SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution | Approved by AICTE | Affiliated to Anna University | Accredited by NAAC with A++ Grade
Kuniamuthur, Coimbatore – 641008
Phone : (0422)-2678001 (7 Lines) | Email : info@skcet.ac.in | Website : www.skcet.ac.in

Curriculum & Syllabi

Regulation 2022

2022-26 Batch

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(Batch 2022-2026)

VISION OF THE INSTITUTION

- To produce Globally Competitive Engineers with High Ethical Values and Social Responsibilities.

MISSION OF THE INSTITUTION

- To impart the highest quality state-of-the-art technical education by providing impetus to innovation, research, and development and empowering students with entrepreneurship skills.
- To instil ethical values, imbibe a sense of social responsibility, and strive for societal well-being.
- To identify the needs of society and offer sustainable solutions through outreach programs.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

VISION OF THE DEPARTMENT

- To produce globally competitive professionals in Artificial Intelligence and Data Science by imparting cognitive learning and encouraging industry collaboration towards serving the greater cause of society.

MISSION OF THE DEPARTMENT

- Impart knowledge in cutting edge Artificial Intelligence and Data Science technologies in par with industrial standards.
- Inculcate research and lifelong learning that benefit society at large.
- Promote ethical values and entrepreneurial skills.

I.	PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
PEO 1	To build a successful career in IT/relevant industry or carryout research in advance areas of Artificial Intelligence, Data Science and address various issues in the society.
PEO 2	To develop problem solving skills and ability to provide solution for real time problems.
PEO 3	To develop the ability and attitude of adapting themselves to emerging technological Challenges.
PEO 4	To excel with excellent communication skills, leadership qualities and social responsibilities.

II.	PROGRAMME OUTCOMES (POs)
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

III. PROGRAMME SPECIFIC OUTCOMES (PSOs)

The Graduates of B.Tech – Artificial Intelligence and Data Science programme will be able to:

PSO 1	Understand, analyze and develop innovative solutions for real world problems in industry and research establishments related to Artificial Intelligence and Data Science.
PSO 2	Ability to choose or develop the right tool for Data analysis and develop high end intelligent systems.
PSO 3	Apply programming principles and practices for developing software solutions to meet future business and society needs.

IV. MAPPING OF PEOs WITH POs

PEO	**POs**											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	3	3	3	3	3	3	3	2	1	2	2	3
2	3	3	3	3	3	2	2	2	2	3	3	3
3	1	3	1	2	3	2	3	1	1	2	2	2
4	1	1	3	2	1	3	3	3	3	3	3	1

V. MAPPING OF PEOs WITH PSOs

PEO	PSO 1	PSO 2	PSO 3
PEO 1	3	3	3
PEO 2	3	3	2
PEO 3	2	2	3
PEO 4	2	1	3

AUTONOMOUS CURRICULA AND SYLLABI

Regulations 2022

SEMESTER I						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**Category**
Theory (Internal 40 Marks & External 60 Marks)						
1	22AD101	Introduction to Artificial Intelligence	3/0/0	3	3	PC
2	22MA102	Mathematics I	3/1/0	4	4	BSC
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
3	22IT101	Application Development Practices	3/0/2	5	4	PC
4	22CS101	Problem Solving using C++	3/0/2	5	4	PC
5	22EN101	Technical Communication Skills	2/0/2	4	3	HSMC
6	22CH101	Engineering Chemistry	3/0/2	5	4	BSC
Mandatory Course (Internal 100 Marks)						
7	22MC101	Induction Programme	3 weeks		0	MC
Total				**26**	**22**	

SEMESTER II						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**Category**
Theory (Internal 40 Marks & External 60 Marks)						
1	22MA202	Mathematics II	3/1/0	4	4	BSC
2	22EE111	Basics of Electrical and Electronics Engineering	2/1/0	3	3	ESC
3	22TA101	Heritage of Tamils	1/0/0	1	1	HSMC
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
4	22CS201	Data Structures and Algorithms	3/0/2	5	4	PCC
5	22IT201	Data Base Management Systems	3/0/2	5	4	PCC
6	22AD201	Java Programming	3/0/2	5	4	PCC
7	22PH201	Physics	3/0/2	5	4	BSC
Practicals (Internal 60 Marks & External 40 Marks)						

8	22EE114	Basics of Electrical and Electronics Engineering Laboratory	0/0/2	2	1	BSC
Mandatory Course (Internal 100 Marks)						
9	22MC102	Environmental Science			0	MC
			TOTAL	**32**	**25**	

SEMESTER III						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**Category**
Theory (Internal 40 Marks & External 60 Marks)						
1	22GE201	Universal Human Values	3/0/0	3	3	HSMC
2	22MA302	Random Variables and Statistics	3/1/0	4	4	BSC
3	22TA201	Tamils and Technology	1/0/0	1	1	HSMC
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
4	22AD301	Design and Analysis of Algorithms	1/0/4	5	3	PCC
5	22IT302	Web Technology	1/0/4	5	3	PCC
6	22CS301	Advanced Java Programming	1/0/4	5	3	PCC
7	22AD302	Python Essentials	2/0/2	4	3	PCC
Mandatory Course (Internal 100 Marks)						
8	22MCXXX	Mandatory Course-III	2/0/0	2	0	MC
			TOTAL	**29**	**20**	

SEMESTER IV						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**Category**
Theory (Internal 40 Marks & External 60 Marks)						
1	22MA401	Optimization and Project Management	3/1/0	4	4	BSC
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
2	22IT402	Software Testing	1/0/4	5	3	PCC
3	22AD401	Cloud Computing	1/0/4	5	3	PCC
4	22CS402	Web Frameworks	1/0/4	5	3	PCC
5	22AD402	Data Warehousing and Data	2/0/2	4	3	ESC

		Mining				
6	22CS403	Operating Systems	3/0/2	5	4	PCC
Mandatory Course (Internal 100 Marks)						
7	22MCXXX	Mandatory Course-IV	2/0/0	2	0	PJW
			TOTAL	**30**	**20**	

SEMESTER V						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**Category**
Theory-Blended Learning(Internal 100 Marks)						
1	22AD501	Signals, Systems and Networks	3/0/0	3	3	ESC
Theory (Internal 40 Marks & External 60 Marks)						
2	22AD502	Machine Learning	3/0/0	3	3	PCC
3	22AD9XX	Professional Elective – I	3/0/0 or 0/0/6	3/6	3	PEC
4	22AD9XX	Professional Elective – II	3/0/0	3	3	PEC
5	22XXXXX	Open Elective – I	3/0/0	3	3	OEC
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
6	22AD503	Data Science using R	2/0/2	4	3	PCC
Practicals (Internal 60 Marks & External 40 Marks)						
7	22AD504	Machine Learning Laboratory	0/0/3	3	1.5	PCC
Mini Project (Internal 100 Marks)						
8	22AD505	Mini Project	0/0/2	2	1	PJW
			TOTAL	**24**	**20.5**	

SEMESTER VI						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**Category**
Theory (Internal 40 Marks & External 60 Marks)						
1	22CS701	Internet of Everything	3/0/0	3	3	ESC
2	22AD9XX	Professional Elective – III	3/0/0 or 0/0/6	3/6	3	PEC
3	22AD9XX	Professional Elective – IV	3/0/0	3	3	PEC
4	22ADXXX	Emerging Elective – I	3/0/0	3	3	EEC

Theory with Practicals (Internal 50 Marks & External 50 Marks)						
6	22AD601	Deep Learning and its Applications	3/0/2	5	4	PCC
7	22AD602	Natural Language Processing	3/0/2	5	4	PCC
Practicals (Internal 60 Marks & External 40 Marks)						
8	22CS702	Internet of Everything Laboratory	0/0/3	3	1.5	ESC
			TOTAL	**25**	**21.5**	

SEMESTER VII						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**Category**
Theory (Internal 40 Marks & External 60 Marks)						
1	22AD9XX	Professional Elective – V	3 / 0 / 0	3	3	PCC
2	22AD9XX	Professional Elective – VI	3 / 0 / 0	3	3	PCC
3	22XXXXX	Open Elective – II	3 / 0 / 0	3	3	OEC
4	22ADXXX	Emerging Elective – II	3 / 0 / 0	3	3	EEC
Theory with Practicals (Internal 50 Marks & External 50 Marks)						
5	22AD701	Data Analytics and Visualization	3/0/2	5	4	PCC
Project (Internal 60 Marks & External 40 Marks)						
6	22AD702	Project Phase - I	0 / 0 / 6	6	3	PJW
Internship (Internal 100 Marks)						
7	22EES01	Employment Enhancement Skills (Internship)	28 Days		2	PJW
Mandatory Course (Internal 100 Marks)						
			TOTAL	**23**	**21**	

SEMESTER VIII						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**Category**
Project (Internal 60 Marks & External 40 Marks)						
1	22AD801	Project Phase - II	0 / 0 / 24	24	12	PJW
			TOTAL		**12**	

SCHEME OF CREDIT DISTRIBUTION – SUMMARY											
Sl. No.	Stream	Credits/Semester								C	%
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences Including Management (HSMC)	3	1	4						8	7.36
2	Basic Sciences (BSC)	8	8	4	4					24	11.04
3	Engineering Sciences (ESC)		4			3	4.5			11.5	8.59
4	Professional Core (PCC)	11	12	12	16	7.5	8	4		70.5	45.09
5	Professional Electives (PEC)					6	6	6		18	9.20
6	Open/Emerging/Industry (OEC)					3	3	6		12	5.52
7	Project Work (PROJ)					1		5	12	18	13.19
8.	Mandatory Course (MC) / Spoken Hindi									-	0
Total		**22**	**25**	**20**	**20**	**20.5**	**21.5**	**21**	**12**	**162**	

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM			
S. No.	**Course Work - Subject Area**	**AICTE Suggested Credits**	**SKCET Credits (AI&DS)**
1.	Humanities and Social Sciences (HS), including Management;	15	12
2.	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology;	23	18
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;	22	14
4.	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required	54	73.5
5.	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	18	15
6.	Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	15	9
7.	Project Work, Seminar and/or Internship in Industry or elsewhere.	16	21.5

8.	Mandatory Courses (MC)	Non-credit	0
Total		163	163
**Minor Variations is allowed as per need of the respective disciplines*			

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (8 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./ Wk.**	**C**	**Category**
1.	22GE201	Universal Human Values	2/0/0	2	3	HSMC
2.	22EN101	Technical Communication Skills	2/0/2	4	3	HSMC
3.	22TA101	Heritage of Tamils	1/0/1	1	1	HSMC
4.	22TA201	Tamils and Technology	1/0/1	1	1	HSMC

BASIC SCIENCE COURSES (24 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
1.	22MA102	Mathematics I	3/1/0	4	4	BSC
2.	22CH101	Engineering Chemistry	3/0/2	4	4	BSC
3.	22PH201	Physics	3/0/2	4	4	BSC
4.	22MA202	Mathematics II	3/1/0	4	4	BSC
5.	22MA302	Random Variables and Statistics	3/1/0	4	4	BSC
6.	22MA401	Optimization and Project Management	3/1/0	4	4	BSC

ENGINEERING SCIENCE COURSES (11.5 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
1.	22EE111	Basics of Electrical and Electronics Engineering	2/1/0	3	3	ESC
2.	22EE114	Basics of Electrical and Electronics Engineering Laboratory	0/0/2	2	1	ESC
3.	22AD501	Signals, Systems and Networks	3/0/0	3	3	ESC
4.	22CS701	Internet of Everything	3/0/0	3	3	ESC
5.	22CS702	Internet of Everything Laboratory	0/0/3	3	1.5	ESC

PROFESSIONAL CORE COURSES (70.5 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
1	22AD101	Introduction to Artificial Intelligence	3/0/0	3	3	PCC
2	22IT101	Application Development Practices	3/0/2	5	4	PCC
3	22CS101	Problem Solving using C++	3/0/2	5	4	PCC
4	22CS201	Data Structures and Algorithms	3/0/2	5	4	PCC
5	22IT201	Data Base Management Systems	3/0/2	5	4	PCC
6	22AD201	Java Programming	3/0/2	5	4	PCC
7	22AD301	Design and Analysis of Algorithms	1/0/4	5	3	PCC
8	22IT302	Web Technology	1/0/4	5	3	PCC
9	22AD302	Python Essentials	2/0/2	4	3	PCC
10	22CS301	Advanced Java Programming	1/0/4	5	3	PCC
11	22AD402	Data Warehousing and Data Mining	2/0/2	4	3	PCC
12	22IT402	Software Testing	1/0/4	5	3	PCC
13	22AD401	Cloud Computing	1/0/4	5	3	PCC
14	22CS402	Web Frameworks	1/0/4	5	3	PCC
15	22CS403	Operating Systems	3/0/2	5	4	PCC
16	22AD502	Machine Learning	3/0/0	3	3	PCC
17	22AD503	Data Science using R	2/0/2	4	3	PCC
18	22AD504	Machine Learning Laboratory	0/0/3	3	1.5	PCC
19	22AD601	Deep Learning and its Applications	3/0/2	5	4	PCC
20	22AD603	Natural Language Processing	3/0/2	5	4	PCC
21	22AD702	Data visualization using Tableau	3/0/0	3	3	PCC
22	22AD704	Data Visualization Laboratory	0/0/2	3	1	PCC
23	22AD701	Data Analytics and Visualization	3/0/2	5	4.5	PCC

PROFESSIONAL ELECTIVE COURSES (15 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
ELECTIVE STREAM I – CLOUD COMPUTING AND DATA STORAGE TECHNOLOGIES						
1.	22CD901	Data Virtualization	3 / 0 / 0	3	3	PEC

2.	22IT901	Cloud Services and Integration	3 / 0 / 0	3	3	PEC
3.	22CY901	Security and Privacy in Cloud	3 / 0 / 0	3	3	PEC
4.	22AD902	Storage Technologies	3 / 0 / 0	3	3	PEC
5.	22CS901	Software Defined Networks	3 / 0 / 0	3	3	PEC
6.	22CB901	Stream Processing	3 / 0 / 0	3	3	PEC
7.	22CD903	Multimedia and Animation	3 / 0 / 0	3	3	PEC
ELECTIVE STREAM II - APPLIED AI						
1.	22IT911	Intelligent Multiagent and Expert Systems	3 / 0 / 0	3	3	PEC
2.	22AD901	App Development	3 / 0 / 0	3	3	PEC
3.	22CY911	ETL Tools	2 / 0 / 2	4	3	PEC
4.	22CS911	Statistical Pattern Recognition	3 / 0 / 0	3	3	PEC
5.	22CD911	Stochastic and Network Control	3 / 0 / 0	3	3	PEC
6.	22AD911	Bayesian Data Analysis	3 / 0 / 0	3	3	PEC
7.	22AD917	Virtual Reality and Augmented Reality	3 / 0 / 0	3	3	PEC
ELECTIVE STREAM III - INFORMATION SECURITY						
1.	22IT921	Cyber Threats and Vulnerabilities	3 / 0 / 0	3	3	PEC
2.	22IT923	Cyber Physical Systems	3 / 0 / 0	3	3	PEC
3.	22IT924	Ethical Hacking and Auditing Frameworks	3 / 0 / 0	3	3	PEC
4.	22CY921	Data Privacy and Security	3 / 0 / 0	3	3	PEC
5.	22CY944	Cyber Crime and Forensics	3 / 0 / 0	3	3	PEC
6.	22CY922	Digital and Mobile Forensics	3 / 0 / 0	3	3	PEC
ELECTIVE STREAM IV – NEXT GENERATION AI						
1.	22AD931	Generative AI	3 / 0 / 0	3	3	PEC
2.	22AD932	Quantum Artificial Intelligence	3 / 0 / 0	3	3	PEC
3.	22AD933	Prompt Engineering	3 / 0 / 0	3	3	PEC
4.	22AD934	Intelligent Robotic Automation	3 / 0 / 0	3	3	PEC
5.	22AD935	Advanced Machine Learning	3 / 0 / 0	3	3	PEC
6.	22AD936	Explainable AI	3 / 0 / 0	3	3	PEC
7.	22AD937	AI for Humanity	3 / 0 / 0	3	3	PEC
8.	22AD938	Autonomous Vehicles and Drones	3 / 0 / 0	3	3	PEC
9.	22AD939	AI for Remote Sensing	3 / 0 / 0	3	3	PEC
ELECTIVE STREAM V – DATA SCIENCE						
1.	22AD941	Predictive Analytics	3/0/0	3	3	PEC
2.	22AD942	Information Extraction and Retrieval	3/0/0	3	3	PEC
3.	22AD943	Computational Statistics for Data Science	3/0/0	3	3	PEC
4.	22AD944	Ethics in Data Science	3/0/0	3	3	PEC
5.	22AD945	Video Analytics	3/0/0	3	3	PEC
6.	22AD946	Web and Social Media Mining	3/0/0	3	3	PEC
7.	22AD947	Business Analytics	3/0/0	3	3	PEC
8.	22AD948	Speech Processing	3/0/0	3	3	PEC
9.	22AD949	Risk Analytics	3/0/0	3	3	PEC
ELECTIVE STREAM VI – EXTENDED REALITY						
1.	22AD951	Virtual Reality in Game Development	3/0/0	3	3	PEC
2.	22AD952	Augmented Reality and Video Streaming	3/0/0	3	3	PEC
3.	22AD953	APP Development using VRAR	3/0/0	3	3	PEC
4.	22AD954	Extended Reality for UX/UI Design	3/0/0	3	3	PEC
5.	22AD955	Metaverse Technologies	3/0/0	3	3	PEC
6.	22AD956	Virtual Reality Design and Communication	3/0/0	3	3	PEC

7.	22AD957	3D Modeling using VR	3/0/0	3	3	PEC
8.	22AD958	Sensors and Actuators in AR/VR	3/0/0	3	3	PEC
9.	22AD959	Mixed Reality and Advanced Systems	3/0/0	3	3	PEC

OPEN/ INDUSTRY (6 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
1.	22AD001	Fundamentals of Database Systems	1/0/4	5	3	OEC
2.	22AD002	Information Retrieval Techniques	3/0/0	3	3	OEC
3.	22AD003	Machine Learning Algorithms in Python	3/0/0	3	3	OEC
4.	22AD004	Data Visualization using R	3/0/0	3	3	OEC
5.	22AD005	Introduction to Data Analytics	3/0/0	3	3	OEC
6.	22AD006	Introduction to Deep Learning	3/0/0	3	3	OEC

EMERGING/ INDUSTRY (6 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
1.	22IT013	IT Infrastructure and Support	2/0/2	4	3	EEC
2.	22AD008	Crypto currencies	3/0/0	3	3	EEC
3.	22AD009	AI in Healthcare Applications	3/0/0	3	3	EEC
4.	22AD010	Scalable System for Data Science	3/0/0	3	3	EEC
5.	22AD011	Brain and Neuroscience	3/0/0	3	3	EEC
6.	22AD012	Data Engineering	3/0/0	3	3	EEC
7.	22CS005	Networks and Security	2/0/2	4	3	EEC

PROJECT WORK (18 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
3.	22AD505	Mini Project	0 / 0 / 2	2	1	PRJ
4.	22AD702	Project Phase - I	0/0/6	6	3	PRJ
5.	22EES01	Internship	28 Days		2	PRJ
6.	22AD801	Project Phase - II	0/0/24	12	12	PRJ

PROFESSIONAL ELECTIVE COURSES: VERTICALS					
Vertical I	**Vertical II**	**Vertical III**	**Vertical IV**	**Vertical V**	**Vertical VI**
Data Virtualization	Intelligent Multiagent and Expert Systems	Cyber Threats and Vulnerabilities	Generative AI	Predictive Analytics	Virtual Reality in Game Development
Cloud Services and Integration	App Development	Cyber Physical Systems	Quantum Artificial Intelligence	Information Extraction and Retrieval	Augmented Reality and Video Streaming
Security and Privacy in Cloud	ETL Tools	Ethical Hacking and Auditing Frameworks	Prompt Engineering	Computational Statistics for Data Science	APP Development using VRAR
Storage Technologies	Statistical Pattern Recognition	Data Privacy and Security	Intelligent Robotic Automation	Ethics in Data Science	Extended Reality for UX/UI Design
Software Defined Networks	Stochastic and Network Control	Cyber Crime and Forensics	Advanced Machine Learning	Video Analytics	Metaverse Technologies
Stream Processing	Bayesian Data Analysis	Digital and Mobile Forensics	Explainable AI	Web and Social Media Mining	Virtual Reality Design and Communication
Multimedia and Animation	Virtual Reality and Augmented Reality		AI for Humanity	Business Analytics	3D Modeling using VR
			Autonomous Vehicles and Drones	Speech Processing	Sensors and Actuators in AR/VR
			AI for Remote Sensing	Risk Analytics	Mixed Reality and Advanced Systems

INTERN (02 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
1.	22EES01	Employment Enhancement Skills (Internship)	28 Days		2	PRJ

VALUE ADDED COURSES (Based on student's interest)							
S. No	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**	**Sem**
1.	22VA701	Data Representation and Interpretation using Python	1/0/0	1	-	2,12,13	3/4/5/6
2.	22VA702	Android Enterprise	1/0/0	1	-	4,9,10	3/4/5/6
3.	22VA703	Chatbot Development	1/0/0	1	-	8,9,12	3/4/5/6
4.	22VA704	Hardware and Troubleshooting	1/0/0	1	-	9,17	3/4/5/6
5.	22VA705	Rapid Development for AI	1/0/0	1	-	4,10,16	3/4/5/6
6.	22VA706	Robotic Process Automation	1/0/0	1	-	9,11,13	3/4/5/6
7	22VA707	Spark and Scala	1/0/0	1	-	3,4,8	3/4/5/6

MANDATORY COURSES (Non-Credits) (Courses conducted either by internal faculty or through MOOCs)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Category**
1.	22MC101	Induction Programme			0	MC
2.	22MC401	Environmental Sciences	1/0/0	1	0	MC
3.	22MC501	Indian Constitution	1/0/0	1	0	MC
4.	22MC103	Soft Skills	1/0/0	1	0	MC
5.	22MC104	Management Organizational Behaviour	1/0/0	1	0	MC
6.	22MC105	General Aptitude	1/0/0	1	0	MC
7.	22MC106	Life Skills and Ethics	1/0/0	1	0	MC
8.	22MC107	Stress Management	1/0/0	1	0	MC

9.	22MC109	Essence of Indian Traditional Knowledge	1/0/0	1	0	MC
10.	22MC110	Biology	1/0/0	1	0	MC

L: Lecture **T:** Tutorial **P:** Practical **C:** Credit **O:** Outside Class hours **Cat.:** Category

HSMC : Humanities and Social Sciences including Management
BSC : Basic Science Courses
ESC : Engineering Science Courses
PCC : Professional Core Courses
PEC : Professional Elective Courses
OEC : Open and Emerging Elective Courses
PRJ : Project Work
INT : Internship
MC : Mandatory Course

Definition of Credit:

L – Lecture	1 Hr. Lecture (L) per week	1 credit
T – Tutorial	1 Hr. Tutorial (T) per week	1 credit
P - Practical/Practice (Project and Industry based Courses)	1 Hr. Practical (P) per week	0.5 credit

SEMESTER – VII

22AD701	DATA ANALYTICS AND VISUALIZATION	3/0/2/4
Pre-requisite(s):Nil		
Course Objectives:		
1	To learn data collection and preprocessing techniques for data science.	
2	To Understand and practice analytical methods for solving real life problems.	
3	To study data exploration techniques.	
4	To learn different types of data and its visualization.	
5	To study different data visualization techniques and tools.	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C701.1	Apply the fundamental concepts and principles of data science in data analysis.	AP
C701.2	Implement statistical concepts and machine learning techniques to enhance data analysis.	AP
C701.3	Utilize clustering, association rule for effective data mining.	AP
C701.4	Perform regression, and classification techniques to analyze and interpret data patterns effectively	AP
C701.5	Apply different data visualization techniques using Tableau and Power BI to understand the data.	AP

Course Content:

Module 1: Introduction to Data Science and Big Data **15 Hrs**

Defining data science and big data, Recognizing the different types of data, Gaining insight into the data science process, Data Science Process: Overview, Different steps, Machine Learning Definition and Relation with Data Science Introduction to Big Data Platform – Evolution of Analytic scalability - Statistical concepts: Sampling distributions, resampling, statistical inference,
prediction error.

Data Analysis Techniques: Clustering, Association, Regression, and Classification **15 Hrs**

Data Analysis Theory and Methods: Clustering –Overview, K-means- overview of method, determining number of clusters, Association Rules- Overview of method, Apriori algorithm, evaluation of association rules, Regression-Overview of linear regression method, model description. Classification-Overview, Naïve Bayes classifier Decision Tree, Entropy, Creating a Decision Tree.

Module 3: Data Visualization Strategies and Interactive Dashboards **15 Hrs**

Data Visualization: Basic principles, ideas and tools for data visualization - Tableau - An Interactive Analytics platform, Tableau Product Suite. How to connect to a data source using Tableau interface. Tableau interface and basic terminologies. Harness the power of your data. Build interactive dashboards. How to Install Power BI desktop? Preparing data with Power BI.
Data visualization using Power BI.

Total Hours: 45 Hours

1	Data Preprocessing and Exploration.
2	Conducting Cluster Analysis using K-Means Clustering.
3	Configuring Decision Tree
4	Performing Regression Analysis using Linear Regression.
5	Creating an Interactive Dashboard using Tableau
6	Data Aggregation and Statistical functions in Tableau
7	Model evaluation using accuracy,precision,recall and F1 score
8	Configuring Data Visualization using Power BI.
9	Conducting Comparative Analysis of Visualization Techniques.
10	Connect to data, Build Charts and Analyze Data, Create Dashboard, Create Stories using Tableau

Text Books:	
1	Data Science for Business: What You Need to Know about Data Mining and Data- Analytic Thinking" by Foster Provost and Tom Fawcett (2013).
2	"Introduction to Data Mining" by Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, and Vipin Kumar (2nd Edition, 2018).
3	"The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios" by Steve Wexler, Jeffrey Shaffer, and Andy Cotgreave (2017).
Reference Books:	
1	Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.
2	"Learning Tableau 2020: Make Business Intelligence Quicker and Easier by Learning to Understand Your Data with Tableau" by Joshua N. Milligan (Published in 2020)
3	"Mastering Power BI: Power BI Beginner to Pro: Learn to Master Power BI and Power BI Desktop" by Jason Lengstorf (Published in 2020)
Web References:	
1	https://towardsdatascience.com/introduction-to-data-science-6ed95e926e11
2	https://www.datacamp.com/community/tutorials/data-science-introduction
3	https://www.datavisualizationsociety.com/introduction-to-data-visualization/
Online References:	
1	https://www.coursera.org/learn/what-is-datascience
2	https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/
3	https://www.khanacademy.org/math/statistics-probability

22AD702	PROJECT PHASE - I	0/0/6/3
Nature of Course	M (Practical Application)	
Pre-Requisites	Programming Languages	
Course Objectives:		
1	To identify a problem area and showcasing a strong understanding of the selected domain.	
2	To explore the latest advancements within their selected field of study.	
3	To understand and adhere to ethical standards and professional practices in software development.	
Course Outcomes: **Upon completion of the course, students shall have ability to**		
C702.1	Identify a problem and carry out a thorough study on the chosen problem	[AP]
C702.2	Analyze ongoing developments in the chosen domain and demonstrate technical knowledge pertaining to the same.	[A]
C702.3	Apply suitable tools, techniques, Algorithms, frameworks to solve the practical problems.	[AP]
C702.4	Develop a solution for the chosen problem and validate the results.	[C]

Course Guidelines:

Introduction: Identify domain, Framing Problem Statement, Dataset Collection, Analyse the Techniques, Organize the work flow. **Experiments:** Develop software life cycle model, Implement, and provide solution for the chosen problem statement, Validate the result, and provide the documentation for findings.

1. The entire semester shall be utilized by the students to do their Mini project work by receiving the directions from the project guide.
2. Every student shall have a project guide who is the member of the faculty of the institution for the in-house project or an industry mentor from the industry as project guide for an industry/internship project.
3. Identification of project guide has to be completed by the end of previous semester of the project work to be carried out.
4. The duration may be used for library reading, laboratory work, literature survey, computer analysis or field work as assigned by the guide and also to present periodical seminars about the progress made in the project.
5. Number of students in the project team should be maximum of 4.
6. Students can select project topics from the thrust areas.
7. Projects can be Research Based, Application Based, or Multidisciplinary.
8. Students can choose projects in line with the Departmental Mission, Vision and Program Outcomes.
9. Students can identify the project area / title, obtain the consent of faculty to guide them.
10. Students can make use of college subscribed E-resources like IEEE, ScienceDirect and Elsevier to choose base papers and thereby do literature surveys.
11. After project guide allocation, the student team must meet the respective project guide and update about the status of project periodically.
12. While working on the project, every student team must keep a project diary and record all relevant information. The diary must be verified and signed by the project guide which will be the periodic progress report and submitted during the project review to the project coordinator.

13. Students should not be involved in unethical behaviour, such as plagiarism, copyright violations, etc while working on projects and when submitting project reports.
14. The progress of the project will be evaluated on a continuous basis by conducting periodic internal reviews. The review committee may be constituted by the Head of the Department.
15. A final external project viva-voce examination will be conducted to evaluate the student project work based on oral presentation and the project report by an Internal and External Examiner.
16. Every student team will be required to prepare and submit two (2) copies plus (no. of students) copies of the Project report of typical length 30 – 60 pages (excluding Appendices).
17. The final report shall be in typewritten form as specified in the guidelines issued by the COE.
18. As outcome of the project, students are motivated to publish papers in Scopus Indexed Journals or present the project work in International Conferences.

22AD951	VIRTUAL REALTY IN GAME DEVELOPMENT	3/0/0/3

Nature of Course	F (Theory Programming)

Course Objectives:

1	To Identify 3D Immersive Environments and content creation specifically for 3D Game development.
2	To gain knowledge in game creation pipeline, from design, implementation and testing.
3	To Understand how game players move in virtual environments.
4	To familiar with immersive games using various head mounted displays.
5	To analyze the differences between Desktop and VR based Computer Games.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C951.1	Understand about 3D digital games in both desktop and immersive context.	[U]
C951.2	Recognize basic principles and requirements of virtual reality.	[U]
C951.3	Identify the 3D Game content including character generation and control.	[AN]
C951.4	Develop software for using game controllers and tracking for motion control.	[AN]
C951.5	Learn about immersive gaming differs from classical desktop gaming.	[U]
C951.6	Apply principles and algorithms to narrative experiences and application specifically for VR.	[AP]

Course Contents:

MODULE I: Game Content Creation and Asset Production **15 Hours**

Introduction to Game Content Creation using 3DS Max - Overview of Game Creation Software: Introduction to Unity3D - Game Asset Production Pipeline for Unity - Materials and Textures: Texture Unwrapping and Creating Materials in Unity3D and Photoshop - Terrains and Landscapes: Painting, Sculpting, Trees, and Plants - Shaders: Water, Fog, Cloud, Rain, Fire. **Case Study:** Asset Creation in "Assassin's Creed Odyssey"

MODULE II: Game Design and Mechanics **15 Hours**

Planning Levels - Gameplay Mechanics: First-Person Perspective, Moving through the Scene - VR Hardware Requirements: Motion Tracking and Stereo Vision HMDs - VR Software Scripting: C# and VR Toolkits for Unity3D - Cameras for Desktops and HMDs - Lights and Skybox Creation: Indirect Illumination and Environmental Effects. **Case Study:** Level Design and Mechanics in "Portal".

MODULE III: Advanced VR and Immersive Gaming **15 Hours**

Displays: Desktop Systems, Immersive Systems, HMDs (Google Cardboard, HTC Vive, GearVR, Oculus Rift) - Virtual Reality Limitations and Immersive Gaming - Interaction: Motion Control, Controller, Gaze Input Interaction - Virtual Agents: Animation, Artificial Intelligence, Unity NavMesh - Audio and Sound Effects: Background Sounds and Triggered Sounds. **Case Study:** Immersive Interaction in "Half-Life: Alyx"

Total Hours:	**45**

Text Books:

1	John Williamson, "Virtual Reality Blueprints", O'Reilly Media, 2018.
2	Jonathan Linowes, Ryan O'Donnell, "Unity 2020 Virtual Reality Projects", O'Reilly Media, 2020.
3	Jesse Glover "Enhancing Virtual Reality Experiences with Unity 2022", O'Reilly Media, 2022

Reference Books:

1	Erin Pangilinan, Steve Lukas, and Vasanth Mohan "Creating Augmented and Virtual Realities" by, O'Reilly Media, 2019.

	Micheal Rodriguez and Brian Ries "Augmented Reality Game Development", O'Reilly Media, 2021.
Web References:	
1	https://sdlccorp.com/post/a-comprehensive-guide-to-virtual-reality-game-development-for beginners/
2	https://docs.unity3d.com/Manual/VROverview.html
3	https://www.tomlooman.com/unreal-engine-vr-getting-started/
4	https://developer.mozilla.org/en-US/docs/Games/Techniques/3D_on_the_web/WebXR
Online References:	
1	https://gamedevacademy.org/the-complete-virtual-reality-game-development-course/
2	https://developer.mozilla.org/en-US/docs/Web/API/WebXR
3	https://www.perforce.com/
4	https://polydin.com/virtual-reality-game-development/
5	https://www.udemy.com/course/oculus-quest-development-with-unity/

22AD937	AI FOR HUMANITY	3/0/0/3
Nature of Course: D (Theory Applications)		
Prerequisite: Nil		
Course Objectives:		
1	Understand the foundational concepts of AI and machine learning	
2	Explore the potential and limitations of AI technologies in various domains.	
3	Examine the ethical implications and societal impact of AI.	
4	Develop strategies for implementing AI solutions that align with human values and ethical principles.	
5	Evaluate real-world case studies to understand the practical applications and challenges of AI.	
Course Outcomes: Upon completion of the course, students shall have ability to:		
C937.1	Develop critical thinking skills to evaluate AI solutions and their impact on society.	[AP]
C937.2	Acquire problem solving skills to design AI solutions that address humanitarian challenges.	[AP]
C937.3	Learn to communicate complex AI concepts to non-technical stake holders.	[U]
C937.4	Develop collaboration skills to work effectively in interdisciplinary teams.	[AP]
C937.5	Develop a responsible and ethical approach to AI development and deployment.	[AP]

Course Contents:

MODULE I CORE TECHNOLOGIES OF AI **15 Hours**

Overview of AI and Machine Learning - History and Evolution of AI - Types of AI: Narrow AI vs. General AI - Machine Learning Basics - Deep Learning and Neural Networks - Natural Language Processing - AI in Healthcare, Education, and Environmental Sustainability - Bias and Fairness in AI - Privacy Concerns and Data Security - Transparency and Accountability - Case Studies: AI for Disaster Relief, Public Health, and Climate Change.

MODULE II DESIGNING HUMAN CENTRIC AI & ITS FRAMEWORK **15 Hours**

User-Centered Design in AI - Ensuring Inclusivity and Accessibility - Human-AI Collaboration and Augmentation - Metrics for Assessing AI Performance - Real-World Evaluation and Testing -Case Studies of AI Failures and Lessons Learned - Regulatory and Policy Frameworks - AI Governance and Policy - International Regulations and Standards - The Role of Governments and NGOs – Case Study: Regulations for ethical AI deployment.

MODULE III FUTURE OF AI AND COMMUNITY **15 Hours**

Emerging Trends in AI - The Impact of AI on Employment and Society - Future Directions for AI Research and Development - AI's Impact on Job Markets - Automation and the Changing Nature of Work - AI in Decision-Making Processes - Case Studies: Existing AI Policies and Their Effectiveness.

	Total Hours:	**45**

Text Books:

1	Andeed ma, James Ong,Siok Siok Tan, "AI for Humanity: Building a Sustainable AI for the Future",Wiley Publishers, 2024.

2	Fang Chen, Liyun Li, Jian Long Zhou, “Humanity driven AI”, Springer Cham Publishers, 2022.
Reference Books:	
1	Hamilton Mann, “Artificial Integrity: The Paths to Leading AI Toward a Human-Centered Future”, Wiley Publishers, 2024.
2	Juan M.Lavista Ferres,William B.Weeks,Brad Smith, “AI for Good: Applications in Sustainability, Humanitarian Action, and Health”, Wiley Publishers, 2024.
Web References:	
1	https://onlinecourses.swayam2.ac.in/imb24_mg116/preview

22AD936	EXPLAINABLE AI	3/0/0/3

Nature of Course	F (Theory Programming)
Pre-Requisite	Nil

Course Objectives:

1	To introduce fundamental principles and the need for explainability in AI models.
2	To familiarize learners with the taxonomy of XAI methods across various model types and data modalities.
3	To develop understanding of perturbation-based, propagation-based and concept-based explanation techniques.
4	To explore interpretable models and visualization tools for global and local explanations.
5	To examine real-world applications, counterfactual reasoning and evaluation of XAI methods.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C936.1	Identify and classify different types of XAI methods and their appropriate usage.	[U]
C936.2	Implement key explanation techniques such as LIME, SHAP, PDP and Integrated Gradients.	[AP]
C936.3	Analyze the interpretability of AI models across structured, image and text data.	[A]
C936.4	Apply XAI methods to evaluate model transparency, fairness and accountability.	[AP]
C936.5	Design interpretable AI workflows suitable for practical domains like healthcare, finance and NLP.	[AP]

Course Contents:

MODULE I: Fundamentals and Taxonomy of XAI **15 hours**

Definition and importance of explainability-Key concepts: interpretability, transparency, fidelity-Types: intrinsic vs post-hoc, global vs local, model-specific vs model-agnostic-Taxonomy of XAI techniques-Human-centered design and explainability in ML pipelines-Trade-off between accuracy and explainability

MODULE II: XAI Methods and Techniques **15 hours**

Perturbation-based: LIME, SHAP, Anchors-Propagation-based: Saliency maps, Relevance propagation, Integrated gradients-Concept-based: Net2Vec, T-CAV, ACE-Interpretable models: Linear/logistic regression, Decision trees, GAM, RuleFit, CBMs, SENNs-Visualization tools: PDP, ICE, surrogate models

MODULE III: Applications and Advanced Topics **15 hours**

Explanation for structured, unstructured, time series, and multimodal data-Deep learning explainers for images, text, and LLMs-Sample-based explanations: Influence functions, ProtoPNets-Counterfactual and contrastive explanations-Neurosymbolic systems: DeepProbLog, Neural Reasoners-Evaluation metrics: stability, fidelity, consistency-Case studies in healthcare, finance, NLP, vision

Total Hours:	**45 hours**

Text Books:	
1	Sameer Singh, Christoph Molnar, Marco Ribeiro, *"*Interpretable Machine Learning*"*, Leanpub Publishing, 2022.
2	Ajay Thampi, "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning", Packt Publishing, 2020.
Reference Books:	
1	Ankur Taly, Been Kim, Been Kim, "Explainable AI: Foundations, Developments, Prospects and Challenges", Springer, 2023.
2	Wojciech Samek, Klaus-Robert Müller, "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning", Springer Lecture Notes in Artificial Intelligence, 202.
Web References:	
1	https://christophm.github.io/interpretable-ml-book/
2	https://shap.readthedocs.io – SHAP documentation
Online Resources:	
1	https://www.coursera.org/learn/interpretable-machine-learning – Coursera Course: Interpretable Machine Learning
2	https://xai-tools.github.io – Open-source tools for Explainable AI

22AD911	BAYESIAN DATA ANALYSIS	3/0/0/3
Nature of Course	G (Theory Analytical)	
Pre-requisite	Nil	

Course Objectives:

1	To learn basic concepts of Bayesian analysis.
2	To introduce the Bayesian concepts and methods with emphasis on data analysis.
3	To assess the outcome of prior distributions as well as posterior means.
4	To identify the optimal model and to learn how to apply the same in suitable applications.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C911.1	Understand the basics of probability and relate it to the Bayesian inference.	[U]
C911.2	Apply the inference rules customized for single parameter models.	[AP]
C911.3	Examine the simulation environment for generation of inferences by utilizing various algorithms.	[A]
C911.4	Analyze the inference mechanism for multi-parameter and hierarchical models.	[A]
C911.5	Identify multiple modeling algorithms for predictive analysis and evaluate the outcome metrics	[AP]
C911.6	Apply the inference mechanism effectively in different nonlinear models.	[AP]

Course Contents:

SINGLE PARAMETER MODELS: **15 Hours**

Introduction to Probability, Priors and Posterior Analysis, Statistical Models, The Bayes inference. Bayes Rule, Normal model, Conjugate model, Binomial model, Posterior Distribution and Inferences. Markov Chain Monte Carlo simulation, RJags, The Metropolis-Hasting algorithm, Gibbs Sampler, Approximation based on posterior modes.

MULTI-PARAMETER AND HIERARCHICAL MODELS: **15 Hours**

Multi-parameter -Normal data with non-informative, conjugate, and semi-conjugate prior distributions, Multivariate normal model, Hierarchical - Exchangeability and setting up, Computation. Bayesian Data Analysis: Model checking, Evaluating, comparing, and expanding models, modeling accounting for data collection, Decision analysis.

NON-LINEAR MODELS: **15 Hours**

Mixture models- Setting up and interpreting mixture models, Gaussian process models Multivariate models- Non - normal models and multivariate regression surfaces. Comparison of Population: Inference for Proportions, Inference for Normal Populations, Rates and Sample Size Determination.

Total Hours:	**45**

Text Books:

1	Ronald Christensen, Wesley Johnson, Adam Branscum, Timothy E Hanson, “Bayesian Ideas and Data Analysis: An Introduction for Scientists and Statisticians”, CRC Press, 2019.
2	Andrew Gelman, John B, Carlin, Chapman, “Bayesian Data Analysis”, Hall/CRC Publication, 2013.

Reference Books:

1	Gelman, A., Carlin, J. B., Stern, H. S., Rubin, D. B, “Bayesian Data Analysis”, Third Edition, Chapman & Hall/CRC, 2018.

2	Gill, Jeff, “Bayesian Methods: A Social and Behavioral Science Approach”, CRC. 3rd Edition, 2013.
3	Peter D. Hoff, “A First Course in Bayesian Statistical Methods”, Springer, 2009.
Web References:	
1	https://www.coursera.org/learn/bayesian-statistics
2	https://onlinecourses.swayam2.ac.in/imb21_mg03/preview

22AD009	AI IN HEALTH CARE APPLICATIONS	3/0/0/3

Nature of Course	F (Theory Programming)
Prerequisite	Artificial Intelligence

Course Objectives:

1	To Identify healthcare myths and digital transformation.
2	To gain knowledge in Precision Medicine and Intelligent Personal Health records.
3	To Understand AI Healthcare operations and Innovation.
4	To familiar with AIOps Strategy.
5	To analyse the future healthcare technologies.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C009.1	Understand about Health care myths and Digital Transformation.	[U]
C009.2	Recognize Health Records analytics.	[U]
C009.3	Identify the various healthcare operations.	[A]
C009.4	Develop an understanding in security services.	[A]
C009.5	Learn about telemedicine and their innovation.	[U]
C009.6	Apply principles and algorithms to evaluate a model.	[AP]

Course Contents:

MODULE I: INTRODUCTION **15 Hours**

AI health care myths - Human centered AI - Prescription for Personal Health - Ambient Computing Healthcare - Continuous monitoring using AI-Precision medicine -Intelligent Personal Health records - Digital Transformation- Case Study in Personalized Healthcare

MODULE II: AI HEALTHCARE OPERATIONS **15 Hours**

AIops strategy- Clinical Impact of AIops - Data Analytics and AI-Design and Innovation - AIops for Healthcare Delivery-AIOps for service performance - HIPAA, PH1, PII Protection - AIOps Usecase. Leveraging AIOps for Enhanced IT Operations

MODULE III: FUTURE OF HEALTHCARE **15 Hours**

Role of Medical Imaging Computing - AI in Radiology and Practical Use cases - Chronic Disease Management-AI Telemedicine - Telehealth Innovation-Digital Medication- Case Study: Cancer diagnostics and treatment decisions.

Total Hours:	**45**

Text Books:

1	Kerrie L. Holley, Siupo Becker, “AI -First Healthcare”, O'Reilly Media, Inc., 2018.
2	Adam Bohr, Kaveh Memarzadeh, “Artificial Intelligence in Healthcare”, Elsevier Science, 2020.
Reference Books:	
1	Robert Shimonski, Robert Shimonski”, “How Artificial Intelligence Is Changing IT Operations and Infrastructure Services” , wiley, 2020.
Web References:	
1	https://www.coursera.org/specializations/ai-healthcare
2	https://www.udemy.com/course/the-complete-healthcare-artificial-intelligence-course-2021

22CS005	NETWORKS AND SECURITY	2/0/2/3
Nature of Course	C (Theory Concept)	
Pre requisites	Nil	
Course Objectives:		
1.	To describe the fundamentals of networking protocols such as TCP/IP, OSI model, and encapsulation.	
2.	To explain the configuration and management of networking devices, including switches and routers.	
3.	To familiarize VLAN configurations and IP addressing to create efficient network segmentation.	
4.	To assess the role of SD-WAN in modern network architectures, focusing on scalability and flexibility.	
5	To implement network redundancy using Spanning Tree Protocol and VRRP for high availability.	
Course Outcomes		
Upon completion of the course, students shall have ability to		
C005.1	Understand the differences between IPv4 and IPv6 protocols in various networking scenarios.	[U]
C005.2	Effectively apply VLAN configurations in optimizing network performance.	[AP]
C005.3	Construct secure WLANs using 802.1X authentication and AAA protocols to enhance network security.	[AP]
C005.4	Analyze the performance of various routing protocols like OSPF and static routing in different network setups.	[AN]
C995.5	Illustrate the benefits and limitations of different types of physical media in LAN and WAN environments.	[AN]

FOUNDATIONS OF NETWORKING AND PROTOCOLS **10 Hours**

Introduction to Networking- LAN, WAN and components- OSI model & encapsulation- Different types of physical media Compare unicast, multicast, and broadcast, TCP/IP stack, IPv4 & IPv6-Different types of networking devices. **Switching Fundamentals** Connecting and accessing switch - Initial switch setup-Configuring VLANs, tagging, and IP addressing- Usage of LLDP and ICMP for network discovery and diagnosis-Configure link aggregation. **Basic IP Setup:** Inter-VLAN routing IPv4 & IPv6- DHCP relay-Static IP routing and configuration, single area OSPF- Basics of VoIP and its Advantages-Types of VoIP.

NETWORK SWITCHING TECHNOLOGIES **10 Hours**

Network Redundancy: Spanning Tree- VRRP and VSX - VSF configuration - Auto VSF - VSF MAD. **Device Profiling:** Use of device profiling - LLDP and MAC profiling - Establishing connections between APs and HPE- Setting up AP's. **WLAN Fundamentals**: Fundamentals of 802.11, RF frequencies and channels- RF Patterns and coverage including SNR - Roaming standards and QOS requirements - RF design - Configuring WLANs. **SD-WAN** Fundamentals of SD-WAN - Future of SD-WAN - SD-WAN edge devices - SD-WAN gateway controllers - Configuring SD-WANs - Benefits of SD-WAN - Understanding WLC.

IMPLEMENTING SECURE WLANS **10 Hours**

AAA Security Frameworks - 802.1X authentication - Configuring secure WLANs - Roles and Access rules - **Guest Access**: setting up captive portal authentication- Configuration of guest WLANs- **WLAN Security**: WLAN security certificates- Cloud authentication. **Network Security:** Security devices (Firewalls, Routers and Wireless API's)-Principles of

Network security-Types of Security-Pillars of Network security-Types of Network security Protections.	
Total Hours	**30**

Laboratory Component:	
S. No	**List of Experiments**
1	Configuring and accessing a Switch in Packet Tracer
2	Configure and analyze IPv4 and IPv6 addressing schemes and subnetting
3	Design and simulate VLAN configuration with inter-VLAN routing and static IP routing
4	Simulate DHCP relay and basic VoIP setup
5	Configure STP (Spanning Tree Protocol) and analyze redundancy in network switches
6	Setup and test VRRP (Virtual Router Redundancy Protocol)
7	Implement secure WLAN setup using 802.1X authentication with RADIUS
8	Create and analyze WLANs with guest access via captive portals
9	Analyze OSPF routing protocol performance through simulation
10	Emulate SD-WAN-like behavior using static routes and redundancy simulation
Total Hours	**30**

Text Books:	
1.	Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, “Computer Networks”, 6th Edition, Pearson, 2022.
2.	Behrouz A. Forouzan, ”Data Communications and Networking with TCP/IP Protocol Suite”, 6th Edition, McGraw Hill, 2022.
3.	William Stallings, “Network Security Essentials - Applications and Standards”, 6th Edition, Pearson, 2018.
Reference Books:	
1.	James F. Kurose, Keith W. Ross, “Computer Networking - A Top down Approach”, 8th Edition, Pearson, 2022.
2.	Charlie Kaufman, Radia Perlman, and Mike Speciner, Ray Perlner, “Network Security: Private Communication in a Public World”, 3rd Edition, Pearson, 2022.
3.	Vijay K. Garg, “Wireless Communications and Networking”, 2nd Edition, Morgan Kaufmann Publishers, 2018.
Web References:	
1.	https://www.netacad.com/courses/getting-started-cisco-packet-tracer?courseLang=en-US
2.	https://networklessons.com/
3.	https://www.cisco.com/c/en_in/products/security/what-is-network-security.html
Online Resources:	

1.	https://learn.microsoft.com/en-us/training/modules/network-fundamentals/
2.	https://learn.microsoft.com/en-us/azure/networking/fundamentals/
3.	https://www.juniper.net/documentation/

22AD934	INTELLIGENT ROBOTIC AUTOMATION	3/0/0/3
Nature of Course	F (Theory Programming)	
Pre-Requisite	Nil	

Course Objectives:

1	Understand the Robot types and its end effectors.
2	Develop the Analytical and Experimental skills necessary to Design and Implement robotic assistance for both minimally invasive surgery and Image guided interventions.
3	Recall the robot application for pick and place.
4	Simulations in RoboAnalyzer / Matlab to verify kinematics and dynamics of robots.
5	Inculcate the controlling applications of robotics using sensor responses

Course Outcomes:

Upon completion of the course, students shall have ability to:

C934.1	Identify and describe different types of medical robots and their potential applications.	[U]
C934.2	Understand various robot classifications, specifications and applications.	[U]
C934.3	Apply coordinate transformations to map position and orientation coordinates from end effector to robot base.	[AP]
C934.4	Understand the challenges in the design of a medical robotic system given the specific requirements for a particular application.	[U]
C934.5	Analyze forward and inverse kinematics to manipulate objects by robots.	[A]

Course Contents:

MODULE I: Introduction **15 Hours**

Introduction: Robot Anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems- Specifications of Robot-Speed of Robot-Robot joints and Links-Robot classifications -Architecture of robotic Systems-Robot Drive systems- Hydraulic, Pneumatic and Electric system. End Effectors and Robot Controls: Mechanical Grippers-Slider crank mechanism, Screw type, Rotary actuators, cam Type-Magnetic grippers -Vacuum grippers -Air operated Grippers-Gripper force Analysis-Gripper Design-Simple Problems-Robot controls **Case Study** - State of art of robotics in the field of healthcare.

MODULE II: Micro/Nano Robotics **15 Hours**

Robot Cell Design and Micro/Nano Robotics System: Robot work cell design and Control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions- Robot applications- Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot. Micro/Nanorobotics system Overview-Scaling effect- Top down and bottom-up approach- Actuators of Micro/Nano robotics system-Nanorobot communication Techniques-Fabrication of micro/nano Grippers-Wall climbing micro robot working Principles-Biomimetic Robot-Swarm Robot-**Case Study** - Nano robot in targeted drug delivery system.

MODULE III: Robot Kinematics **15 Hours**

Robot Transformations and Sensors: Robot Kinematics- Types – 2D & 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple Transformation Simple problems. Sensors in robot – Touch sensors -Tactile sensor – Proximity and range sensors – Robotic vision Sensor-Force sensor -Light sensors, Pressure sensors. Motion Instructions- Pick and place operation using Industrial robot- manual mode, automatic mode, subroutine command-based programming - Move master command language **Case Study** - Robot welding application using VAL program.

Total Hours:	**45**

Text Books:

1	Mikell P Groover& Nicholas Godrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, “Industrial Robotics, Technology Programming and Applications”, McGraw Hill, 2nd Edition, 2019.

2	J John Craig , “Introduction to Robotics“, Pearson Education, 4th Edition, 2021
Reference Books:	
1	Klafter. R.D, Chmielewski. T.A. and Noggin‟s., “Robot Engineering: An Integrated Approach”, Prentice Hall of India Pvt. Ltd., 2022.
2	S.R. Deb, “Robotics Technology and flexible automation “, Tata McGraw-Hill Education., 2021
Web References:	
1	https://community.sap.com/t5/enterprise-resource-planning-blogs-by-sap/sap-intelligent-robotic-process-automation-best-practice-content-for-s/ba-p/13399775
2	https://www.koombea.com/blog/intelligent-automation/
Online Resources:	
1	https://www.ibm.com/topics/intelligent-automation
2	https://www.sap.com/products/technology-platform/process-automation/what-is-rpa.html

22AD946	WEB AND SOCIAL MEDIA MINING	3/0/0/3
Nature of Course	H (Theory Technology)	
Pre requisites	Data Warehousing and Mining	

Course Objectives:

1	To provide an overview of common text mining and social media data analytic activities.
2	To introduce the various tools for Text Mining and carry out Pattern Discovery, Predictive Modeling.
3	To understand the complexities of processing text and network data from different data sources.
4	To enable students to solve complex real-world problems for sentiment analysis and Recommendation systems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C946.1	Interpret the terminologies, metaphors and perspectives of social media analytics.	[U]
C946.2	Apply a wide range of classification, clustering, estimation and prediction algorithms on Textual data.	[AP]
C946.3	Perform social network analysis to identify important social actors, subgroups and network properties in social media sites.	[A]
C946.4	Provide solutions to the emerging problems with social media such as behavior analytics and recommendation systems.	[A]
C946.5	Design new solutions to opinion extraction, sentiment classification and data summarization problems.	[AP]

Course Contents:

Module 1: Text and Web Mining: **18 Hours**

Text Representation- tokenization, stemming, stop words, TF-IDF, Feature Vector Representation, NER, Text Clustering, Text Classification, Topic Modeling, Query optimization, page ranking. Web Crawling-Crawler Algorithms, Implementation Issues, Evaluation, Session & visitor Analysis, Visitor Segmentation, Analysis of Sequential & Navigational Patterns, Predictions based on web user transactions.

Module 2: Social Media Mining **15 Hours**

Social network and web data and methods. Graphs and Matrices. Basic measures for individuals and networks. Information visualization. **Making connections**: Link analysis. Random graphs and network evolution. **Social contexts**: Affiliation and identity; Social network analysis, Recommendation system

Module 3: Sentimental and Behavioral Analytics **12 Hours**

Content Analysis; Natural Language Processing; Clustering & Topic Detection; Simple Predictive Modeling; Sentiment Analysis; Sentiment Prediction. **Behavior Analytics**: Individual Behavior, Collective

Behavior. **Case study:** Usage of Linguistic Inquiry and Word Count (LIWC) analysis software program and similar tools.	
Total Hours:	**45**
Text Books:	
1.	Matthew A. Russell, Mikhail Klassen “Mining the Social Web”, Third Edition, 2019.
2.	Bing Liu, “Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data”, Springer, Second Edition, 2011.
3.	Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, “Social Media Mining – An Introduction”, Cambridge University Press, 2014.
Reference Books:	
1.	Bing Liu, “Sentiment Analysis and Opinion Mining”, Morgan & Claypool Publishers, 2012.
2.	Nitin Indurkhya, Fred J Damerau, “Handbook of Natural Language Process”, 2nd Edition, CRC Press, 2010.
3.	Matthew A.Russell, “Mining the social web”, 2nd edition- O'Reilly Media, 2013.
4.	Ronen Feldman and James Sanger, The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data, Cambridge University Press, First Edition, 2009.
Web References:	
1.	https://www.g2.com/articles/social-media-data-mining
2.	www.gsb.stanford.edu/faculty-research/behavioral-lab
Online Resources:	
1.	https://www.coursera.org/projects/basic-sentiment-analysis-tensorflow
2.	https://cs.ccsu.edu/~markov/ccsu_courses/WebMining.html
3	https://www.coursera.org/learn/text-mining?specialization=data-mining

22AD947	BUSINESS ANALYTICS	3/0/0/3

Nature of Course	F (Theory Programming)
Pre-Requisite	Nil

Course Objectives:

1	To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
2	To become familiar with the processes needed to develop, report, and analyze business data.
3	To learn how to use and apply Excel and Excel add-ins to solve business problems.
4	Learn calculations of measures of central tendency
5	It leads the way for better understanding and viewing of data.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C947.1	To understand the Business Analytics in practice	[U]
C947.2	To understand concepts of Descriptive Analytics	[U]
C947.3	To learn about Data mining for business	[A]
C947.4	To understand concepts of Prescriptive Analytics	[AP]
C947.5	To learn about the R environment Unit	[AP]

Course Contents:

MODULE I: INTRODUCTION TO BUSINESS ANALYTICS **15 hours**

Definition of Business Analytics, Categories of Business Analytical methods and models, Business Analytics in practice, Big Data - Overview of using Data, Types of Data- Business decision modeling.

MODULE II: DESCRIPTIVE ANALYTICS **15 hours**

Overview of Description Statistics (Central Tendency, Variability), Data Visualization -Definition, Visualization Techniques – Tables, Cross Tabulations, charts, Data Dashboards using Advanced Ms-Excel or SPSS, Data Exploration & Reduction, Data mining and business intelligence. Data Analysis and Frequency Distribution (DAFD), Scales of Measurement. Measures of Central Tendency, Pythagorean, Means, Dispersion, Skewness and Kurtosis. **Case Study -** Selective Inventory Control Techniques: ABC, VED, FNSD & XYZ

MODULE III: PRESCRIPTIVE ANALYTICS **15 hours**

Overview of Linear Optimization, Non-Linear Programming Integer Optimization, Cutting Plane algorithm and other methods, Data mining for business, Classification, Association, Cause Effect Modeling -Decision Analysis – Relative frequency and Subjective -Risk and uncertainty methods - Text analytics Web analytics. **Case Study** - KDD Process

Total Hours:	**45**

Text Books:	
1	Camm, Cochran, Fry, Ohlmann, Anderson, Sweeney, Williams – "Essentials of Business Analytics" Cengage Learning.2022
2	Albright Winston, "Business Analytics - Data Analysis - Data Analysis and Decision Making" Cengage Learning, Reprint 2022
Reference Books:	
1	Sahil Raj, "Business Analytics" First Edition, John Wiley & Sons, Inc., USA 2020.
2	James Evans, "Business Analytics", Pearson., First Edition, Maker Media Inc, San Francisco CA, 2019
Web References:	
1	https://www.ibm.com/topics/business-analytics
2	https://www.datacamp.com/blog/what-is-business-analytics
Online Resources:	
1	https://www.learnquest.com/course-detail-v3.aspx?cnum=BACS-200-IN
2	https://online.hbs.edu/courses/business-analytics/

22AD952	AUGMENTED REALITY AND VIDEO STREAMING	3/0/0/3
Nature of Course	F (Theory Programming)	

Course Objectives:

1	To understand key concepts of Augmented Reality and distinguish it from Virtual Reality and their applications.
2	To analyze various AR user interfaces and their impact on user interaction and experience.
3	To explore AR business models and market trends, focusing on market share, forecasts, and applications in gaming, healthcare, and retail.
4	To gain expertise in AR feature extraction techniques and their role in enhancing AR experiences.
5	To understand principles of video streaming technologies and the importance of Content Delivery Networks in efficient streaming.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C952.1	Demonstrate a clear understanding of Augmented Reality concepts and differentiate them from Virtual Reality.	[U]
C952.2	Evaluate and critique various AR user interfaces, assessing their effectiveness and impact on user experience.	[AN]
C952.3	Analyze and interpret market trends and business models in AR, including applications in gaming, healthcare, and retail.	[AN]
C952.4	Apply AR feature extraction techniques effectively to enhance AR applications.	[AP]
C952.5	Explain the principles of video streaming technologies and assess the role of Content Delivery Networks in optimizing streaming performance.	[AP]

Course Contents:

MODULE I: AR Technologies and Applications **15 Hours**

Definitions and characteristics of Augmented Reality (AR) and its comparison with Virtual Reality (VR). Exploration of AR user interfaces, including smartphones, AR eyeglasses, and head-mounted displays (HMDs). AR business models and market analysis, including AR/VR market share and forecasts for AR/VR headsets. **Case study**: IKEA Place.

MODULE II: AR Feature Extraction & Cloud Technologies **15 Hours**

Overview of AR technological components and Interest Point Detection (IPD). In-depth study of feature extraction techniques: SIFT (Scale Invariant Feature Transform), SURF (Speeded-Up Robust Features), FAST (Features from Accelerated Segment Test), BRIEF (Binary Robust Independent Elementary Features), ORB (Oriented FAST and Rotated BRIEF), and BRISK (Binary Robust Invariant Scalable Key points). AR cloud computation and offloading, including cloud-based cooperative computation. **Case study:** Google Lens.

MODULE III: Video Streaming & CDN Technologies **15 Hours**

Introduction to video streaming services such as Skype and YouTube, and their use of H.264/MPEG-4 AVC encoding - Detailed explanation of MPEG-DASH (Dynamic Adaptive Streaming over HTTP) and its role in adaptive streaming - Examination of Content Delivery Networks (CDNs), including hierarchical content delivery, caching mechanisms, and the differences between traditional CDN and Mobile CDN technologies. **Case study:** YouTube and MPEG-DASH.

Total Hours:	**45**

Text Books:

1	Tony Parisi, “Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile,” O'Reilly Media, 2020.
2	Raffaello D'Andrea, “Aerial Robotics: A Comprehensive Approach to the Study of Aerial Vehicles,” O'Reilly Media, 2022.

3	Irene Y. Chen, “Building Virtual Reality with Unity and Steam VR,” Apress, 2020.
Reference Books:	
1	David M. Matuszak, “Creating Augmented and Virtual Realities: Emerging Technologies for Business,” Business Expert Press, 2021.
2	Blake J. Harris, “The History of the Future: Oculus, Facebook, and the Revolution That Swept Virtual Reality,” HarperCollins, 2019.
Web References:	
1	https://edgemontlibrary.org/virtual-reality-books-a-curated-2024-updated-list-of-the-top-20/
2	https://callaba.io/potential-of-vr-and-ar-for-live-video-streaming
3	https://www.agora.io/en/blog/building-live-video-streaming-into-your-ar-experience-on-magic-leap-2/
4	https://www.deepar.ai/use-cases/ar-for-live-video-streaming
Online References:	
1	https://www.coursera.org/courses?query=augmented%20reality
2	https://www.careervira.com/en-US/course/ar-augmented-reality-and-video-streaming-services-emerging-technologies
3	https://digitaldefynd.com/best-augmented-reality-courses/

22AD959	MIXED REALITY AND ADVANCED SYSTEMS	3/0/0/3
Nature of Course: D (Theory Applications)		
Prerequisite: Nil		
Course Objectives:		
1	Understand the principles and applications of mixed reality	
2	Explore advanced systems like AI, ML, and IoT in MR environments	
3	Understand human-computer interaction in MR settings.	
4	Develop prototypes incorporating MR technologies.	
5	Examine the future of MR in areas such as healthcare, gaming, education, and entertainment.	
Course Outcomes: Upon completion of the course, students shall have ability to:		
C959.1	Design and implement interactive MR applications using development platforms	[AP]
C959.2	Apply principles of human-computer interaction (HCI) to create intuitive, user-friendly MR experiences	[AP]
C959.3	Develop problem-solving methodologies and rapid prototyping techniques to build MR solutions	[AP]
C959.4	Analyze current trends and emerging technologies in MR	[A]
C959.5	Able to assess the ethical, privacy, and societal impacts of MR technologies	[A]

Course Contents:

MODULE I INTRODUCTION **15 Hours**

Overview of MR, VR, and AR: Definitions and distinctions - Historical development and milestones in mixed reality - MR hardware components: Headsets (HoloLens, Oculus), Input devices (Controllers, Gloves), Sensors - Programming for MR: Introduction to MR SDKs, ARKit, ARCore - AI and MR: Role of AI in Mixed Reality applications (Natural Language Processing, Computer Vision).

MODULE II HCI IN MR **15 Hours**

Human perception in MR environments: Depth, spatial awareness, and latency - Designing for usability and user experience in MR - Ethical concerns in MR: Privacy, accessibility, and inclusivity - Project ideation and concept development: From prototype to final product - Testing and debugging MR applications.

MODULE III FUTURE OF MR AND EMERGING TECHNOLOGIES **15 Hours**

Future trends: MR and 5G, edge computing, cloud-based MR - Wearable and Haptic Technologies - Augmented Reality Glasses - Blockchain and Decentralized Systems - Biometric Data and Brain-Computer Interfaces (BCI).

Total Hours:	**45**

Text Books:	
1	Alan B. Craig," Understanding Augmented Reality: Concepts and Applications", Second edition, Morgan Kaufman,2023
2	Dawid Borycki ,"Programming for Mixed Reality with Windows 10, Unity, Vuforia, and UrhoSharp", Microsoft press,2021.
Reference Books:	
1	Sai Rohit Chenchu Boga," Integration of Augmented Reality and Virtual Reality in Building Information Modeling",IRMA publishers,2018.
Web References:	
1	https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/?v=c86ee0d9d7ed

22AD938	AUTONOMOUS VEHICLES AND DRONES	3/0/0/3
Nature of Course: D (Theory Applications)		
Prerequisite: Nil		
Course Objectives:		
1	To develop practical and engineering knowledge with autonomous vehicles, and drone technologies	
2	To build experience in modern sensor technologies that enable automation and autonomy	
3	To Understand the regulatory procedures of drones, pilot certification and licensing and basic safety measures required of UAS / UAV.	
Course Outcomes: Upon completion of the course, students shall have ability to:		
C938.1	Apply the concepts and classification of Drones / SLAM like Simultaneous Localization And Mapping.	[AP]
C938.2	Explore PID controllers, state estimation, and feedback control systems specific to autonomous systems.	[AP]
C938.3	Understand the principles of communication systems used in autonomous vehicles and drones.	[U]
C938.4	Apply AI and machine learning techniques to enable decision-making and improve autonomy in vehicles and drones.	[AP]
C938.5	Design intuitive user interfaces for controlling and monitoring autonomous vehicles and drones.	[A]

Course Contents:

MODULE I INTRODUCTION AND FUNCTIONAL ARCHITECTURE **15 Hours**

Basic Concept- autonomous systems- AI in autonomous systems, Autonomous systems vs robots-Major functions in an autonomous vehicle system-Motion Modelling - Coordinate frames and transforms-Point mass model - Case study: Agriculture autonomous drones - Modern sensor technologies.

MODULE II SLAM **15 Hours**

Modeling in autonomous systems Vehicle modelling (kinematic and dynamic bicycle model - two-track models),-Sensor Modelling – encoders- inertial sensors- Sensors and sensor fusion - GPS-Localization and mapping fundamentals-LIDAR and visual SLAM, Navigation - Global path planning-Local path planning- Vehicle control - Control structures,-PID control, Linear quadratic regulator, Sample controllers. Case study: Autonomous Drones for Construction – Wheeled robots and odometry.

MODULE III DRONES **15 Hours**

Overview-Definition,- applications- components platforms- propulsion,-on-board flight control,-payloads- communications,-concepts of flight-regulatory norms and regulations,-Machine learning and deep learning for autonomous driving, Case study(Commercial Drones and Kits).

Total Hours:	**45**

Text Books:

1	Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc Gaudiot, “Creating Autonomous Vehicle Systems” Morgan & Claypool Publishers, 2018
2	Kevin M. Lynch and Frank C, Park, “Modern Robotics: Mechanics, Planning, and Control”, 1st Edition,2021

Reference Books:	
1	Mohammad H. Sadraey, “Design of Unmanned Aerial Systems” First Edition, John Wiley & Sons, Inc., USA 2020.
2	Terry Kilby and Belinda Kilby Make, “Getting Started with Drones”, First Edition, Maker Media Inc, San Francisco CA, 2016.
Web References:	
1	https://www.coursera.org/learn/Drones

22AD942	INFORMATION EXTRACTION AND RETRIEVAL	3/0/0/3
Nature of Course	G (Theory Analytical)	
Prerequisites	Data mining	

Course Objectives:

1	To outline basic terminology and components in information retrieval.
2	To understand the concepts of IR models.
3	To explore information extraction and integration.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C942.1	Understand the basic concepts in Information Retrieval.	[U]
C942.2	Analyze the searching and indexing techniques.	[A]
C942.3	Understand the link analysis for ranking.	[U]
C942.4	Apply classification and clustering techniques on text documents.	[AP]
C942.5	Evaluate the effectiveness of information retrieval methods.	[E]
C942.6	Able to understand extraction of information and integration.	[U]

Course Contents:

Module I - Introduction **15 Hours**

History, Components of IR – Open-source Search engine Frameworks - The impact of the web on IR - The role of artificial intelligence (AI) in IR – IR Versus Web Search - Characterizing the web. **Querying:** Pre-processing - wildcard queries, Phrase Queries - Relevance Feedback - Query expansion. **Models:** Boolean and vector-space retrieval models - Term weighting - TF - IDF weighting - cosine similarity –- efficient processing with sparse vectors – Language Model based IR - Probabilistic IR –Latent Semantic Indexing. **Searching and Indexing:** Web Search Architectures - crawling - meta crawlers - Focused Crawling - Inverted indices - web indexes – Near-duplicate detection - Index Compression – XML retrieval.

Module II - Link Analysis, Classification and Clustering **15 Hours**

Link Analysis: Hubs and Authorities – Page Rank and HITS algorithms- Evaluation- metrics Recall, Precision and F measure – Evaluations on Benchmark Text Collections – Text Representation – Word Statistics – Morphology – Index Term Selection using Thesauri –Metadata and Markup Languages. **Classification-** Text classification and clustering - Categorization algorithms: Naive Bayes; decision trees; and nearest neighbour, Support Vector Machine – **Clustering algorithms:** Flat clustering, Hierarchical Clustering, Agglomerative clustering, K-means, Expectation Maximization (EM) - Semantic Matching using Neural Networks. Recommendation System.

Module III: Information Extraction **15 Hours**

Integration of Information extraction- Entity Extraction-Rule based methods and Statistical methods-Extracting Data from Text – XML – Ontologies, thesauri, semantic web – Collecting and Integrating Specialized Information on the Web - Evaluation of Information extraction Technologies **Case Study:** Organizations and Information systems data in Traditional file Environment, Biomedical Texts and Business Texts.

Total Hours:	**45**

Text Books:

1	Christopher D.Manning, Prabhakar Raghavan,Hinrich Schutze, “Introduction to information retrieval”, Cambridge university press, first south asian edition, 2012.
2	Ricardo Baeza-Yates, Berthier Ribeiro-Neto, “Modern information retrieval: The concepts and technology behind search”,ACM press books, second edition, 2011.

3	Marie Francine Moens, “Information Extraction: Algorithms and Prospectus in a Retrieval Context”, 2010.
Reference Books:	
1	Stephen Buettcher, Charles L.A. Clarke and Gordon V. Carmack, “Information Retrieval: Implementing and Evaluating Search Engines”, MIT Press, 2010
2	Bruce Croft, Donald Metzler and Trevor Strohman, “Search Engines: Information Retrieval in Practice”, 1st Edition Addison Wesley, 2009.
3	Mark Levene, “An Introduction to Search Engines and Web Navigation”, 2nd Edition, Wiley, 2010.
Web References:	
1	Information Retrieval,Wiley
2	https://www.coursera.org/courses/information/retrieva
3	https://www.sciencedirect.com/topics/computer-science/information-retrieval-systems
4	https://en.wikipedia.org/wiki/Information_retrieval

22AD801	PROJECT PHASE - II	0/0/24/12
Nature of Course	M (Practical Application)	
Pre-Requisites	Programming Languages	

Course Objectives:

1	To demonstrate technical, interdisciplinary and interpersonal abilities.
2	To enhance problem-solving and critical thinking abilities through the identification and resolution of technical challenges.

Course Outcomes:

Upon completion of the course, students shall have ability to

C801.1	Identify the real-life problem from societal need point of view.	[AP]
C801.2	Choose and compare alternative approaches to select most feasible one.	[C]
C801.3	Analyze and synthesize the identified problem from technological perspective.	[A]
C801.4	Design the reliable and scalable solution to meet challenges.	[C]
C801.5	Examine and validate the solution based on the criteria specified.	[A]

Course Guidelines:

1. The entire semester shall be utilized by the students to do their project work by receiving the directions from the project guide.
2. Every student shall have a project guide who is the member of the faculty of the institution for the in-house project or an industry mentor from the industry as project guide for an industry/internship project.
3. Identification of project guide has to be completed by the end of previous semester of the project work to be carried out.
4. The duration may be used for library reading, laboratory work, literature survey, computer analysis or field work as assigned by the guide and also to present periodical seminars about the progress made in the project.
5. Number of students in the project team should be maximum of 4.
6. Students can select project topics from the thrust areas.
7. Projects can be Research Based, Application Based, or Multidisciplinary.
8. Students can choose projects in line with the Departmental Mission, Vision and Program Outcomes.
9. Students can identify the project area / title, obtain the consent of faculty to guide them.
10. Students can make use of college subscribed E-resources like IEEE, ScienceDirect and Elsevier to choose base papers and thereby do literature surveys.
11. After project guide allocation, the student team must meet the respective project guide and update about the status of project periodically.
12. While working on the project, every student team must keep a project diary and record all relevant information. The diary must be verified and signed by the project guide which will be the periodic progress report and submitted during the project review to the project coordinator.

13. Students should not be involved in unethical behaviour, such as plagiarism, copyright violations, etc while working on projects and when submitting project reports.
14. The progress of the project will be evaluated on a continuous basis by conducting periodic internal reviews. The review committee may be constituted by the Head of the Department.
15. A final external project viva-voce examination will be conducted to evaluate the student project work based on oral presentation and the project report by an Internal and External Examiner.
16. Every student team will be required to prepare and submit two (2) copies plus (no. of students) copies of the Project report of typical length 30 – 60 pages (excluding Appendices).
17. The final report shall be in typewritten form as specified in the guidelines issued by the COE.
18. As outcome of the project, students are motivated to publish papers in Scopus Indexed Journals or present the project work in International Conferences.

Summative assessment based on Continuous and End Semester Examination

Activity	Month	Continuous Assessment [60 marks]	End Semester Examination [40 marks]
Project Evaluation	February	30	100
Project Evaluation	March	30	
Project Evaluation	April	40	