations with horn clauses.	An	20%
CO3	Apply reasoning with inheritance network and default logic.	Ap	20%
CO4	Apply subjective probability with actions and planning.	Ap	20%
CO5	Perform object oriented representation using frames	Ap	20%

UNIT I – INTRODUCTION	(9)
Knowledge Representation and Reasoning – Syntax, Semantics, Pragmatics, Explicit and Implicit Belief - Expressing Knowledge – Resolution: Propositional Case-Handling Variables and Quantifiers-Dealing with Computational Intractability	
UNIT II – HORN CLAUSES	(9)
Horn Clauses-SLD Resolution-g SLD Derivations-Procedural Control of Reasoning - Rules in Production Systems: Production Rules- Conflict Resolution- Applications and Advantages	
UNIT III – OBJECT-ORIENTED REPRESENTATION	(9)
Objects and Frames-Frame Formalism-Frames to Plan a Trip-Beyond the Basics-Structured Descriptions-A Description Language-Meaning and Entailment-Computing Entailments-Taxonomies and Classification	
UNIT IV – INHERITANCE AND DEFAULTS	(9)
Inheritance Networks-Strategies for Defeasible Inheritance-A Formal Account of Inheritance Networks-Defaults: Introduction-Closed-World Reasoning-Circumscription-Default Logic-Autoepistemic Logic	
UNIT V – VAGUENESS, UNCERTAINTY AND DEGREES OF BELIEF	(9)
Noncategorical Reasoning-Objective Probability-Subjective Probability-Vagueness-Diagnosis-Explanation-Actions-Planning- Tradeoff between Expressiveness and Tractability.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, MorganKaufmann, 2004.
2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016.

REFERENCES:

1. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3											3	
2		3	3											
3	3												3	
4	3												3	
5	3													
CO (W.A)	3	3	3										3	

22AIX02 - RECOMMENDER SYSTEMS *(Common to 22CSX03,22ITX03,22CIX14)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To learn the significance of machine learning algorithms for Recommender systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts and applications of recommender systems.	Ap	20%
CO2	Analyze various collaborative filtering models in content based recommendation.	An	20%
CO3	Conduct investigation about the issues in recommender system and experimental setup.	Ap	20%
CO4	Apply Recommendation system properties in IPVT.	Ap	20%
CO5	Implement the knowledge sources and recommendation types.	Ap	20%

UNIT I – INTRODUCTION	**(9)**
Introduction - Recommender Systems Function - Data and Knowledge Sources - Recommendation Techniques - Application and Evaluation - Applications of recommendation systems - Issues with recommender system.	
UNIT II – CONTENT-BASED RECOMMENDATION	**(9)**
High level architecture of content-based systems - Advantages and drawbacks of content based filtering- Item Representation - Learning User Profiles and Filtering - Trends and Future Research - Neighborhood-based Recommendation - Components of Neighborhood Methods.	
UNIT III – COLLABORATIVE FILTERING	**(9)**
Preliminaries: Baseline predictors - The Netflix data - Implicit feedback - Matrix factorization models - Neighborhood models - Enriching neighborhood models - Between neighborhood and factorization - Constraint-based Recommenders.	
UNIT IV – CONTEXT-AWARE RECOMMENDER SYSTEMS	**(9)**
Context in Recommender Systems - Paradigms for Incorporating Context in Recommender Systems - Combining Multiple Approaches – Case Studies - Additional Issues in Context-Aware Recommender Systems- Evaluating Recommender Systems: Experimental Settings - Recommendation System Properties.	

UNIT V – IPVT, MATCHING RECOMMENDATION TECHNOLOGIES	(9)
IPTV Architecture - Recommender System Architecture- Recommender Algorithms- Recommender Services – System Evaluation - Knowledge Sources – Domain - Knowledge Sources - Mapping Domains to Technologies.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Francesco Ricci , Lior Rokach , Bracha Shapira , "Recommender Sytems Handbook", 1st ed, Springer (2011)
2. Charu C. Aggarwal, "Recommender Systems: The Textbook", First Ed., Springer, 2016.

REFERENCES:

1. Manouselis N., Drachsler H., Verbert K., Duval E., "Recommender Systems for Learning", Springer, 1st Edition, 2013.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich, "Recommender Systems: An Introduction", Cambridge University Press (2011), 1st ed.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2		3												
3	3			3										
4	3												3	
5	3	3												3
CO (W.A)	3	3		3									3	3

22AIX03 - SOFT COMPUTING
(Common to 22CSX04,22ITX04)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:

- To learn and understand soft computing concepts and Fuzzy inference systems.

	Course Outcomes The Student will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Make use of the soft computing concepts along with its architecture	Ap	20%
CO2	Apply the techniques of back propagation network along with its parameter tuning.	Ap	20%
CO3	Interpret the fuzzy logics to solve the neural network problems	Ap	20%
CO4	Utilize the genetic algorithm techniques to obtain the optimized solution	Ap	20%
CO5	Illustrate the working of hybrid soft computing and to solve real world problems	An	20%

UNIT I –INTRODUCTION	**9**
Introduction to Soft computing-Soft Computing Constituents-From Conventional AI to Computational Intelligence- Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies – applications.	
UNIT II –NEURAL AND BACKPROPAGATION NETWORK	**9**
Back propagation Neural Networks -single layer artificial neural network- Back propagation learning model for Multilayer perceptron-Back propagation learning- Neural Networks- Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network -Applications-Effect of tuning parameters of Backpropagation neural network- Unsupervised Learning Neural Networks.	
UNIT III-FUZZY LOGIC	**9**
Fuzzy set theory- Introduction to Fuzzy Logic- Fuzzy Sets - Classical Relations and Fuzzy Relations- Fuzzyversus Crisp-crisp set: operations on Crisp sets-Properties of Crisp sets- partition and covering-membership function-basic fuzzy set operations-properties of fuzzy sets-Crisp relations: Cartesian product-other crisp relations.	
UNIT IV – GENETIC ALGORITHMS	**9**
History –Basic concepts-Creation of offspring-Working principle- Encoding-Fitness Function- Population initialization and selection methods - Evaluation function - Operators - Cross Over - Inversion and Deletion - Mutation Operator- Generational cycle-Bit-wise Operators -Convergence of Genetic Algorithm.	

UNIT V – HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS	9
Hybrid systems-Neural networks ,fuzzy logic and genetic algorithms hybrids-GA Based Weight Determination – Fuzzy backpropagation networks-Simplified fuzzy ARTMAP-Fuzzy associative memories-Soft computing tools-Fuzzy constrains-Fuzzy logic controller.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. S. Rajasekharan& G. A. VijayalakshmiPai, "Neural Networks, Fuzzy Systems and Evolutionary algorithms: synthesis and applications", 2nd Edition, Prentice Hall of India, New Delhi, 2018.
2. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
3. 2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2019.

REFERENCES

1. George J. Klir, Ute St. Clair, Bo Yuan, "Fuzzy Set Theory: Foundations and Applications" Prentice Hall, 1997.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3		3								3	
2	3	3			3									3
3			3	3									3	
4		3		3									3	
5				3	3									3
CO (W.A)	3	3	3		3								3	3

22AIX04 - OPTIMIZATION TECHNIQUES *(Common to 22CIX15,22CCX22)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To apply transportation algorithms in engineering problems and to handle the problems of Project Management using CPM and PERT

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Able to apply and solve linear programming problems	Ap	20%
CO2	Evaluate transportation algorithms in engineering problems.	An	20%
CO3	Analyze game theory concepts in practical situations.	An	20%
CO4	Understand the problems of Project Management using CPM and PERT	U	20%
CO5	Analyze various types of Non-linear Programming problems	An	20%

UNIT I – LINEAR PROGRAMMING	**9**
ntroduction – Formulation of Linear Programming Problem – Advantages of Linear Programming methods – Limitations of Linear Programming models – Standard form of LPP – Graphical Method – Simplex Method – Artificial variable techniques – Big M Method. Understanding convex sets, functions, and optimization problems- Non-Convex Optimization: Techniques for dealing with local minima, saddle points, and global optimization in non-convex landscapes.	
UNIT II – TRANSPORTATION PROBLEM	**9**
Mathematical Formulation of Transportation Problem – Initial basic feasible solution – North West Corner Method – Least Cost Method – Vogel's approximation method – Optimal solution – MODI Method – Degeneracy – Unbalanced transportation problem – Maximization transportation problem	
UNIT III – ASSIGNMENT PROBLEM AND THEORY OF GAMES	**9**
Assignment Problem: Mathematical model of Assignment problem – Hungarian Method – Unbalanced assignment problem. Theory of Games: Two-person zero-sum game – Pure strategies - Game with mixed strategies – Rules of Dominance – Solution methods: Algebraic method – Matrix method – Graphical method	
UNIT IV – PROJECT MANAGEMENT	**9**
Basic Concept of network Scheduling – Construction of network diagram – Critical path method – Programme evaluation and review technique – Project crashing – Time-cost trade-off procedure.	

UNIT V – NON-LINEAR PROGRAMMING	9
Formulation of non–linear programming problem – Constrained optimization with equality constraints – Kuhn-Tucker conditions – Constrained optimization with inequality constraints.	
TOTAL= 45 PERIODS	

TEXT BOOKS

1. Kanti Swarup, Gupta P.K. & Man Mohan, "Operation Research", 14th Edition, Sultan Chand & Sons, New Delhi, 2014.

REFERENCES

1. Sharma J.K., "Operations Research – Theory and Applications", 4th Edition, Macmillan Publishers India Ltd., New Delhi, 2009.
2. 2. Gupta P.K. & Hira D.S., "Operations Research: An Introduction", 6th Edition, S.Chand and Co. Ltd, New Delhi, 2008.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3				2								3	
2			3										3	
3					3								3	
4	3		3										3	
5	3		3										3	
CO (W.A)	3		3		3								3	

22AIX05 - COMPUTER VISION
(Common to 22CSX05,22ITX05,22CIX16,22CCX23)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To impart knowledge and understanding about the application of algorithms and techniques used to interpret and analyze visual data from the world.

	Course Outcomes The Student will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Implement image processing techniques for feature extraction and enhancement in computer vision applications.	Ap	30%
CO2	Analyze object detection and recognition systems using various techniques.	An	20%
CO3	Make use of the optimization technique for image alignment and geometric transformations.	Ap	30%
CO4	Apply deep learning models to synthesize images for advanced photography techniques.	An	20%
CO5	Build an innovative solution for immersive rendering techniques in virtual reality.	C	Internal Assessment

UNIT I –INTRODUCTION	**9**
Introduction-Image Formation: Geometric primitives and transformations-Photometric image formation-The digital camera-Image processing: Point operators-Linear filtering -Fourier transforms -Geometric transformations.	
UNIT II – RECOGNITION &FEATURE DETECTION AND MATCHING	**9**
Instance Recognition-Image Classification-Object detection-Semantic segmentation-Points and patches-Edges and contours-Contour tracking-Lines and vanishing points-Segmentation.	
UNIT III – IMAGE ALIGNMENT AND STITCHING & STRUCTURE FROM MOTION	**9**
Pairwise alignment-Image stitching-Geometric Intrinsic calibration-pose estimation-Two-frame structure from motion-Multi-frame structure from motion-Simultaneous localization and mapping(SLAM):"Enhancing Autonomous Navigation: A Case Study on SLAM Implementation"	
UNIT IV – COMPUTATIONAL PHOTOGRAPHY & DEPTH ESTIMATION	**9**
Photometric calibration-High dynamic range imaging-Super-resolution:"Advancing Image Clarity: A Case Study on Super-Resolution Techniques"-denoising-blur removal-Image matting and compositing-Epipolar geometry-Sparse correspondence-Dense correspondence-Local methods-Global optimization-Multi-view stereo	

UNIT V – 3D RECONSTRUCTION & IMAGE-BASED RENDERING	9

Shape from X-3D Scanning-Surface representation-Point-based representation-Volumetric representation-GAN:Generative Adversarial Networks-Vision Transformation-Light fields and Lumigraphs:"Case study on Immersive Rendering in VR"-Video-based rendering:"Case study on Dynamic Scene Reconstruction Techniques".

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. E. R. Davies,"Computer Vision: Principles, Algorithms, Applications, Learning",Cambridge University Press,recent edition,2022.

REFERENCES

1. Simon J.D. Prince,"Computer Vision: Models, Learning, and Inference" ,2nd edition, Cambridge University Press.2012.
2. David A. Forsyth and Jean Ponce,"Computer Vision: A Modern Approach" , published by Prentice Hall,recent edition 2022.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3												
2					3									
3			3											
4				3										
5							3	3	3		3			3
CO (W.A)		3	3	3	3		3	3	3		3			3

22AIX06 - ETHICS OF AI
(Common to 22CSX06,22ITX06,22CIX17)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To Learn about the Ethical initiatives in the field of artificial intelligence and reach AI standards and Regulations

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply about morality and ethics in AI	Ap	20%
CO2	Evaluate the knowledge of real time application ethics, issues and its challenges.	Ap	20%
CO3	Analysis the ethical harms and ethical initiatives in AI	An	20%
CO4	Apply AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems	Ap	20%
CO5	Apply the societal issues in AI with National and International Strategies on AI	Ap	20%

UNIT I –INTRODUCTION	**9**
Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust.	
UNIT II –ETHICAL INITIATIVES IN AI	**9**
International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.	
UNIT III – AI STANDARDS AND REGULATION	**9**
Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems	
UNIT IV – ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS	**9**
Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility Roboethics Taxonomy.	

UNIT V – AI AND ETHICS- CHALLENGES AND OPPORTUNITIES	9
Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI. Chat gpt basics, prompt engineering.	
TOTAL= 45 PERIODS	

TEXT BOOKS

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

REFERENCES

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1								3						3
2	2						2	3						3
3							2	3						3
4	3					2		3						3
5								3						3
CO (W.A)	2.5					2	2	3						3

22AIX07 - BUSINESS INTELLIGENCE *(Common to 22CSX07,22ITX07,22CCX28)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To understand the effect of Business Intelligence (BI) on an organization

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Use of the knowledge of Business Intelligence in solving problems.	U	20%
CO2	Apply the concepts of Data visualization and Visual analytics.	Ap	20%
CO3	Able to apply data mining tools.	Ap	20%
CO4	Demonstrate the text analytics, text mining and sentiment analysis.	An	20%
CO5	Develop web mining.	C	20%

UNIT I –BUSINESS INTELLIGENCE – INTRODUCTION	**9**
A Frame work for Business Intelligence (BI)- The Architecture of BI - Benefits of business intelligence- Business intelligence VS competitive intelligence and knowledge management. Data Warehousing- Characteristics of Data Warehousing- Data Marts- Data warehousing process- Data warehousing Architectures – Data Integration and the Extraction, Transformation and Load (ETL) Process OLAP Versus OLTP- Data warehousing implementation issues – Real time data warehousing.	
UNIT II – BUSINESS REPORTING, VISUAL ANALYTICS AND BUSINESS PERFORMANCE MANAGEMENT	**9**
Data and Information Visualization – Different types of Charts and Graphs- Emergence of Data visualization and Visual analytics - Performance Dashboard - Balance Score Cards – Dashboards Versus Scorecards - Six Sigma as a performance measurement system.	
UNIT III – DATA MINING – SUPERVISED LEARNING, AND UNSUPERVISED LEARNING	**9**
Data mining concepts and applications – Data mining process – Data mining methods – Classification techniques – Decision trees, Case studies. Cluster Analysis – Partition and Hierarchical methods, Association rule mining –Data mining software Tools - Case studies.	
UNIT IV – TEXT ANALYTICS, TEXT MINING AND SENTIMENT ANALYSIS	**9**
Text analytics and Text mining concepts and definition – Text Mining Applications - Text mining process – Text mining tools – Sentiment analysis overview – Sentiment analysis applications – Sentiment analysis process, Sentiment Analysis and Speech Analytics.	

UNIT V – WEB MINING	9
Web mining overview – Web content and Web structure mining – Search Engines - Search Engine Optimization – Web usage mining – Web analytics maturity model and web analytics tools – Social analytics and social network analysis- Social Media Definitions and Concepts- Social Media Analytics.	
TOTAL = 45 PERIODS	

TEXT BOOKS

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics, Pearson 10th edition, 2018

REFERENCES

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson, 2017
2. David Loshin Morgan, Kaufman, —Business Intelligence: The Savvy Manager"s Guidell, Second Edition, 2012.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	2				3								3	
3			2		3								3	
4			3		2								3	
5			3		2								3	
CO (W.A)	3		3		3								3	

22AIX08 - ROBOTICS PROCESS AUTOMATION *(Common to 22CSX08,22ITX08,22CIX18,22CCX38)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To implement the fundamental concepts of AI in robotics and the major paradigms for achieving it.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret features of an Industrial robot with end effectors	AP	20%
CO2	Identify the characteristics of Autonomy robot and use Hierarchical Paradigm for organizing intelligence in Robots.	AP	20%
CO3	Apply reactive paradigm for AI Robots	AP	20%
CO4	The students able to know the various potential areas of automation and material handling	U	20%
CO5	Design sensor and vision system for robots	An	20%

UNIT I – FUNDAMENTALS OF ROBOTICS	**(9)**
Automation and Robotics, A brief history of Robotics, The robotics market and the future prospects, Robot anatomy, Robot drive systems, Precision of Movement, Robotic sensors, Robot programming and work cell control, Robot applications	
UNIT II – ROBOT TECHNOLOGY	**(9)**
Basic control systems concepts and models, Controllers, Control system analysis, Robot sensors and actuators, Velocity sensors, Actuators, Power transmissions systems, Modeling and control of a single joint robot, Robot motion analysis and control.	
UNIT III –ROBOT END EFFECTORS AND SENSORS	**(9)**
Types of end effectors, Mechanical grippers, other types of gripper, Tools as end effectors, The robot/end effectors interface, Considerations in gripper selection and design, Transducers and sensors, Sensors in robotics, Tactile sensors, Proximity and range sensors	
UNIT IV –MACHINE VISION AND ARTIFICIAL INTELLIGENCE	**(9)**
Introduction to machine vision, The sensing and digitizing functions in machine vision, Image processing analysis, Training the vision system, Robotic applications, Introduction to AI, Goals of AI research, AI techniques, AI and Robotics	

UNIT V- ROBOT APPLICATIONS IN MANUFACTURING	(9)
Material transfer and machine loading/unloading, Processing operations – spot welding, continuous arc welding, spray coating, other processing operations using robots, Assembly and Robotic assembly automation, Designing for robotic assembly, Inspection automation	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. M.P.Groover et al, McGrawhill "Industrial robotic technology-programming and application" 2008

REFERENCES:

1. Richared D.Klafter,Thomas Achmielewski and Mickael Negin," Robotic Engineering an Integrated approach"prentice hall India- newdelhi-2001
2. S.R. Deb, Dr Sankha Deb "Robotics technology and flexible automation" Tata McGraw-Hill Education ,2009
3. https://www.robots.com/applications

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1														
2		3												
3	3					3								3
4					3						3			
5			3						3				3	
CO (W.A)	3	3	3		3	3			3		3		3	3

22AIX11 - PATTERN RECOGNITION *(Common to 22CSX11,22ITX11,22CIX21,22CCX24)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PRE-REQUISITE : NIL				
Course Objective:	• To impart knowledge for solving real-world problems in fields such as computer vision, speech recognition, and bioinformatics. • To enrich the proficiency of the students in evaluating and selecting appropriate pattern recognition models based on performance metrics and domain-specific requirements.			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply advanced probabilistic models and decision theory concepts to optimize inference.	Ap	30%
CO2	Apply supervised learning algorithms for solving problems.	An	20%
CO3	Interpret unsupervised learning techniques for clustering data.	Ap	30%
CO4	Apply graphical models and sequential data techniques to solve complex problems such as plant disease diagnosis.	Ap	20%
CO5	Evaluate proficiency in designing, training, and optimizing neural networks	E	Internal Assessment

UNIT I – INTRODUCTION	**9**
Probability Theory:Probability densities-Bayesian probabilities-The Gaussian distribution-Bayesian curve fitting-Model Selection-The Curse of Dimensionality-Decision Theory: Minimizing the misclassification rate-Minimizing the expected loss-The reject option-Inference and decision-Loss functions for regression-Information Theory.	
UNIT II –PROBABILITY DISTRIBUTION AND LINEAR MODELS FOR REGRESSION	**9**
Binary Variables-Multinomial Variables-The Gaussian Distribution-Linear Basis Function Models-Bayesian Linear Regression:Parameter distribution-Predictive distribution-Bayesian Model Comparison-The Evidence Approximation:Evaluation of the evidence function-Maximizing the evidence function-Effective number of parameters-Limitations of Fixed Basis Functions.	
UNIT III –LINEAR MODELS FOR CLASSIFICATION	**9**
Discriminant Functions-Probabilistic Generative Models-Probabilistic Discriminative Models:Logistic regression-Multiclass logistic regression-Probit regression-The Laplace Approximation-Bayesian Logistic Regression:Laplace approximation-Predictive distribution	

UNIT IV –NEURAL NETWORKS AND KERNEL METHODS	9
Feed-forward Network Functions-Network Training-Error Backpropagation-The Hessian Matrix-Regularization in Neural Networks-Mixture Density Networks-Bayesian Neural Networks-Constructing Kernels-Radial Basis Function Networks:Nadaraya-Watson model-Gaussian Processes	
UNIT V –GRAPHICAL MODELS AND SEQUENTIAL DATA	**9**
Bayesian Networks-Conditional Independence-Markov Random Fields-Inference in Graphical Models-Markov Models-Hidden Markov Models-Case study on Plant Disease Diagnosis in Random Forest - Conditional Mixture Models.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. Christopher M. Bishop "Pattern Recognition and Machine Learning", Springer, Second edition 2021.
2. David G.Stork,PeterE.Hart,and Richard O.Duda"PatternClassification",published by Wiley in recent edition in 2022.

REFERENCES

1.Sergios Theodoridis and Konstantinos Koutroumbas"Machine Learning: A Bayesian and Optimization Perspective"AcademicPress,recent edition 2022.

2.David J.C. MacKay"Information Theory, Inference, and Learning Algorithms" Cambridge University Press, 2003.

3.David Barber "Bayesian Reasoning and Machine Learning",Cambridge University Press, 2012.

4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville"DeepLearning",MIT Press, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1					3									
2		3											3	
3				3									2	
4					3									2
5							2	3	3	2	2			3
CO (W.A)		3		3	3		2	3	3	2	2		2.5	2.5

22AIX12 - TEXT AND SPEECH ANALYTICS
(Common to 22CSX12,22ITX12,22CIX22)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To understand natural language processing basics. • To apply classification algorithms to text documents, question-answering and dialogue systems to develop a speech recognition system & speech synthesizer.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Examine the foundations of natural language processing and speech analysis	An	20%
CO2	Apply classification algorithms to text documents	Ap	20%
CO3	Analysis question-answering and dialogue systems	An	20%
CO4	Apply deep learning models for building speech recognition and text-to-speech systems	Ap	20%
CO5	Evaluate coreference and coherence for text processing	An	20%

UNIT I –INTRODUCTION	**(9)**
Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stopwords – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF mode	
UNIT II –TEXT CLASSIFICATION	**(9)**
Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Deep Learning models for text classification– Recurrent Neural Networks (RNN) – Transformers –Text summarization and Topic Models	
UNIT III – QUESTION ANSWERING AND DIALOGUE SYSTEMS	**(9)**
Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems –- evaluating dialogue systems	
UNIT IV – TEXT-TO-SPEECH SYNTHESIS	**(9)**
Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility Roboethics Taxonomy.	

UNIT V – AUTOMATIC SPEECH RECOGNITION	(9)
Named Entity Recognition (NER)-Coreference resolution-Text coherence and cohesion-Advanced sentiment analysis-Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems	
TOTAL= 45 PERIODS	

TEXT BOOKS

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.

REFERENCES

1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3											3	
2	3												3	
3		3												3
4	3				3								3	
5		3			3									3
CO (W.A)	3	3			3								3	3

22AIX13 - TIME SERIES ANALYSIS AND FORECASTING
(Common to 22CIX23)

	L	T	P	C
	3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• Understanding the fundamental concepts of time series analysis and forecasting • Developing forecasting models and evaluating their performance.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Ability to identify time series data patterns and trends	AP	20%
CO2	Make use of various smoothing methods for time series data analysis	AP	20%
CO3	Skill in applying appropriate time series models	AP	20%
CO4	Understand and apply frequency domain time series analysis	U	20%
CO5	Make use of variance transformation techniques for time series analysis and forecasting	AP	20%

UNIT I – EXPLORATORY ANALYSIS	**(9)**
Graphical displays–Numerical description of Time Series Data–Use of Data transformations and Adjustments–General Approach to Time Series Modeling and Forecasting – Evaluating and Monitoring Forecasting Model Performance-Statistical Inference in Linear regression-Model Adequacy Checking	
UNIT II – SMOOTHING METHODS:	**(9)**
First-Order Exponential Smoothing–Modeling Time Series data–Second-Order Exponential Smoothing–Higher-Order Exponential Smoothing–Forecasting–Exponential Smoothing for Seasonal Data–Exponential Smoothing of Bio surveillance data – Exponential Smoothers and ARIMA models	
UNIT III – ARIMA MODELS	**(9)**
Linear Models for Stationary Time Series–Finite Order Moving Average Processes–Finite Order Auto regressive Processes–Mixed Autoregressive-Moving Average Processes –Non stationary Processes – Time Series Model building – Forecasting ARIMA Processes – Seasonal Processes – ARIMA Modeling of Bio surveillance data	
UNIT IV – TRANSFER FUNCTIONS AND INTERVENTION MODELS	**(9)**
Transfer Function Models – Transfer Function – Noise Models – Cross – Correlation Function– Model Specification – Forecasting with Transfer Function-Noise Models–Intervention Analysis	

UNIT V- OTHER FORECASTING METHODS	(9)
Multivariate Time Series Models and Forecasting–State Space Models–Archand Garch models–Direct Forecasting of Percentiles–Combining Forecasts to improve Prediction Performance–Aggregation and Disaggregation of Forecasts–Neural Networks and Forecasting–Spectral Analysis–Bayesian Methods in Forecasting	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:

1. Douglas C. Montgomery, Cheryl L. Jennings, Murat Kulahci, "Introduction to Time Series Analysis and Forecasting", 2nd Edition, Wiley, 2016.

REFERENCES:

1. George E.P.Box, Gwilym M.Jenkins, Gregory C. Reinsel, Greta M. Ljung, "Time Series Analysis: Forecasting and Control", 5thEdition, Wiley, 2016.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3	3											3
2					3									
3	3					3							3	
4													3	
5				3								3		
CO (W.A)	3	3	3	3	3	3						3	3	3

22AIX14 - HEALTH CARE ANALYTICS
(Common to 22CSX14,22ITX14,22CIX24,22CCX26)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:

- To impart knowledge on health care analytics using machine learning concepts.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply machine learning and deep learning in health care analysis.	Ap	40%
CO2	Identify the appropriate selection of data using feature selection to train a model.	Ap	20%
CO3	Develop a database for clinical support and retrieving data using NoSQL database	An	20%
CO4	Visualize preprocessing data using smart sensors.	An	20%
CO5	Prepare a mini project to predict healthcare and data analysis.	C	Internal Assessment

UNIT I – INTRODUCTION TO HEALTHCARE ANALYSIS	**(9)**
Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, weighted sum approach.	
UNIT II – ANALYTICS ON MACHINE LEARNING	**(9)**
Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves – Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit – Learn : Preprocessing , Feature Selection.	
UNIT III – HEALTH CARE MANAGEMENT	**(9)**
IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.	
UNIT IV – HEALTHCARE AND DEEP LEARNING	**(9)**
Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.	

UNIT V – CASE STUDIES	(9)
Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.

REFERENCES:

1. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
2. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition,Wiley, 2016.
3. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3			3									3
3	3		3											
4		3	3		3								3	
5	3				3				3	3				
CO (W.A)	3	3	3		3					3			3	3

22AIX15 - PREDICTIVE ANALYTICS
(Common to 22CSX15,22ITX15,22CIX25)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:

- Proficient in different predictive modeling approaches, such as regression analysis, classification, and clustering.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze the performance of predictive analytics using appropriate metrics and understand the implications of these metrics.	An	20%
CO2	Apply data preparation and rules in predictive analytics to interpret the results in meaningful ways.	Ap	20%
CO3	Analyze and interpret the outputs of predictive models to generate actionable insights	An	20%
CO4	Analyze different predictive models to determine the most suitable model for a given problem based on performance metrics	An	20%
CO5	Apply techniques to collect text data from various sources of text mining	Ap	20%

UNIT I –INTRODUCTION TO PREDICTIVE ANALYTICS **(9)**

Overview of Predictive Analytics-Setting Up the Problem-Data Understanding-Single Variable Summaries - Data Visualization in One Dimension, Two or Higher Dimensions-The Value of Statistical Significance-Pulling it all together into a Data Audit

UNIT II –DATA PREPARATION AND ASSOCIATION RULES **(9)**

Data Preparation-Variable Cleaning-Feature creation-Item sets and Association rules-Terminology-Parameter settings-How the data is organized-Measures of Interesting rules-Deploying Association rules-Problems with Association rules-Building Classification rules from Association rules

UNIT III – MODELING **(9)**

Descriptive Modeling-Data Preparation issues with Descriptive modeling-Model Selection-Principal Component analysis-Clustering algorithms-Interpreting Descriptive models-Standard cluster model interpretation

UNIT IV – PREDICTIVE MODELLING **(9)**

Decision Trees-Logistic Regression-Neural Network Model-K-Nearest Neighbors-Naive Bayes -Regression Models- Linear Regression-Building Neural Networks using XLMiner-Other Regression Algorithms

UNIT V – TEXT MINING	(9)
Motivation for Text Mining-A Predictive modeling approach to Text Mining-Structured vs. Unstructured data-Why Text mining is hard-Data Preparation steps-Text mining features-Modeling with Text mining features-Regular Expressions - Web mining - Text Mining vs. Web Mining - Case studies:-Survey Analysis	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS

1. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014.(Unit 1-5)
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012

REFERENCES

1. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014
3. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, Wiley, 2017.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3												
2		3	3											3
3		3	3	3									3	
4		3	3	3									3	
5	3								3					
CO (W.A)	3	3	3		3					3			3	3

22AIX16 - IMAGE AND VIDEO ANALYTICS *(Common to 22CSX16,22ITX16,22CIX26,22CCX27)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE : NIL

Course Objective:	• To provide a broad view on processing and analyzing images and videos.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the image processing techniques for image and video analysis.	Ap	20%
CO2	Use image pre-processing techniques for object detection.	Ap	20%
CO3	Apply the various levels of segmentation and interpret the results for object detection.	Ap	20%
CO4	Apply recognition and machine learning techniques.	Ap	20%
CO5	Make use of video analysis for real time case studies.	An	20%

UNIT I - INTRODUCTION	(9)
Computer Vision – Image representation and image analysis tasks - Image representations – Digitization- Digital image properties- color images- Linear integral transforms- Images as stochastic processes- Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.	
UNIT II - IMAGE PRE-PROCESSING	(9)
Pixel brightness transformations – Geometric transformations-Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-spectral images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.	
UNIT III - OBJECT DETECTION USING MACHINE LEARNING	(9)
Object detection– Object detection methods – Deep Learning framework for Object detection– Bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-Fast R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Single Shot MultiBox Detector(SSD)-Transfer Learning-Python Implementation.	

UNIT IV - FACE RECOGNITION AND GESTURE RECOGNITION	(9)
Face Recognition- Applications of Face Recognition-Process of Face Recognition-Deep Face solution by Face book- FaceNet for Face Recognition- Python Implementation using FaceNet-Python Solution for Gesture Recognition.	
UNIT V - VIDEO ANALYTICS	(9)
Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-ResNet architecture- ResNet and skip connections-Inception Network- GoogLENet architecture-Improvement in Inception v2-Video analytics-Python Solution using ResNet and Inception v3.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2013. (UNIT-I and II)
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

Mapping of COs with POs / PSOs

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3				3								3	
3	3												3	
4	3													3
5		3	3		3									3
CO (W.A)	3	3	3		3								3	3

22AIX17 - NATURAL LANGUAGE PROCESSING
(Common to 22CSX17,22ITX17,22CIX27)

L	T	P	C
3	0	0	3

PRE-REQUISITE : NIL

Course Objective:	• To learn and understand syntactic and semantic elements of NLP and knowledge representation and interface.

Course Outcomes		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Summarize the concepts in speech and language processing and utilize regular expressions and other statistical methods to create Language Models.	Ap	20%
CO2	Apply Vector Embedding to words and build Neural Language models.	Ap	20%
CO3	Solve sequence labeling problems (Named Entity Tagging and POS tagging) using RNN and LSTM.	An	20%
CO4	Apply the Machine translation model to dialogue systems.	Ap	20%
CO5	Illustrate the working of Automatic speech recognition and information retrieval.	Ap	20%

UNIT I –FUNDAMENTALS OF NATURAL LANGUAGE PROCESSING	**(9)**
Regular Expressions, Text normalization, Edit Distance-.N-gram language models:N-grams-Evaluating language models: training and test sets-perplexity-Sampling sentences from a language model-Generalization and Zeros-Smoothing-Native bayes,text classification and sentiment-Logistic regression	
UNIT II –VECTOR SEMANTICS AND NEURAL NETWORK MODELS	**(9)**
Lexical Semantics – Vector Semantics – Words and Vectors – Cosine for measuring similarity – TF-IDF: weighing terms in vectors – pointwise Mutual Information (PMI) – Applications of TF-IDF and PPMI – Visualizing embeddings-Neural Network Language Models – Units – XOR problem – Feed Forward Neural Networks – Training Neural Nets – Neural Language Models.	
UNIT III – SEQUENCE LABELING AND DEEP LEARNING ARCHITECTURES	**(9)**
English word classes –Part-of-Speech (PoS) Tagging – Named Entities and Named Entities Tagging – HMM PoS – Conditional Random Fields – Evaluation of Named Entity Recognition-RNN and LSTMs-.Transformers and large language models-Fine tuning and masked language models.	
UNIT IV – MACHINE TRANSLATION (MT) AND DIALOGUE SYSTEMS	**(9)**
Language divergences and Typology – Machine translation using Encoder-Decoder model –Encoder-Decoder– Beam search-Translating in low resource situations- MT evaluation – Bias and ethical issues-properties of human conversations-Frame based dialogue systems-Dialogue acts and dialogue state.	

UNIT V –AUTOMATIC SPEECH RECOGNITION AND INFORMATION RETRIEVAL	(9)
The Automatic Speech Recognition Task -Feature Extraction for ASR: Log Mel Spectrum -Speech Recognition Architecture-CTC and TTS -Information Retrieval -Information Retrieval with Dense Vector-Evaluating Retrieval-based Question Answering-Context free grammars and constituency parsing-Dependency parsing-Information extractions-Semantic role labeling.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS

1. Daniel Jurafsky and James H.Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition" (Prentice Hall Series in Artificial Intelligence), 2020
2. "Foundations of Statistical Natural Language Processing" by Christopher D. Manning and Hinrich Schuetze, MIT Press, 2018

REFERENCES

1. Jacob Eisenstein. "Natural Language Processing ", MIT Press, 2019
2. Samuel Burns "Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	
2	3	3			3									3
3	3		3											
4		3	3		3								3	3
5	3		3		3				3	3				
CO (W.A)	3	3	3		3					3			3	3

22AIX18 - AUGUMENTED REALITY AND VIRTUAL REALITY *(Common to 22CSX18,22ITX18,22CIX28)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE :NIL

Course Objective:	• To impart the knowledge of Exploring the design, development, and applications of augmented reality and virtual reality technologies.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of virtual reality and commercial VR technologies.	Ap	30%
CO2	Analyze the classic components of a VR system through hands-on experimentation and simulation.	An	20%
CO3	Make use of diverse modeling techniques with real-world sensor data.	Ap	30%
CO4	Evaluate the solution to enhance VR user experience and safety in diverse fields.	E	20%
CO5	Create VR applications by utilizing VR programming tools.	C	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
The three I's of virtual reality, commercial VR technology and the five classic components of a VR system, Augmented Reality and Tele presence.	
UNIT II -INPUT AND OUTPUT DEVICES	**(9)**
Input Devices : Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. Output Devices: Graphics displays, sound displays& haptic feedback.	
UNIT III –MODELING	**(9)**
Geometric modelling, kinematics modelling, physical modelling, behaviour modelling, model management and Modelling real-life from sensors.	
UNIT IV - HUMAN FACTORS	**(9)**
Methodology and terminology, user performance studies, VR health and safety issues. Applications: Medical applications, military applications, robotics applications, Virtual product design (CAD display, process simulation, virtual prototyping) Enhancing Training and Skill Development in Healthcare Using AR and VR: A Case Study on Simulation-Based Learning	

UNIT V -VR PROGRAMMING	(9)
VR Programming-I: Introducing Unity 3D, Project panel, Scene hierarchy, Simple game object, Scene editor: A case study on Developing and Evaluation of a Simple Game Object and Scene Editor for Indie Game Developers VR Programming-II: Middle VR, device management, graphics card limitation, 3D user interactions, deployment, VR software: A case study on the Impact of Unreal Engine in Architectural Visualization: A Case Study of VR Integration in Real Estate Marketing.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOK:

1. "Virtual Reality Technology", Gregory C. Burdea& Philippe Coiffet, John Wiley & Sons, Inc., Second Edition,2006

REFERENCES:

1. "Virtual Reality Technology" Grigore C. Burdea and Philippe Coiffet,recentedition,January 2022.
2. "Virtual Reality Technology and Applications" Harry F. Shneider ,FirstEdition,2018.
3. "Virtual Reality: Concepts and Technologies" Philippe Fuchs, Pascal Guitton, and Guillaume Moreau, First Edition,2011.
4. "Human Factors in Augmented Reality Environments" Philippe Fuchs, Patrick Reignier, and Fabien Lotte, First Edition,2020.
5. "Unreal Engine Virtual Reality Quick Start Guide: Design and Develop immersive virtual reality experiences with Unreal Engine 4" Jessica Plowman, , First Edition,2019

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3											3	
3			3		3								3	
4			3										3	
5					3		3		3	2		3		3
CO (W.A)	3	3	3		3		3		3	2		3	3	3