HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST

HICET

HINDUSTHAN

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Curriculum and ODD Semesters Syllabus for the Batch

2024 – 2028 (R2022)

2023 – 2027 (R2022)

2022 – 2026 (R2022)

2021 – 2025 (R2019 with Amendments)

(Board of Studies held on 18.05.2024)

(Academic Council Meeting held on 21.06.2024)

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY,

COIMBATORE 641 032

(An Autonomous Institution, Affiliated to Anna University, Chennai)

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.
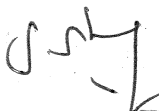
MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.
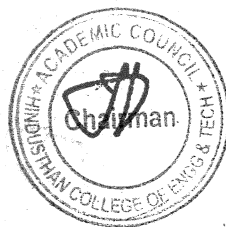
Chairman - BoS
AIML - HiCET

Dean (Academics)
HiCET

VISION AND MISSION OF THE DEPARTMENT

VISION

To impart quality education for students in the field of Artificial Intelligence and human-machine partnership in the technological-embedded world and create competent professionals who serve the greater cause of society.
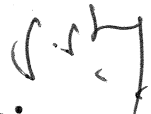
MISSION

DM1: To provide a student-centric learning environment to create competent professionals with knowledge in artificial intelligence, machine learning techniques, natural language processing, deep-learning and computer vision.

DM2: To facilitate the students to develop the necessary skills to sustain in today's globalised technological society, in pursuit of excellence by keeping high personal and professional values and ethics.

DM3: To nurture their skills in research and innovation that contributes to the development of society.

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AIML - HiCET

Dean (Academics)
HiCET

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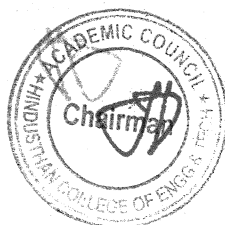
PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

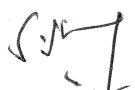|	Graduate attributes	Descriptions
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as,

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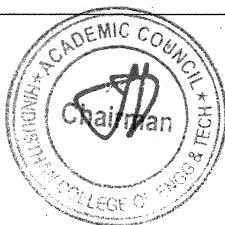
		being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	An ability to apply advanced core AI technologies, to extract information and provide knowledge to intelligent decision-making systems and human-AI collaboration.
PSO2	An ability to develop a principled and thoughtful approach to the machine learning tools that can address complex cognitive tasks for the betterment of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To acquire strong knowledge in the domain of artificial intelligence and machine learning theory and principles for identifying, analyzing and solving problems.

PEO2: To enable students to build intelligent machines, software, or applications with a cutting-edge combination of machine learning, analytics, and visualization technologies.

PEO3: To improve students' ability to work effectively within a team and apply appropriate practices within a professional, legal and ethical framework for societal needs, and accomplish sustainable progress through lifelong learning and research.

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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A++' Grade)

Coimbatore - 641 032.

B.TECH. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

HINDUSTHAN

EDUCATIONAL AND CHARITABLE TRUST

HICET

CHOICE BASED CREDIT SYSTEM

Hindusthan College of Engineering and Technology
(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi& Accredited by NAAC with 'A++' Grade)
Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.
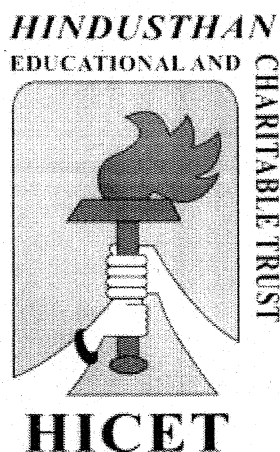
DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (UG)

REGULATION-2022

For the students admitted during the academic year 2024-2025 and onwards

SEMESTER I (Credit : 18)										
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY										
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT										
2	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
3	22CY1152	Chemistry for Computational Sciences	BSC	2	0	2	3	4	50	50	100
4	22IT1151	Python Programming and Practices	ESC	2	0	2	3	4	50	50	100
5	22IT1152	Introduction to Web Application Development	ESC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)										
6	22HE1072	ENTREPRENEURSHIP & INNOVATION	AEC	1	0	0	1	1	100	0	100
7	22HE1073	INTRODUCTION TO SOFT SKILLS	SEC	2	0	0	0	1	100	0	100
MANDATORY COURSES										
8	22MC1093/ 22MC1094	தமிழர்மரபு / Heritage of Tamil	MC	2	0	0	1	2	100	0	100
9	22MC1095	Universal Human Values (Common to All Branches)	MC	2	0	0	0	2	40	60	100
			TOTAL	18	1	8	18	26	580	320	900

SEMESTER II (Credits – 23)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA2103	Differential Equations And Linear Algebra	BSC	3	1	0	4	4	40	60	100
2	22PH2101	Basics of Material Science	BSC	2	0	0	2	3	40	60	100
THEORY WITH LAB COMPONENT											
4	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
5	22PH2151	Physics For Circuit Engineering Programme	BSC	2	0	2	3	4	50	50	100
6	22CS2256	Problem Solving using c Programming	ICC	2	0	2	3	4	50	50	100
7	22IT2253	Dynamic Web Design	PCC	2	0	1	2	3	50	50	100
PRACTICAL											
7	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8	22HE2071	Design Thinking	AEC	1	0	2	2	2	100	0	100
9	22HE2072	SOFT SKILLS AND APTITUDE-1	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2091/ 22MC2092	தமிழர்/ *Heritage of Tamils & TECHNOLOGY*	MC	2	0	0	1	2	100	0	100
11	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, inanyone of the personality and character development programmes and undergo training for about 80 hours							
			TOTAL	18	1	12	23	29	630	370	1000

SEMESTER III (Credits – 25)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA3106	Discrete Mathematics	BSC	3	1	0	4	4	40	60	100
2	22AI3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22AI3202	Foundations of Artificial Intelligence	PCC	3	1	0	4	4	40	60	100
4	22AI3203	Microprocessor and Embedded Systems	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22AI3251	OOPS using Java	ICC	3	0	2	4	4	50	50	100
PRACTICAL											
6	22AI3001	Microprocessor and Embedded Systems Laboratory	ESC	0	0	4	2	4	60	40	100
7	22AI3002	Foundations of Artificial Intelligence Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills And Aptitude -2	SEC	1	0	0	1	1	100	0	100
9	22AI3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
10	22MC3191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	2	100	0	100
			TOTAL	**17**	**2**	**14**	**25**	**34**	**590**	**410**	**1000**

SEMESTER IV (Credits – 23)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2	22AI4201	Database Management Systems	PCC	3	0	0	3	3	40	60	100
3	22AI4202	Data Visualization	ICC	3	0	0	3	3	40	60	100
4	22AI4203	Software Design with UML	PCC	3	0	0	3	3	40	60	100
5	22MA4102	Applied Statistics and Queuing Theory	BSC	2	1	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
6	22AI4251	Operating Systems	PCC	3	0	2	4	4	50	50	100

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		PRACTICAL									
7	22AI4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22AI4002	Data Visualization Laboratory	ICC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
			TOTAL	17	0	12	23	31	480	420	900

SEMESTER V (Credits – 22)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI5201	Machine Learning Techniques & Tools	PCC	3	1	0	4	4	40	60	100
2	22AI5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22AI53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22AI53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22AI53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22AI5251	Introduction to Design Thinking	ICC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22AI5001	Machine Learning Techniques & Tools Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE5071	Soft Skills -4/Foreign Languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	18	1	6	22	25	410	390	800

SEMESTER VI (Credits – 24)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI6201	Compiler Design	PCC	3	0	0	3	3	40	60	100
2	22HE6101	Professional Ethics	HSC	3	0	0	3	3	40	60	100
3	22AI63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100

4	22AI63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5	22AI64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22AI64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
7	22CY6101	Environmental Studies	BSC	2	0	0	2	3	40	60	100
PRACTICAL											
8	22AI6001	Mini Project	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	**22HE6071**	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
			TOTAL	22	0	4	24	27	440	460	900

SEMESTER VII (Credits – 20)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI7201	Big Data Analytics	PCC	3	0	0	3	3	40	60	100
2	22AI7202	Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22AI73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6	22AI7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22AI7701	Internship - II*	SEC	0	0	0	2	2	100	0	100
			TOTAL	15	1	4	20	22	360	340	700

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII (Credits – 10)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1	22AI8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
			TOTAL	0	0	20	10	20	100	100	200

Note:

1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extracredits printed in the Consolidated Mark sheet as per the regulation.
2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2022 – 23.

SEMESTER WISE CREDIT DISTRIBUTION

S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	3	-	2	-	-	25
3	ESC	6	2	5	-	-	-	-	-	13
4	PCC	-	5	13	17	12	5	9	-	61
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	2	4	3	1	1	2	2	10	25
8	MC	✓	✓							
	Total	18	23	25	23	22	24	20	10	165

Table header: **B.E. / B.TECH.PROGRAMMES**

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3

4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE
I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3

				L	T	P		
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
3	22AI7401	Fundamentals Of Management For Engineers	OEC	3	0	0	3	3

OPEN ELECTIVE IV

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3

3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Generic AI	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And AR / VR	Vertical VI Full Stack Development
22AI5301 Data warehouse and Mining	22AI5304 Intelligent Multi Agent and Expert systems	22AI5307 Principles of Cloud Computing	22AI5310 Modern Cryptography and Network Security	22AI5313 Computer Graphics	22AI5316 Web Technology
22AI5302 Python for Data Science	22AI5305 Network Science and Modeling	22AI5308 Virtualization	22AI5311 Ethical Hacking	22AI5314 Image and video analytics	22AI5317 Front End Development with REACT and TYPESCRIPT
22AI5303 Exploratory Data Analysis and Time series	22AI5306 Business Intelligence	22AI5309 Cloud Computing Architecture & Deployment Models	22AI5312 Digital and Mobile Forensics	22AI5315 Game Programming	22AI5318 Node JS
22AI6301 Information Retrieval	22AI6303 Knowledge Engineering	22AI6305 Cloud Services Management	22AI6307 Cyber forensics and information security	22AI6309 Computer Vision	22AI6311 NoSql Databases with Mongo DB
22AI6302 Data Security	22AI6304 Explainable AI	22AI6306 Cloud Application Development	22AI6308 Secured Network Protocols and Standards	22AI6310 Introduction to Augmented Reality	22AI6312 DevOps
22AI7301 Recommender Systems	22AI7302 Ethics and Policy issues in AI	22AI7303 Cloud Security	22AI7304 Data privacy preservation	22AI7305 Virtual Reality	22AI7306 Web Application Security

Note:
Students are permitted to choose all professional electives from any of the verticals.

Vertical I
Data Science

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5301	Data warehouse and Mining	PEC	3	0	0	3	3
2	22AI5302	Python for Data Science	PEC	3	0	0	3	3

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3	22AI5303	Exploratory Data Analysis and Time series	PEC	3	0	0	3	3
4	22AI6301	Information Retrieval	PEC	3	0	0	3	3
5	22AI6302	Data Security	PEC	3	0	0	3	3
6	22AI7301	Recommender Systems	PEC	3	0	0	3	3

Vertical II
Generic AI

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5304	Intelligent Multi Agent and Expert systems	PEC	3	0	0	3	3
2	22AI5305	Network Science and Modeling	PEC	3	0	0	3	3
3	22AI5306	Business Intelligence	PEC	3	0	0	3	3
4	22AI6303	Knowledge Engineering	PEC	3	0	0	3	3
5	22AI6304	Explainable AI	PEC	3	0	0	3	3
6	22AI7302	Ethics and Policy issues in AI	PEC	3	0	0	3	3

Vertical III
Cloud Computing

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5307	Principles of Cloud Computing	PEC	3	0	0	3	3
2	22AI5308	Virtualization	PEC	3	0	0	3	3
3	22AI5309	Cloud Computing Architecture & Deployment Models	PEC	3	0	0	3	3
4	22AI6305	Cloud Services Management	PEC	3	0	0	3	3
5	22AI6306	Cloud Application Development	PEC	3	0	0	3	3
6	22AI7303	Cloud Security	PEC	3	0	0	3	3

Vertical IV
Cyber Security and Data Privacy

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5310	Modern Cryptography and Network Security	PEC	3	0	0	3	3

S No	Course Code	Course Title	Category	L	T	P	Total Contact Periods	Credits
2	22AI5311	Ethical Hacking	PEC	3	0	0	3	3
3	22AI5312	Digital and Mobile Forensics	PEC	3	0	0	3	3
4	22AI6307	Cyber forensics and information security	PEC	3	0	0	3	3
5	22AI6308	Secured Network Protocols and Standards	PEC	3	0	0	3	3
6	22AI7304	Data privacy preservation	PEC	3	0	0	3	3

Vertical V
Computer Vision And AR / VR

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5313	Computer Graphics	PEC	3	0	0	3	3
2	22AI5314	Image and video analytics	PEC	3	0	0	3	3
3	22AI5315	Game Programming	PEC	3	0	0	3	3
4	22AI6309	Computer Vision	PEC	3	0	0	3	3
5	22AI6310	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	22AI7305	Virtual Reality	PEC	3	0	0	3	3

Vertical VI
FULL STACK DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5316	Web Technology	PEC	3	0	0	3	3
2	22AI5317	Front End Development with REACT and TYPESCRIPT	PEC	3	0	0	3	3
3	22AI5318	Node JS	PEC	3	0	0	3	3
4	22AI6311	NoSql Databases with Mongo DB	PEC	3	0	0	3	3
5	22AI6312	DevOps	PEC	3	0	0	3	3
6	22AI7306	Web Application Security	PEC	3	0	0	3	3

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree. For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For a minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

AIML OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5231	Sem 5: Datastructures using C Programming	MDC	3	0	0	3	3
2	22AI6231	Sem 6: Introduction to Databases	MDC	3	0	0	3	3
3	22AI6232	Sem6: Foundation of Artificial Intelligence & Machine Learning	MDC	3	0	0	3	3
4	22AI7231	Sem 7: Introduction to Robotics	MDC	3	0	0	3	3
5	22AI7232	Sem 7: Foundations of Data Analytics	MDC	3	0	0	3	3
6	22AI8231	Sem 8: Deep Learning -Principles& Practices	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I
Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5231	Financial Management	MDC	3	0	0	3	3
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II
Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	22MB72334	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III
Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3

3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B. TECH (HONS) AI & ML

Vertical I ROBOTICS	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III CYBER PHYSICAL SYSTEMS
22AI5204 Foundations of Robotics	22AI5205 Public Key Infrastructure and Trust Management	22AI5206 Principles of Cyber Physical Systems
22AI6203 Sensors and Actuators	22AI6205 Introduction to block chain	22AI6207 Communication for CPS
22AI6204 Robots, bots and communication	22AI6206 Cryptocurrency	22AI6208 CPS System Design
22AI7203 Human-Robot Interaction	22AI7205 Smart Contracts and Solidity	22AI7207 CPS for Internal and External Security
22AI7204 Medical Robotics	22AI7206 Block chain and distributed ledger technology	22AI7208 Biomedical Instrumentation for Cyber Physical Systems
22AI8201 Fundamentals of Autonomous Systems	22AI8202 Bitcoin Essentials and Use-Cases	22AI8203 Security and Privacy of CPS

B. TECH (HONS) AI & ML SPECIALIZATION WITH ROBOTICS

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5204	Sem 5: Foundations of Robotics	PC	3	0	0	3	3
2	22AI6203	Sem 6: Sensors and Actuators	PC	3	0	0	3	3
3	22AI6204	Sem 6: Robots, bots and communication	PC	3	0	0	3	3
4	22AI7203	Sem 7: Human-Robot Interaction	PC	3	0	0	3	3
5	22AI7204	Sem 7: Medical Robotics	PC	3	0	0	3	3
6	22AI8201	Sem 8: Fundamentals of Autonomous Systems	PC	3	0	0	3	3

B. TECH (HONS) AI & ML SPECIALIZATION WITH BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22AI6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22AI6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22AI7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22AI7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3

6	22AI8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B. TECH (HONS) AI & ML SPECIALIZATION WITH CYBER PHYSICAL SYSTEMS

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5206	Sem 5: Principles of Cyber Physical Systems	PC	3	0	0	3	3
2	22AI6207	Sem 6: Communication for CPS	PC	3	0	0	3	3
3	22AI6208	Sem 6: CPS System Design	PC	3	0	0	3	3
4	22AI7207	Sem 7: CPS for Internal and External Security	PC	3	0	0	3	3
5	22AI7208	Sem 7: Biomedical Instrumentation for Cyber Physical Systems	PC	3	0	0	3	3
6	22AI8203	Sem 8: Security and Privacy of CPS	PC	3	0	0	3	3

Credit Distribution R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	18	23	25	23	22	24	20	10	165

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SYLLABUS

I SEMESTER

Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22HE1151	ENGLISH FOR ENGINEERS (Common to all Branches)	2	0	2	3

Course Objective	The student should be able
	1. To help the students of engineering and technology develop a strong base in the use of English.
	2. To help learners use language effectively in professional writing.
	3. To impart basic English grammar and essentials of important language skills
	4. To impart knowledge about the importance of vocabulary and grammar
	5. To develop the communication skills of the students in both formal and informal situations

Unit	Description	Instructional Hours
I	**Language Proficiency:** Parts of Speech, Degrees of Comparison, Abbreviation& Acronyms **Writing:** Process Description, Instructions. **Vocabulary** – Words on Environment. **Practical Component: Listening-** Watching Short Videos and answer the questions, **Speaking-** Self introduction , Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts / interviews **Reading-** Purpose of Reading - Churning & Assimilation, Interpreting Ideas - Interpreting Graphs in Technical Writing.	7+2
II	**Language Proficiency:** Types of Sentences, Framing Question, One Word Substitution **Writing:** Writing Checklist, Reading Comprehension. **Vocabulary–** Words on Entertainment. **Practical Component: Listening-**Comprehensions based on TED talks **Speaking-** Story Telling **Reading -** Skimming – Scanning – Reading: Scientific Texts	7+2
III	**Language Proficiency:** Tenses, Conditional Clause ('If' clause), Active and Passive voices, **Writing:** Formal letter (invitation, acceptance, decline, Congratulation) Cloze test. **Vocabulary** – Words on Tools. **Practical Component: Listening-**Listening pre-recorded English language learning programme **Speaking -** Just a minute **Reading-** Reading feature articles (from newspapers and magazines) -Reading to identify point of view and perspective (opinion pieces, editorials etc.)	5+4
IV	**Language Proficiency:** Subject Verb Concord, Articles, The Use of Prefixes and Suffixes **Writing:** Preparing Agenda &Minutes, Writing Recommendations. **Vocabulary–** Words on Engineering process. **Practical Component: Listening-**An interview with someone who works for recruitment personnel. **Speaking-**Presentation on a general topic. **Reading-** Reading Comprehension - Literary Texts.	5+4
V	**Language Proficiency:** Prepositions, Phrasal Verbs, Modal Auxiliaries, **Writing:** Letter to the Editor, Sequencing of Sentences **Vocabulary** –Words on Engineering material **Practical Component: Listening-** Listening- Comprehensions based on Nat Geo/Discovery channel videos **Speaking-** Preparing posters and presenting as a team. **Reading-** Biographies, Travelogues, Technical blogs.	6+3
	Total Instructional Hours	45

Course Outcome	After completion of the course the learner will be able
	CO1: Understand English and converse effectively.
	CO2: Enable the students to write coherently and cohesively.
	CO3: Enable the development of basic grammar to enhance language for a better communication
	CO4: Use suitable vocabulary and grammar with confidence and express their ideas both in speech and writing.
	CO5: Follow the etiquettes in formal and informal communication.

TEXT BOOKS:
T1- Raymond Murphy, "English Grammar in Use"-5theditionCambridgeUniversityPress, 2019.
T2-Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.

REFERENCE BOOKS:
R1- Kapoor A.N., Business Letters for Different Occasions, New Delhi: S. Chand & Co. Pvt. Ltd., 2012.
R2-RaymondMurphy, " English Grammar For ESL Learners - Premium Fourth Edition.
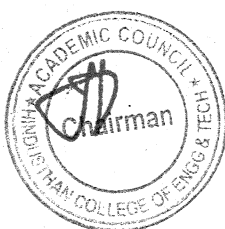R3- McCarthy, Michael et.al (2011) English Vocabulary in Use – advanced, Cambridge University Press.

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PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	2	-	3	2	1	-	-
CO2	-	-	-	-	2	3	2	3	1	3	1	-	-	-
CO3	-	-	-	3	-	2	-	2	2	3	2	2	-	-
CO4	-	-	-	-	-	2	-	2	1	3	1	1	-	-
CO5	-	-	-	2	-	-	-	2	3	3	3	1	-	-
AVG	-	-	-	2.5	2	2.3	2	2.2	1.8	3	1.8	1.3	-	-

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Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MA1101	MATRICES AND CALCULUS (Common to all Branches)	3	1	0	4

Course Objective	**The learner should be able to** 1. Construct the characteristic polynomial of a matrix and use it to identify Eigen values and Eigenvectors 2. Impart the knowledge of single variate calculus. 3. Familiarize the student with functions of several variables. 4. Acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications. 5. Make a vector differential operator for vector function and theorems to solve engineering problems

Unit	Description	Instructional Hours
I	**Matrices** Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**Single Variate Calculus** Rolle's Theorem – Lagrange's Mean Value Theorem - Maxima and Minima – Taylor's and Maclaurin's Series.	12
III	**Functions of Several Variables** Partial derivatives - Total derivative - Jacobians – Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.	12
IV	**Integral Calculus** Double integrals in Cartesian coordinates – Area enclosed by plane curves (excluding surface area) – Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.	12
V	**Vector Calculus** Gradient, divergence and curl vectors - Green's theorem - Stoke's and Gauss divergence theorem (statement only) for cubes only.	12
	Total Instructional Hours	60

Course Outcome	**At the end of the course, the learner will be able to** CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form. CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve. CO3: Able to use differential calculus ideas on several variable functions. CO4: Apply multiple integral ideas in solving areas, volumes and other practical problems. CO5: Apply the concept of vector calculus in two and three-dimensional spaces.

TEXT BOOKS:
T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th edition, 2019.
T2 - K. P. Uma and S. Padma, "Engineering Mathematics I (Matrices and Calculus) ", Pearson Ltd,2022.

REFERENCE BOOKS:
R1 - Jerrold E. Marsden, Anthony Tromba, "Vector Calculus", W.H.Freeman, 2003-Strauss M. J, G. L Bradley and K. J .Smith, "Multivariable calculus", 6th edition, Prentice Hall, 2011.
R2 - Veerarajan T, "Engineering Mathematics", 5th edition, Mc Graw Hill Education(India) Pvt Ltd, New Delhi, 2016.
R3 - G. B. Thomas and R. L. Finney, "Calculus and Analytical Geometry", 9th Edition, Addison Wesley Publishing Company, 2016.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	-	-	1	2	2	3	2
CO2	3	3	3	3	2	2	2	-	-	1	2	2	2	2
CO3	3	3	3	3	2	2	2	-	-	1	2	2	2	2
CO4	3	3	3	3	2	2	2	-	-	1	2	2	2	2
CO5	3	3	3	3	2	2	2	-	-	1	2	2	3	3
AVG	3	3	3	3	2.2	2	2			1	2	2	2.4	2.2

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Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22CY1152	Chemistry for Computational Sciences	2	0	2	3

Course Objective	The learner should be able to
	1. Inculcate sound understanding of water quality parameters and water treatment techniques.
	2. Apply electrochemical basics to the field of battery technology and the main components, fundamental aspects of biosensors.
	3. Acquire knowledge on the concepts of chemistry involved in display systems and conducting polymer materials.
	4. Acquire the concept and working principle of spectral analytical instruments and applications.
	5. Understand and gain the knowledge of electronic waste management.

Unit	Description	Instructional Hours
I	**WATER SCIENCE** Impurities in Water, Hardness of Water and Boiler feed Water – Boiler troubles -Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosion- - Softening Methods - Ion-Exchange Method, Desalination of Brackish Water - Reverse Osmosis. **Estimation of hardness of water by EDTA.** **Determination of Dissolved Oxygen in sewage water by Winkler's method.** **Estimation of alkalinity of water sample by indicator method.**	6+9
II	**BATTERIES AND SENSORS:** Batteries - battery characteristics- classification of batteries: primary, secondary - Applications –Alkaline Battery – Lead-Acid Battery – Lithium Ion Batteries – Fuel Cells –Hydrogen Oxygen fuel cell and Solar cells – Advantages. Sensors - Biosensors - application and advantages. **Estimation of Ferrous iron by Potentiometry**	6+3
III	**ORGANIC ELECTRONIC MATERIALS** Conducting Polymers types and mechanism – Organic Semiconducting materials – Fullerenes – C60- Organic dielectric materials- definition – working principle – Polystyrene, PMMA- Properties & Applications in Liquid Crystal Display (LCDS) - Principle - construction – working and applications.	6
IV	**SPECTRAL ANALYSIS** Introduction- UV- Visible Spectroscopy- Beer – Lambert's Law- IR-Spectroscopy, principles – instrumentation (block diagram only)and applications – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry **Determination of Fe^{2+} by colorimetric method.**	6
V	**ELECTRONIC WASTE MANAGEMENT** E-waste - Introduction - Definition – Sources - Effects of E-waste on environment and human health - need for E-waste management - Extraction Gold and copper from printed circuit boards (PCBs) - Disposal treatment methods of E-waste - recycling of E-waste. **Estimation of copper by EDTA method.**	6+3
Total Instructional Hours		45

Course Outcome	At the end of the course, the learner will be able to
	CO1: Explain the basic properties of water and its usage in domestic and industrial purposes
	CO2: Describe the fundamentals of battery and its types, and to attain basic knowledge about sensors.
	CO3: Utilize the electronic materials for various applications.
	CO4: Extend the knowledge on the concepts of spectroscopy and its applications on analytical instrumentation.
	CO5: Understand the environmental impacts of electronic-waste

TEXT BOOKS
T1 - P. C. Jain& Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi, 17th edition, (2022).
T2 -O. G. Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCE BOOKS:
R1 – Shikha Agarwal "Engineering Chemistry -Fundamentals and Applications, Cambridge University, Press, Delhi, 2019
R2 - S. S. Dara "A Text book of Engineering Chemistry" S. Chand& Co. Ltd., New Delhi (2018).

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PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	1	1	1	-	1	-	1	2		
CO2	2	3	2	1	1	1	1	-	1	-	1	2		
CO3	2	2	2	2	1	1	1	-	1	-	1	2		
CO4	2	2	2	2	1	1	1	-	1	-	1	2		
CO5	2	3	2	-	-	-	3	-	-	-	-	-		
AVG	2	2.6	2.2	1.5	1	1	1.4	-	1	-	1	2		

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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22IT1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objectives	The learner should be made: 1. To understand and be aware of algorithmic problem solving 2. To read, understand and write simple Python programs 3. To develop Python functions/programs with conditionals and loops 4. To use Python data structures -- lists, tuples, dictionaries 5. To do input and output with files in Python

Unit	Description	Instructional Hours
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudocode, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion) **Illustrative problems: Finding LCM/GCD, Fahrenheit to Celsius conversion, Performing Matrix addition.**	6
II	**DATA, STATEMENTS and CONTROL FLOW** Data Types, Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if –elif-else); Iteration: state, while, for, break, continue, pass. **Illustrative problems: Area of the polygon, check the given year is Leap year or not, Factorial of a Number, Fibonacci series generation**	6
III	**FUNCTIONS and STRINGS** Functions, parameters and arguments; Fruitful functions: return values, local and global scope, function composition, recursive functions. Strings: string slices, immutability, string functions and methods, string module. **Illustrative programs: Perform Linear Search, Selection sort, Sum of all elements in a List, Pattern Programs**	6
IV	**LISTS, TUPLES and DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension. **Illustrative programs: List and Dictionary manipulation, Finding Maximum/minimum/average in a List, String processing.**	6
V	**FILES, MODULES and PACKAGES** Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, modules, packages **Illustrative programs: Creating/Reading/writing in a file, word count, Handling Exceptions scenarios with simple examples**	6
	Total Instructional Hours (Theory)	30
	Total Instructional Hours (Practicals)	30
	Total Instructional Hours	30 + 30

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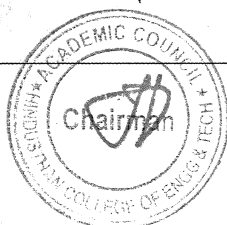
Laboratory (Practical) Exercises (The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.)	30 hours
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.) 2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of *n* variables, distance between two points). 3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern) 4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples) 5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries) 6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape) 7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters) 8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy) 9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word) 10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation) 11. Exploring Pygame tool. 12. Developing a game activity using Pygame like bouncing ball, car race etc	
Course Outcomes	At the end of the course, the learner will be able to CO1: Design effective algorithms to solve computational problems by utilizing building blocks like statements, control flow, functions, and employing problem-solving techniques with iteration and recursion. CO2: Develop fundamental Python programs that utilize data types, operators, control flow with conditionals and iteration, while incorporating comments for readability. CO3: Construct Python functions that process and manipulate strings using parameters, return values, and understand its scope. CO4: Utilize Python's built-in data structures like lists, tuples, and dictionaries to effectively store, manipulate, and access data. CO5: Create robust Python programs that interact with the file system by reading and writing text files.

TEXT BOOKS:

T1: Guido van Rossum and Fred L. Drake Jr, - An Introduction to Python (Revised and updated for Python 3.6.2), Schroff Publishers, First edition, 2017.

T2: S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, - Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019.

REFERENCE BOOKS:

R1:M.Sabrigiriraj, K.Manoharan – Programming Prowess: Conquering 110 coding challenges illustrated

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with Python code, Publisher: Hindusthan Educational Institutions, 2024

R2: Charles Dierbach —Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.

R3:Robert Sedgewick, Kevin Wayne, Robert Dondero —Introduction to Programming in Python: An Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016

Web Links for Programming Practice:
1. https://www.hackerrank.com/domains/python
2. https://leetcode.com/problemset/

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	3	3	2	1	-	-	-	-	2	-	2	3	2
CO2	1	1	3	1	1	-	-	-	-	2	-	2	2	1
CO3	2	2	3	1	2	-	-	-	-	2	-	2	2	1
CO4	2	2	3	1	3	-	-	-	-	2	1	2	2	1
CO5	2	2	3	1	3	-	-	-	-	2	1	2	2	1

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Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	22IT1152	INTRODUCTION TO WEB APPLICATION DEVELOPMENT(IT/CSE/AIML)	2	0	2	3

Course Objectives	The learner should made 1. To understand the fundamental building blocks of web pages. 2. To develop common HTML form elements for user input. 3. To analyse the basic building blocks of CSS and how to style HTML elements. 4. To apply fundamental CSS concepts for styling text, backgrounds, borders, and layout. 5. To understand different software development methodologies and their characteristics.

Unit	Description	Instructional Hours
I	**Hyper Text Markup Language-1** Web Essentials: Clients, Servers, Basic Terminologies-HTML Basic Tags – Elements - Attributes - Basic Formatting, Fonts and Colors-Hyperlink-Images- Tables - cell spanning, cell spacing- Table contents, Border. List –ordered List-Unordered List-Definition List.	06
II	**Hyper Text Markup Language-II** Frames-HTML Forms - Single line text field, Text area, Check box, Radio buttons, Password fields, Pull-down menus, File selector dialog box–HTML 5 features.	06
III	**Cascading Style Sheet-I** Introduction - CSS Syntax -Type of CSS Selector-Simple Selectors, Universal Selector, ID Selector, Class selector and Pseudo Classes – Style Specification Formats-Inline Style-Embedded Style sheet-External Style sheet.	06
IV	**Cascading Style Sheet-II** Font properties-List properties- Background properties-Colors RGB and RGBA, HSL and HSLA, Borders, Rounded Corners, Applying Shadows in border- Padding, Margin-CSS Layout- Normal Flow Layout-Relative positioning-Float positioning-Absolute positioning.	06
V	**Software Development Life Cycle** Software Development Model -Waterfall Model- Incremental Process Models- Evolutionary Process Models- Spiral Model-Agile Software Development –Agile process-Agility principles-Introduction Github.	06
	TotalInstructionalHours(Theory)	30
	Total Instructional Hours(Practical)	30
	Total Instructional Hours	60

Laboratory Practical Exercises

1. Create a basic HTML page to provide a description of yourself, using fundamental HTML tags.

2. Create a web page that embeds an image using the <img> tag and includes a hyperlink to your 'About Me' page.

3. Create an HTML web page to display a list of courses available in your department and prepare a timetable for them.

4. Create an HTML web page for a quiz program using various types of input options.

5. Develop an HTML webpage for a student registration form, incorporating various input fields and form elements.

6. Develop a basic HTML webpage for a simple calculator using inline and embedded CSS.

7. Create an HTML webpage for a Personal Portfolio using external CSS.

8. Create an HTML webpage to display a product report with a suitable background color and an image. Use various text properties and padding to enhance the layout.

9. Develop an HTML webpage to create a simple college website and utilize a software development process tool for its development.

10. Create a GitHub account, then create a new repository. Develop an HTML code to display your name.

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	At the end of the course, the learner will be able to	
Course Outcomes	CO1	Describe the roles of clients and servers, explain basic web terminologies, and apply HTML tags, attributes, and CSS to format and structure web content.
	CO2	Design web pages with frames, integrate HTML forms with single-line text fields, text areas, checkboxes, radio buttons, password fields, pull-down menus, and file selector dialog boxes.
	CO3	Analyse and apply fundamental CSS syntax including selectors and style specification formats to achieve desired webpage aesthetics.
	CO4	Apply fundamental CSS styling concepts to create visually appealing and well-structured web pages.
	CO5	Develop a critical understanding of various software development and their core principles to effectively select and implement an approach for project management.

TEXT BOOKS:
T1 - Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
T2 – J.Jaya, S.Shankar, M.Ganesan, M.Umapriya"Introduction To Web Application Development",schand publications,2023
T3 - Roger S.Pressman, Bruce R. Maxim, Software engineering- "A practitioner's Approach, McGraw-Hill International Edition", 8th edition (2015). ISBN: 9789353165710

REFERENCES:
R1 - Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
R2- Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
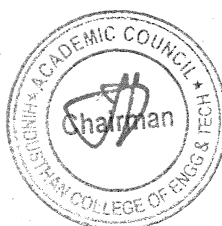
WEB RESOURCES:
https://www.w3schools.com/html/default.asp
https://html.com/
https://www.geeksforgeeks.org/html-tutorial/

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	3	-	-	-	1	1	2	1	1	3
CO2	1	1	3	-	3	-	-	-	1	1	2	1	1	3
CO3	2	2	3	3	3	-	-	-	1	1	2	1	1	3
CO4	2	2	3	-	3	-	-	-	1	1	3	1	1	3
CO5	2	2	1	1	1	-	-	1	2	2	3	2	2	1

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MANDATORY COURSES

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Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech /I	22HE1095	UNIVERSAL HUMAN VALUES (COMMON TO ALL BRANCHES)	2	0	0	0

Course Objectives	The student should be made 1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings. 2. Tofacilitatethedevelopmentofa Holisticperspectiveamongstudentstowardslifeandprofession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way. 3. Tohighlightplausibleimplicationsofsucha HolisticunderstandingIntermsofethicalhumanconduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Unit	Description	Instructional Hours
I	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations	6
II	**Harmony in the Human Being and Harmony in the Family** Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body - Programme to ensure self-regulation and Health	6
III	**Harmony in the Family and Society** Harmony in the Family – the Basic Unit of Human Interaction. Values in Human to Human Relationship 'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship 'Respect' – as the Right Evaluation Understanding Harmony in the Society	6
IV	**Harmony in the Nature / Existence** Understanding Harmony in the Nature.Inter connectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasivespace Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence. Vision for the Universal Human Order	6
V	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order- Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	6
	Total Instructional Hours	30

Course Outcome	At the end of the course, the learner will be able CO1: To become more aware of holistic vision of life - themselves and their surroundings. CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions. CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior. CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and in handling problems with sustainable solutions. CO5: To develop competence and capabilities for maintaining Health and Hygiene.

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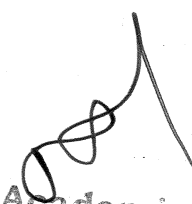**AIML - HiCET**
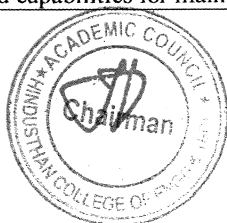
Dean (Academics)
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Reference Books:

R1- A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

R2- Teachers'ManualforAFoundationCourseinHumanValuesandProfessionalEthics,RRGaur, R Asthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-53-2

R3-JeevanVidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.

R4- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

CO PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	-	2	-	-	-	2	-	-	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2
AVG	2	3	3	-	2	-	-	-	2	-	-	2

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Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/I	22HE1072	ENTREPRENEURESHIP AND INNOVATION (Common to all Branches)	1	0	0	1

Course Objectives	The student should be made 1. To acquire the knowledge and skills needed to manage the development of innovation. 2. To recognize and evaluate potential opportunities to monetize these innovations. 3. To plan specific and detailed method to exploit these opportunities. 4. To acquire the resources necessary to implement these plans. 5. To make students understand organizational performance and its importance.

Module	Description	
1	Entrepreneurial Thinking	
2	Innovation Management	
3	Design Thinking	
4	Opportunity Spotting / Opportunity Evaluation	
5	Industry and Market Research	
6	Innovation Strategy and Business Models	
7	Financial Forecasting	
8	Business Plans/ Business Model Canvas	
9	Entrepreneurial Finance	
10	Pitching to Resources Providers / Pitch Deck	
11	Negotiating Deals	
12	New Venture Creation	
13	Lean Start-ups	
14	Entrepreneurial Ecosystem	
15	Velocity Venture	
	TOTAL INSTRUCTIONAL HOURS	15

Course Outcome	At the end of the course, the learner will be able to CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects. CO2: Understand the processes by which innovation is fostered, managed, and commercialized. CO3: Remember effectively and efficiently the potential of new business opportunities. CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness.. CO5: Develop a business model for a new venture, including revenue. Margins, operations, Working capital, and investment

TEXT BOOKS
T1:Arya Kumar"Entrepreneurship–CreatingandleadinganEntrepreneurialOrganization",Pearson,SecondEdition(2012).
T2: EmrahYayici"DesignThinkingMethodology", Artbiztech, FirstEdition(2016).

REFERENCE BOOKS
R1: Christopher Golis "Enterprise & Venture Capital", Allen &Unwin Publication, Fourth Edition (2007).
R2: ThomasLockWood&EdgerPapke"InnovationbyDesign",CareerPress.com,SecondEdition(2017).
R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition(2010).
WEB RESOURCES
    W1:https://blof.forgeforward.in/tagged/startup-lessons
    W2:https://blof.forgeforward.in/tagged/entrepreurship
    W3:https://blof.forgeforward.in/tagged/minimum-viable-product
    W4:https://blof.forgeforward.in/tagged/minimum-viable-product
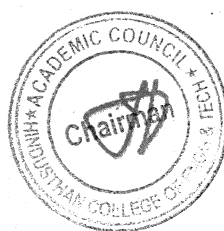   W5:https://blof.forgeforward.in/tagged/innovation

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CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2
AVG	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

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Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/1	22MC1094	HERITAGE OF TAMIL (Common to all Branches)	2	0	0	1

Course Objective	The learner should be able to
	1. Introduce students to the great History of Tamil literature.
	2. Establish the heritage of various forms of Rock art and Sculpture art.
	3. To study and understand the various folk and Martial arts of Tamil culture
	4. Introduce students to Ancient Tamil concepts to understand the richness of Tamil literature.
	5. To learn about the various influences or impacts of Tamil language in Indian culture.

Unit	Description	Instructional Hours
I	**Language and Literature** Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry _ Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidasan.	6
II	**Heritage _ Rock Art Paintings to Modern Art – Sculpture** Hero Stone to Modern Sculpture – Bronze icons – Tribes and their handcrafts - Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments – Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.	6
III	**Folk and Martial Arts** Therukoothu, Karagattem, Villupattu, Kaniyankoothu, Oyilattam, Leather puppertry, Silambattam.,Valari Tiger dance – Sports and Games of Tamils.	6
IV	**Thinai Concept of Tamils** Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Exporot and Import during Sangam age – Overseas conquest of Cholas.	6
V	**Contribution of Tamils to Indian National Movement and Indian Culture** Contribution of Tamils to Indian freedom struggle – The cultural influence of Tamils over the other parts of India – Self respect movement – Role of Siddha Medicine in indigenous systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil books.	6
	Total Instructional Hours	30

Course Outcome	At the end of the course, the learner will be able to
	CO1: Learn about the works pertaining to Sangam age
	CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture.
	CO3 Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.
	CO4: Appreciate the intricacies of Tamil literature that had existed in the past.
	CO5: Understand the contribution of Tamil Literature to Indian Culture

TEXT BOOKS:
T1- Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
T2- Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
T3- Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).

REFERENCE BOOKS:
R1-The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
R2- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu TextBookand Educational Services Corporation, Tamil Nadu)
R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

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Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MC1093	TAMIZHAR MARABHU	2	0	0	1

GE3152   தமிழர் மரபு   L T P C
1 0 0 1

அலகு I   மொழி மற்றும் இலக்கியம்   3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி

இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II   மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை   3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III   நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்   3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்

விளையாட்டுகள்.

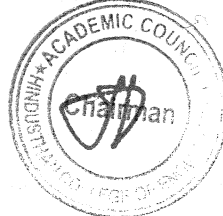### அலகு IV   தமிழர்களின் திணைக் கோட்பாடுகள்   3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V   இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு   3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழப் புத்தகங்களின் அச்சு வரலாறு.

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

Chairman, Board of Studies   Dean - Academics

Chairman - BoS
AIML - HiCET

Dean (Academics)
HiCET

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PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2
CO1	2	3	3	-	-	-	-	-	2			2
CO2	2	3	3	-	-	-	-	-	2			2
CO3	2	3	3	-	-	-	-	-	2			2
CO4	2	3	-	-	-	-	-	-	2			2
CO5	2	3	-	-	-	-	-	-	2			2
AVG	2	3	1.8	-	-	-	-	-	2			2

Chairman, Board of Studies

Chairman - BoS
AIML - HiCET

Dean - Academics

Dean (Academics)
HiCET

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Programme/ Semester	Course Code	Course Title		L	T	P	C
B.E./B.Tech/ I	22HE1073	INTRODUCTION TO SOFT SKILLS		2	0	0	0

Course Objectives:	1. To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
	2. To enhance the students ability to deal with numerical and quantitative skills.
	3. To identify the core skills associated with critical thinking.
	4. To develop and integrate the use of English language skills.

Unit	Description	Instructional Hours
I	**Lessons on excellence** Skill introspection, Skill acquisition, consistent practice	2
II	**Logical Reasoning** Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11
III	**Quantitative Aptitude** Addition and Subtraction of bigger numbers - Square and square roots - Cubes and cube roots - Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers – Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11
IV	**Recruitment Essentials** Resume Building - Impression Management	2
V	**Verbal Ability** Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement – Punctuations	4
	Total Instructional Hours	30

Course Outcome	CO1	Students will analyze interpersonal communication skills. public speaking skills.
	CO2	Students will exemplify tautology, contradiction and contingency by logical thinking.
	CO3	Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.
	CO4	Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity.
	CO5	Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar.

Chairman, Board of Studies

Dean - Academics

Chairman - BoS
AIML - HiCET

Dean (Academics)
HiCET

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Hindusthan College of Engineering and Technology

An Autonomous Institution, Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NBA (AERO, AUTO, CIVIL, CSE, ECE, EEE, IT, MECH, MCTS)
Accredited by NAAC 'A+' Grade with CGPA of 3.69 out of 4 in Cycle 2
Valley Campus, Coimbatore – 641 032, Tamil Nadu, INDIA

2022 Regulation – 2023 Batch I semester- Syllabus revision
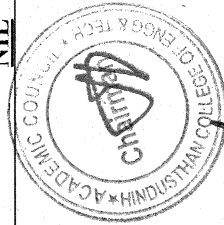
S. No	Year	Semester	Course Code and Course Name	Existing content (in academic Year 2023-24)	Revised Content (for 2024-25)	Percentage of Revision
				NIL		

New Course Introduced (2022 Regulation) – 2023 Batch I semester

S.No	Regulation	Course Code with Name	Credits
		NIL	

Chairman-BoS

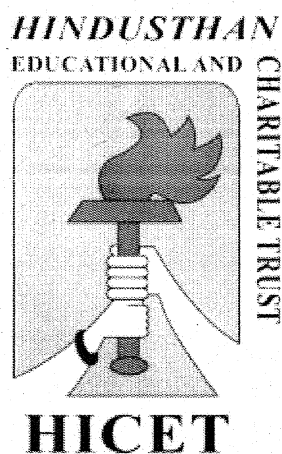**Chairman - BoS**
AIML - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A++' Grade)

Coimbatore - 641 032.

B.TECH. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

CHOICE BASED CREDIT SYSTEM

Hindusthan College of Engineering and Technology
(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi& Accredited by NAAC with 'A++' Grade)
Valley Campus, Poliachi Highway, Coimbatore, Tamil Nadu.

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (UG)

REGULATION-2022

For the students admitted during the academic year 2023-2024 and onwards

SEMESTER I (Credit : 18)										
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT											
2	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
3	22CY1151	ENGINEERING APPLICATIONS OF CHEMISTRY	BSC	2	0	2	3	4	50	50	100
4	22CS1152	Object Oriented Programming using Python	PCC	2	0	2	3	4	50	50	100
5	22IT1152	Introduction to Web Application Development	ESC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6	22HE1072	Entrepreneurship & Innovation (Common to all)	AEC	1	0	0	1	1	100	0	100
7	22HE1073	Introduction to Soft Skills	SEC	1	0	0	0	1	100	0	100
MANDATORY COURSES											
8.	22MC1093/ 22MC1094	தமிழர்மரபு / Heritage of Tamil	MC	2	0	0	1	2	100	0	100
9.	22MC1095	Universal Human Values (Common To All Branches)	MC	2	0	0	0	2	40	60	100
			TOTAL	17	1	8	18	26	580	320	900

		SEMESTER II (Credits – 23)									
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA2103	Differential Equations And Linear Algebra	BSC	3	1	0	4	4	40	60	100
2	22PH2101	Basics of Material Science	BSC	2	0	0	2	3	40	60	100
THEORY WITH LAB COMPONENT											
4	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
5	22PH2151	Physics For Engineers	BSC	2	0	2	3	4	50	50	100
6	22CS2256	Problem Solving using c Programming	ICC	2	0	2	3	4	50	50	100
7	22IT2253	Dynamic Web Design	PCC	2	0	1	2	3	50	50	100
PRACTICAL											
7	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8	22HE2071	Design Thinking	AEC	2	0	0	2	2	100	0	100
9	22HE2072	SOFT SKILLS AND APTITUDE-1	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2094/ 22MC2095	தமிழரும்தொழில்நுட்பமும் / Tamils and Technology	MC	2	0	0	1	2	100	0	100
11	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
		TOTAL		18	1	12	23	29	640	360	1000

SEMESTER III (Credits – 25)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA3106	Discrete Mathematics	BSC	3	1	0	4	4	40	60	100
2	22AI3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22AI3202	Foundations of Artificial Intelligence	PCC	3	1	0	4	4	40	60	100
4	22AI3203	Microprocessor and Embedded Systems	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22AI3251	Object Oriented Programming using Java	PCC	3	0	2	4	4	50	50	100
PRACTICAL											
6	22AI3001	Microprocessor and Embedded Systems Laboratory	ESC	0	0	4	2	4	60	40	100
7	22AI3002	Foundations of Artificial Intelligence Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills -II (Common to all)	SEC	1	0	0	1	1	100	0	100
9	22AI3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
10	22MC3191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	2	100	0	100
		TOTAL		17	2	14	25	34	590	410	1000

SEMESTER IV (Credits – 23)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2	22AI4201	Database Management Systems	PCC	3	0	0	3	3	40	60	100
3	22AI4202	Data science Essentials	ICC	3	0	0	3	3	40	60	100
4	22AI4203	Software Design with UML	PCC	3	0	0	3	3	40	60	100
5	22MA4102	Applied Statistics and Queuing Theory	BSC	2	1	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
6	22AI4251	Operating Systems	PCC	3	0	2	4	4	50	50	100

PRACTICAL											
7	22AI4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22AI4002	Data Science Laboratory	ICC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
			TOTAL	17	0	12	23	31	480	420	900

SEMESTER V (Credits – 22)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI5201	Machine Learning Techniques & Tools	PCC	3	1	0	4	4	40	60	100
2	22AI5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22AI53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22AI53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22AI53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22AI5251	Introduction to Design Thinking	ICC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22AI5001	Machine Learning Techniques & Tools Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE5071	Soft Skills -4/Foreign Languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	18	1	6	22	25	410	390	800

SEMESTER VI (Credits – 24)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI6201	Compiler Design	PCC	3	0	0	3	3	40	60	100
2	22HE6101	Professional Ethics	HSC	3	0	0	3	3	40	60	100
3	22AI63XX	Professional Elective-4	PEC/ICC	3	0	0	3	3	40	60	100

4	22AI63XX	Professional Elective-5	PEC/ICC	3	0	0	3	3	40	60	100
5	22AI64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22AI64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
7	22CY6101	Environmental Studies	BSC	2	0	0	2	3	40	60	100
PRACTICAL											
8	22AI6001	Mini Project	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	**22HE6071**	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
		TOTAL		22	0	4	24	27	440	460	900

		SEMESTER VII (Credits – 20)									
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI7201	Big Data Analytics	PCC	3	0	0	3	3	40	60	100
2	22AI7202	Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22AI73XX	Professional Elective-6	PEC/ICC	3	0	0	3	3	40	60	100
4	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6	22AI7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22AI7701	Internship - II*	SEC	0	0	0	2	2	100	0	100
		TOTAL		15	1	4	20	22	360	340	700

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

		SEMESTER VIII (Credits – 10)									
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1	22AI8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
		TOTAL		0	0	20	10	20	100	100	200

Note:

1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extracredits printed in the Consolidated Mark sheet as per the regulation.

2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.

3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2022 – 23.

SEMESTER WISE CREDIT DISTRIBUTION

S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	3	-	2	-	-	25
3	ESC	6	2	5	-	-	-	-	-	13
4	PCC	-	5	13	17	12	5	9	-	61
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	3	3	3	1	1	2	2	10	25
8	MC	✓	✓							
	Total	18	23	25	23	22	24	20	10	165

B.E. / B.TECH.PROGRAMMES

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3

				PERIODS PER WEEK				
				L	T	P		
4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE
I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3

10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3		3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3		3
12	22EE6401	Digital Marketing	OEC	3	0	0	3		3
13	22EE6402	Research Methodology	OEC	3	0	0	3		3
14	22FT6401	Traditional Foods	OEC	3	0	0	3		3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3		3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3		3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
3	22AI7401	Fundamentals Of Management For Engineers	OEC	3	0	0	3	3

OPEN ELECTIVE IV

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3

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3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Generic AI	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And AR / VR	Vertical VI Full Stack Development
22AI5301 Data warehouse and Mining	22AI5304 Intelligent Multi Agent and Expert systems	22AI5307 Principles of Cloud Computing	22AI5310 Modern Cryptography and Network Security	22AI5313 Computer Graphics	22AI5316 Web Technology
22AI5302 Python for Data Science	22AI5305 Network Science and Modeling	22AI5308 Virtualization	22AI5311 Ethical Hacking	22AI5314 Image and video analytics	22AI5317 Front End Development with REACT and TYPESCRIPT
22AI5303 Exploratory Data Analysis and Time series	22AI5306 Business Intelligence	22AI5309 Cloud Computing Architecture & Deployment Models	22AI5312 Digital and Mobile Forensics	22AI5315 Game Programming	22AI5318 Node JS
22AI6301 Information Retrieval	22AI6303 Knowledge Engineering	22AI6305 Cloud Services Management	22AI6307 Cyber forensics and information security	22AI6309 Computer Vision	22AI6311 NoSql Databases with Mongo DB
22AI6302 Data Security	22AI6304 Explainable AI	22AI6306 Cloud Application Development	22AI6308 Secured Network Protocols and Standards	22AI6310 Introduction to Augmented Reality	22AI6312 DevOps
22AI7301 Recommender Systems	22AI7302 Ethics and Policy issues in AI	22AI7303 Cloud Security	22AI7304 Data privacy preservation	22AI7305 Virtual Reality	22AI7306 Web Application Security

Note:
Students are permitted to choose all professional electives from any of the verticals.

Vertical I
Data Science

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5301	Data warehouse and Mining	PEC	3	0	0	3	3
2	22AI5302	Python for Data Science	PEC	3	0	0	3	3

3	22AI5303	Exploratory Data Analysis and Time series	PEC	3	0	0	3	3
4	22AI6301	Information Retrieval	PEC	3	0	0	3	3
5	22AI6302	Data Security	PEC	3	0	0	3	3
6	22AI7301	Recommender Systems	PEC	3	0	0	3	3

Vertical II
Generic AI

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5304	Intelligent Multi Agent and Expert systems	PEC	3	0	0	3	3
2	22AI5305	Network Science and Modeling	PEC	3	0	0	3	3
3	22AI5306	Business Intelligence	PEC	3	0	0	3	3
4	22AI6303	Knowledge Engineering	PEC	3	0	0	3	3
5	22AI6304	Explainable AI	PEC	3	0	0	3	3
6	22AI7302	Ethics and Policy issues in AI	PEC	3	0	0	3	3

Vertical III
Cloud Computing

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5307	Principles of Cloud Computing	PEC	3	0	0	3	3
2	22AI5308	Virtualization	PEC	3	0	0	3	3
3	22AI5309	Cloud Computing Architecture & Deployment Models	PEC	3	0	0	3	3
4	22AI6305	Cloud Services Management	PEC	3	0	0	3	3
5	22AI6306	Cloud Application Development	PEC	3	0	0	3	3
6	22AI7303	Cloud Security	PEC	3	0	0	3	3

Vertical IV
Cyber Security and Data Privacy

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5310	Modern Cryptography and Network Security	PEC	3	0	0	3	3

2	22AI5311	Ethical Hacking	PEC	3	0	0	3	3
3	22AI5312	Digital and Mobile Forensics	PEC	3	0	0	3	3
4	22AI6307	Cyber forensics and information security	PEC	3	0	0	3	3
5	22AI6308	Secured Network Protocols and Standards	PEC	3	0	0	3	3
6	22AI7304	Data privacy preservation	PEC	3	0	0	3	3

Vertical V
Computer Vision And AR / VR

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5313	Computer Graphics	PEC	3	0	0	3	3
2	22AI5314	Image and video analytics	PEC	3	0	0	3	3
3	22AI5315	Game Programming	PEC	3	0	0	3	3
4	22AI6309	Computer Vision	PEC	3	0	0	3	3
5	22AI6310	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	22AI7305	Virtual Reality	PEC	3	0	0	3	3

Vertical VI
FULL STACK DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5316	Web Technology	PEC	3	0	0	3	3
2	22AI5317	Front End Development with REACT and TYPESCRIPT	PEC	3	0	0	3	3
3	22AI5318	Node JS	PEC	3	0	0	3	3
4	22AI6311	NoSql Databases with Mongo DB	PEC	3	0	0	3	3
5	22AI6312	DevOps	PEC	3	0	0	3	3
6	22AI7306	Web Application Security	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree. For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For a minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

AIML OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5601	Sem 5: Data structures Using C Programming	MDC	3	0	0	3	3
2	22AI6601	Sem 6: Introduction to Databases	MDC	3	0	0	3	3
3	22AI6602	Sem 6: Foundation of Artificial Intelligence & Machine Learning	MDC	3	0	0	3	3
4	22AI7601	Sem 7: Introduction to Robotics	MDC	3	0	0	3	3
5	22AI7602	Sem 7: Foundations of Data Analytics	MDC	3	0	0	3	3
6	22AI8601	Sem 8: Deep Learning -Principles& Practices	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I
Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5601	Financial Management	MDC	3	0	0	3	3
2	22MB6601	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6602	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MB7601	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22MB7602	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8601	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II
Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5602	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6603	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6604	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7603	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	22MB7604	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8602	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III
Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5602	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6603	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3

3	22BM6603	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7603	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7603	Green Technology	MDC	3	0	0	3	3
6	22CE8602	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B. TECH (HONS) AI & ML

Vertical I ROBOTICS	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III CYBER PHYSICAL SYSTEMS
22AI5204 Foundations of Robotics	22AI5205 Public Key Infrastructure and Trust Management	22AI5206 Principles of Cyber Physical Systems
22AI6203 Sensors and Actuators	22AI6205 Introduction to block chain	22AI6207 Communication for CPS
22AI6204 Robots, bots and communication	22AI6206 Cryptocurrency	22AI6208 CPS System Design
22AI7203 Human-Robot Interaction	22AI7205 Smart Contracts and Solidity	22AI7207 CPS for Internal and External Security
22AI7204 Medical Robotics	22AI7206 Block chain and distributed ledger technology	22AI7208 Biomedical Instrumentation for Cyber Physical Systems
22AI8201 Fundamentals of Autonomous Systems	22AI8202 Bitcoin Essentials and Use-Cases	22AI8203 Security and Privacy of CPS

B. TECH (HONS) AI & ML SPECIALIZATION WITH ROBOTICS

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5204	Sem 5: Foundations of Robotics	PC	3	0	0	3	3
2	22AI6203	Sem 6: Sensors and Actuators	PC	3	0	0	3	3
3	22AI6204	Sem 6: Robots, bots and communication	PC	3	0	0	3	3
4	22AI7203	Sem 7: Human-Robot Interaction	PC	3	0	0	3	3
5	22AI7204	Sem 7: Medical Robotics	PC	3	0	0	3	3
6	22AI8201	Sem 8: Fundamentals of Autonomous Systems	PC	3	0	0	3	3

B. TECH (HONS) AI & ML SPECIALIZATION WITH BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22AI6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22AI6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22AI7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22AI7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3

S No	Course Code	Course Title	Category	L	T	P	Total Contact Periods	Credits
6	22AI8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B. TECH (HONS) AI & ML SPECIALIZATION WITH CYBER PHYSICAL SYSTEMS

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5206	Sem 5: Principles of Cyber Physical Systems	PC	3	0	0	3	3
2	22AI6207	Sem 6: Communication for CPS	PC	3	0	0	3	3
3	22AI6208	Sem 6: CPS System Design	PC	3	0	0	3	3
4	22AI7207	Sem 7: CPS for Internal and External Security	PC	3	0	0	3	3
5	22AI7208	Sem 7: Biomedical Instrumentation for Cyber Physical Systems	PC	3	0	0	3	3
6	22AI8203	Sem 8: Security and Privacy of CPS	PC	3	0	0	3	3

Credit Distribution R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	18	23	25	23	22	24	20	10	165

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III SEMESTER

SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH	22AI3201	DATA STRUCTURES	3	0	0	3

Course Objective
1. Understand the fundamental concepts of linear data structures and list
2. Comprehend the concept of various linear data structures like stack and queue.
3. Acquire the various non-linear data structures like binary tree, binary search tree, AVL Tree
4. Understand the concepts of Sorting, Searching and Hashing techniques
5. Apply graph algorithms for solving real world problems

Unit	Description	Instructional Hours
	FUNDAMENTALS OF DATA STRUCTURES AND LINKED LIST	
I	Introduction – Need for data structures – Types of data structures – List ADT-Single Linked List-Doubly Linked List-Circular Linked List- its operations.	9
	STACK AND QUEUE	
II	Stack: Array and Linked Stacks – Applications: Balancing Symbols, Expression conversion, Postfix evaluation – Queue: Array implementation of Queue and Linked list implementation of Queue, Circular Queue and its operations.	9
	TREES	
III	Tree ADT-Binary Tree-Tree Traversal Algorithms-Search Tree: Binary Search Tree-AVL Tree- B+ trees- Priority Queues- Binary Heap	9
	SEARCHING, SORTING AND HASHING	
IV	Searching: Linear search – Binary Search – Sorting: Insertion sort- Bubble sort – Selection sort – Merge sort-Quick sort- Hash Functions – Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing – Double Hashing	9
	GRAPHS	
V	Definitions – Representation of Graphs – Types of Graph – Depth-first traversal – Breadth-first traversal – Topological Sort – Minimum Spanning Tree-Prim's Algorithm-Kruskal's Algorithms-Dijkstra's Shortest path algorithm	9

Total Instructional Hours   45

Course Outcome

CO1: Comprehend the working of linear data structures and identify their applications.

CO2: Acquire knowledge the most common abstractions for data collections (e.g., stacks, queues).

CO3: Understand the various tree data structures for efficient storage and retrieval of data.

CO4: Apply Algorithms for solving problems like sorting and searching.

CO5: Employ graph data structure for solving real world problems

TEXT BOOKS:

T1: Mark A.Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2010.

T2: Reema Thareja, —Programming in C, Oxford University Press, Second Edition, 2016.

REFERENCE BOOKS:

R1: Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, 'Data structures using C', Pearson Education, 2008.

R2: Stephen G. Kochan, "Programming in C", Fourth edition, Pearson Education, 2015.

R3: Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	1	-	-	-	-	-	-	2	2	3
CO2	3	3	2	1	1	-	-	-	-	-	-	2	3	3
CO3	3	2	3	2	2	-	-	-	-	-	-	2	3	3
CO4	2	2	3	2	2	-	-	-	-	-	-	3	2	3
CO5	3	3	2	1	2	-	-	-	-	-	-	2	3	3

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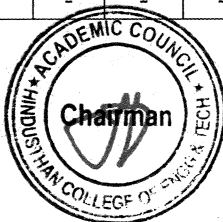
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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI3202	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE	3	1	0	4

Course Objective

1. To understand concepts of Artificial Intelligence and characteristics of intelligent agents
2. To learn the different search strategies in AI
3. To understand various knowledge representation techniques
4. To understand the concepts of Planning and uncertainty
5. To learn the concepts of learning in AI

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction - Foundations of AI - History of AI - Intelligent agent - Types of agents - Structure - Problem solving agents - AI programming languages - Introduction to LISP and PROLOG - Uninformed search strategies - Breadth first search - Uniform cost search - Depth first search - Depth limited search - Bidirectional search - Searching with partial Information.	12
II	**SEARCHING TECHNIQUES** Informed search - Strategies - A* Heuristic function - Hill Climbing - Simulated Annealing - Constraint satisfaction problem - Local Search in continuous space - Genetic algorithm - Optimal decisions in games - Pruning - Imperfect decisions - Alpha - Beta pruning - Games that include an element of chance.	12
III	**KNOWLEDGE REPRESENTATION** Knowledge based agent - The Wumpus world environment - Propositional logic - Inference rules - First-order logic - Syntax and semantics - Situation calculus - Building a knowledge base - Electronic circuit domain - Ontological Engineering - Forward and backward chaining - Resolution - Truth maintenance system.	12
IV	**PLANNING AND UNCERTAINITY** Planning - Representation of planning - Partial order planning - Planning and acting in real world - Acting under uncertainty - Bayes's rules - Semantics of Belief networks - Inference in Belief networks.	12
V	**LEARNING** Learning from observation - Inductive learning - Decision trees - Explanation based learning - Statistical Learning methods - Reinforcement Learning Case Study: Chat bot System.	12
	Total Instructional Hours	**60**

Course Outcome

CO1:	Understand the characteristics of intelligent agents
CO2:	Understand and implement the Informed search strategies
CO3:	Able to Represent a problem using first order logic.
CO4:	Apply the Baye's rule to solve the problem
CO5:	Analyze the different learning systems to solve a given problem.

TEXT BOOKS:

T1: Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rd Edition, Pearson Education, 2009.

T2: Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.

REFERENCE BOOKS:

R1:   M.Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., 1st Edition, 2008.

R2:   David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", 2nd Edition, Cambridge University Press, 2010.

R3:   Wolfgang Ertel, "Introduction to Artificial Intelligence", 1st Edition, Springer, 2017.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3	1	1	-	-	-	-	-	-	2	2	3
CO2	3	3	2	1	1	-	-	-	-	-	-	2	3	2
CO3	3	2	3	2	2	-	-	-	-	-	-	2	3	2
CO4	2	2	3	2	2	-	-	-	-	-	-	3	2	3
CO5	3	3	2	1	2	-	-	-	-	-	-	2	3	2
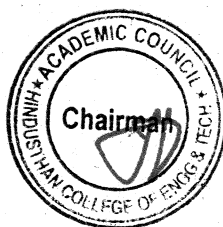
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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22AI3251	OBJECT ORIENTED PROGRAMMING USING JAVA	3	0	2	4

Course Objective

1. To conceptualize the basic Java based code for solving low complexity problems.

2. To study the Object Oriented Features in Java for solving medium complexity problems.

3. To understand the polymorphism, abstraction, inheritance and interface concepts

4. To develop Java Applications using Multithreading, Packages and Collections.

5. To familiarize the concepts of data structures using java.

Unit	Description	Instructional Hours

INTRODUCTION TO JAVA and OOP

Object Oriented Programming- First java program Hello World- JVM architecture- JDK-JRE-identifiers-variables-comments-command line arguments-operators in java-control structures- Series and patterns-strings -immutable string-string operations-String Buffer class-StringBuilder class-String Joiner-String Tokenizer.

Programs:

1. Write a program to generate the given pattern.
if n = 5,

```
    1
   1 1
  1 2 1
 1 3 3 1
1 4 6 4 1
```

Unit: I   12

2. Petya started to attend programming lessons. On the first lesson, his task was to write a simple program. The program was supposed to do the following: in the given string, consisting of uppercase and lowercase letters, it:

- Deletes all the vowels.
- Inserts a character "." before each consonant.
- Replaces all uppercase consonants with corresponding lowercase ones.

ARRAYS, CLASS AND INHERITANCE

Introduction to Arrays in java-Arrays class-declaration and initialization of an array-2D array declaration and initialization -Multi-dimensional array-Classes and objects-naming convention in java-methods-access modifiers-constructors- copy constructors -singleton class- object class-inner class-abstract class- Throwable class- types of inner class- static and non static nested class-Inheritance-Types of inheritance-Difference between inheritance in C++ and java·

Programs:

1. *A magic square is an arrangement of numbers (usually integers) in a square grid, where the numbers in each row, and in each column, and the numbers in the forward and backward main diagonals, all add up to the same number. Write a program to find whether a given matrix is a magic square or not.*

II

Input Format: *The input consists of (n*n+1) integers. The first integer corresponds to the number of rows/columns in the matrix. The remaining integers correspond to the elements in the matrix. The elements are read in row wise order, first row first, then second row and so on. Assume that the maximum value of m and n is 5.*

12

2. *A company maintains a database that has the details of all the employees. There are two levels of employees where level 1 is the top management having salary more than 100 dollars and level 2 is the staffs who are getting a salary less than 100 dollars. Create a class named Employee with empId and salary as attributes. Create another class empLevel that extends employee and categorizes the employee into various levels.*

Input Format: *The input should contain only the employee id and salary of the employee separated by space. Employee id should be of integer type and salary float type.*

Output Format: *The output of the program must display the employee id, salary, and level of the employee one below the other in the same order.*

III   ABSTRACTION, POLYMORPHISM AND INTERFACES

Abstraction in java -abstract class-control abstraction-data hiding vs abstraction-encapsulation- Runtime polymorphism-compile time vs run time polymorphism-constructor overloading-constructor chaining-private constructors and singleton class- Methods-different method calls-method overriding-method overloading-method overloading vs method overriding. Interfaces-interfaces and inheritance-class vs interface-Functional interface-nested interface-Marker interface-Comparator

III interface.

12

Programs:

1. *Write a Java program to demonstrate method overriding and dynamic method dispatch.*
Create a class named 'Animal' with a method named 'Print' that prints "Animal" to the console. Next, create two subclasses named 'Dog' and 'Cat' that inherit from the 'Animal' class and override the 'Print' method to print "Dog" and "Cat" to the console, respectively.

In the 'Main' class, declare a variable 'a' of type 'Animal' and initialize it with a new object of the 'Dog' class. Call the 'Print' method on the 'a' variable and observe that "Dog" is printed to the console. Next, set the 'a' variable to a new object of the 'Cat' class and again call the 'Print' method. Observe that "Cat" is printed to the console this time.

Input Format

No console input.

Output Format

Print the String from subclass named Dog and Cat in seperate lines.

2. *Write a java program to create an interface called "ShapeCalculator" that has a method called "calc(int n)". Then, create two classes called "Square" and "Circle" that implement the "ShapeCalculator" interface and implement the "calc(int n)" method. Your program should calculate the area and perimeter of both squares and circles.*

Input Format: *The input to your program will be a single integer that represents the side of the square and the radius of the circle.*

MULTITHREADING, PACKAGES AND COLLECTIONS

Threads-lifecycle and stages of a Thread-Thread priority-main Thread-Runnable interface-naming thread-start () method-Java packages-built in packages-user defined packages-Collections-List interface-Queue interface-Map interface-Set-Iterator-Comparator-JDBC-connectivity with JDBC-DriverManager-Statement-JDBC Exceptions.

IV
12

Programs:

1. *Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.*
2. *Simple OPAC system for library using event-driven paradigms with JDBC.*

DATA STRUCTURE IN JAVA

Arrays-Linked list- implementation of linked list-stack-implementation of stack operations-Queue-implementation of queue operations-Tree-Binary search tree implementation-Graphs-shortest path algorithm using java.

V
12

Programs:

1. *Write a program to evaluate an expression entered in "postfix" form using stack concept.*
2. *Write a program to implement single source shortest path algorithm.*

Total Instructional Hours   **60**

	CO1:	Apply Java based code for solving low complexity problems
	CO2:	Utilize Object Oriented Features in Java for solving medium complexity problems
Course Outcome	CO3:	Exploit polymorphism, abstraction, inheritance and interfaces in Java.
	CO4:	Develop Packages, Collections and Multi-Threaded Java Applications.
	CO5:	Utilize appropriate Java Classes to solve data structure based problems.

TEXT BOOKS:

1. Herbert Schildt, "JAVA The Complete Reference", 10th Edition, McGraw Hill Education, 2017.

2. Cay S. Horstman and Gary Cornell,"Core Java Volume I—Fundamentals", 11th Edition, Prentice Hall, 2018.

REFERENCE BOOKS

1. Cay Horstman, "Big Java: Early Objects", 6th Edition, Wiley Publications, 2016.

2. Ken Arnold, James Gosling, and David Holmes, "The Java Programming Language", 4th edition, Addison-Wesley, 2005.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	3	1	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	3

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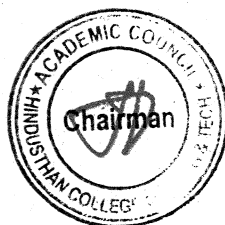
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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH	22AI3203	MICROPROCESSOR AND EMBEDDED SYSTEMS	3	0	0	3

Course Objective

1. Study the Architecture of 8085 and 8086 microprocessor.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study about communication and bus interfacing.
4. Study about overview of embedded systems
5. Analyze the various case studies to understand embedded system for a real time application

Unit	Description	Instructional Hours
I	**8086 MICROPROCESSOR** Introduction to Microprocessor – Architecture of Microprocessor 8085-Internal registers-Block diagram of 8085-Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set – Assembly language programming - Interrupts and interrupt service routines. Case study: I5 and I7 processors	9
II	**8086 SYSTEM BUS STRUCTURE** 8086 signals – Basic configurations –System design using 8086 – Introduction to Multiprogramming – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.	9
III	**I/O INTERFACING** Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer Interface – Keyboard /display controller – Interrupt controller – DMA controller.	9
IV	**EMBEDDED SYSTEMS AN OVERVIEW** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES - Core of an Embedded System – Memory, Sensors, Actuators – Communication Interface – Characteristics of Embedded system – Qualitative attributes of Embedded system	9
V	**RTOS BASED EMBEDDED SYSTEM DESIGN** Operating System basics - Types of operating systems - Task, process and threads - Task scheduling – Task communication - How to choose an RTOS - Integration and testing of Embedded hardware and firmware - Embedded system Development Environment: IDE, Cross compilation	9
	Total Instructional Hours	45

Course Outcome

CO1: Design and implement programs on 8086 microprocessor.
CO2: Design I/O circuits.
CO3: Design Memory Interfacing circuits.
CO4: Design and implement embedded systems
CO5: Design RTOS based embedded systems methodologies
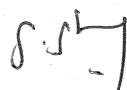
TEXT BOOKS:

T1	Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Prentice Hall of India, 2011.
T2	Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011
T3	Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlayt, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson, Second Edition
T4	Shibu K V, Introduction to Embedded Systems, Tata McGraw Hill Education Private
T5	Microprocessor Architecture, Programming and Application with the8085, Ramesh S. Gaonakar, PenramLnternational Publishing, Mumbai, (2011).

REFERENCE BOOKS:
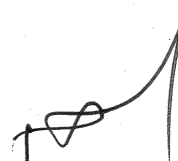
R1: Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware",TMH,2012

R2: A.K.Ray,K.M.Bhurchandi,"Advanced Microprocessors and Peripherals",3rd Edition,Tata McGrawHill,2012.

R3: The 8051 Microcontrollers Architecture, Programming & Applications Kenneth J. Ayala

R4: R.S.Gaonkar,"Microprocessor Architecture Programming and Application",with 8085,Wiley Eastern LTD.,New Delhi,2013.

R5: Embedded Systems: Architecture, Programming And Design, By Raj Kamal Second Edition, Tata McGraw Hill Education Private

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	-	-	-	-	2	-	-	2	3	3
CO2	3	2	2	1	-	-	-	-	2	-	-	2	3	3
CO3	3	3	2	1	-	-	-	-	2	-	-	2	2	3
CO4	3	3	2	1	-	-	-	-	2	-	-	3	3	2
CO5	2	3	3	1	-	-	-	-	2	-	-	2	2	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI3003	DATA STRUCTURES LABORATORY	0	0	4	2

Course Objective

1. To learn the methodical way of solving problem.

2. To comprehend the different methods of organizing large amount of data.

3. To efficiently implement the different data structures.

4. To implement traversal operations of trees and graphs

5. To understand concepts about various algorithm design techniques, searching and sorting techniques

S. No.	Description of the Experiments
1	**Singly Linked List and Doubly Linked List** a) Create and display Singly Linked List. b) Given a singly linked list with head node root, write a function to split the linked list into k consecutive linked list "parts". c) Find k^{th} node from the end of linked list d) Reverse a doubly linked list. e) Merge two sorted singly Linked Lists without creating new nodes.
2	**a) Implementation of Stack** Arun reads lot of story books and he keeps all the story books piled as a single stack. He wants to write a program to keep the order of the books in the pile. The program must implement the following functionalities. Add a book to the top of the pile when 1 is followed by the name of the book. Remove a book from the top of the pile when -1 is given as the input (provided the pile has at least one book). Print the name of the book on the top of the pile when 2 is given as the input (provided the pile has at least one book). The program must exit when 0 is given as the input. **b) Implementation of Queue** Riyaz has a book of tickets and wants to store ticket numbers in a data structure. New tickets are added to the end of the booklet. Ticket at the top of the stack is issued to the customer. Implement the data structure should Riyaz use to represent the ticket booklet?
3	a) Given an Infix expression convert it into its postfix Equivalent using stack data structure. b) Write a program to implement deque using linked lists
4	**Binary search tree and traversal** a) Insertion, Deletion, Searching in a BST b) Find k'th smallest and k'th largest element in a BST Check if a given sequence represents the in-order, pre-order and post-order traversal of a BST.
5	**Write a program for AVL tree having functions for the following operations:** a) Insert an element (no duplicates are allowed), b) Delete an existing element, Traverse the AVL (in-order, pre-order, and post-order)
6	**Heaps using priority queue** Geek hosted a contest and N students participated in it. The score of each student is given by an integer array arr. The task is to print the number of each student (indexes) in the order they appear in the scoreboard. A student with a maximum score appears first. If two people have the same score then higher indexed student appears first.
7	Write a C program to Implement Hash Tables with Quadratic Probing.

8 **a) Merge Sort**
Write a function that takes two list, each of which is sorted in increasing order, and merges the two into one list, which is in descending order, and returns it. In other words, merge two sorted linked list from their end.
b) Quick Sort
Given an array arr[], its starting position low and its ending position high. Implement the partition() and quickSort() functions to sort the array.

9 Implementation of the following graph traversal algorithms:
a) Depth first traversal
b) Breadth first traversal

10 **Minimum spanning tree using prim's and kruskal's algorithm.**
Given a graph which consists of several edges connecting its nodes, find a subgraph of the given graph with the following properties: The subgraph contains all the nodes present in the original graph. The subgraph is of minimum overall weight (sum of all edges) among all such subgraphs. It is also required that there is exactly one, exclusive path between any two nodes of the subgraph. One specific node S is fixed as the starting point of finding the subgraph using Prim's Algorithm. Find the total weight or the sum of all edges in the subgraph.

11 **Time Complexity**
a) Write a C program to print the time complexity of merge sort algorithm
b) C program to store time taken by bubble sort, insertion sort and selection sort

Total Practical Hours: 60

Course Outcome	CO1: Apply good programming design methods for program development.
	CO2:Apply the different data structures for implementing solutions to practical problems.
	CO3:Develop recursive programs using trees ,graphs.
	CO4:DevelopMinimum spanning tree using prim's and kruskal's algorithm.
	CO5:Develop about various algorithm design techniques

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	-	-	-	-	2	-	-	2	3	2
CO2	3	2	2	1	-	-	-	-	2	-	-	2	3	2
CO3	3	3	2	1	-	-	-	-	2	-	-	2	2	3
CO4	2	3	2	1	-	-	-	-	2	-	-	3	3	2
CO5	2	3	3	1	-	-	-	-	2	-	-	2	2	3
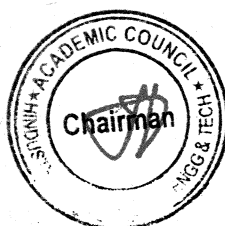
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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI3002	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE LABORATORY	0	0	4	2

Course Objective

1. To learn Prolog
2. To understand and learn LISP
3. To learn the methodical way of solving problem
4. To learn the methodical way of 4-queen problems
5. To learn the methodical way of medical diagnostic

S. No.	Description of the Experiments
1	Installation of gnu-prolog, Study of Prolog (gnu-prolog), its facts, and rules
2	Write simple fact for the statements using PROLOG
3	Write a program to solve the Monkey Banana problem
4	Write a program to implement factorial, fibonacci of a given number
5	Write a program to solve 4-Queen problem
6	Write a program to solve traveling salesman problem
7	Write a program to solve water jug problem using LISP
8	Write a program which behaves a small expert for medical Diagnosis

Total Practical Hours: 60

Course Outcome

CO1: Able to implement facts and rules in Prolog
CO2: Able to solve problems using LISP
CO3: Apply good programming design methods for program development

CO4: learn the methodical way of 4-queen problems
CO5: learn the methodical way of medical diagnostics

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Programme	Course code	Name of the course	L	T	P	C
B.TECH	22A13001	MICROPROCESSOR AND EMBEDDED SYSTEMS LABORATORY	0	0	4	2

Course Objective

1. Demonstrate the 8086 Microprocessor kit and perform basic operation.
2. Understand the peripheral devices and interface to 8086 Microprocessor.
3. Apply the programming concepts to 8051 Microcontroller.
4. Use proper peripheral devices and interface with 8051 Microcontroller.
5. Build a small low-cost embedded system using ARM processor

Expt. No	Description of the Experiments
1	Basic arithmetic and Logical operations using 8086 Microprocessor kit and MASM software.
2	Code conversion and Matrix operations using 8086 Microprocessor kit and MASM software.
3	Sorting and Searching using 8086 Microprocessor kit and MASM software.
4	Serial and Parallel interface with 8086 Microprocessor.
5	Basic arithmetic and Logical operations using 8051Microcontroller.
6	Code conversion and squaring using 8051Microcontroller.
7	A/ D Converter and D/A Converter interface with 8051 Microcontroller.
8	Stepper motor control interface using 8051 Microcontroller.
9	LED blinking using ARM Processor.
10	ADC and temperature sensor interfacing with ARM Processor.

Total Instructional Hours   60

Course Outcome

CO1: Analyze the performance of 8086 programs for various types of inputs.

CO2: Interface different I/Os with processor.

CO3: Formulate the design logic of 8051 programs.

CO4: Develop an industrial application using 8051 Microcontroller.

CO5: Design an embedded system application.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	-	-	1	-	-	-	-	-	2	3	3
CO2	3	3	2	-	-	2	-	-	-	-	-	2	3	3
CO3	3	3	1	-	-	-	-	-	-	-	-	2	3	3
CO4	3	3	2	3	-	1	1	-	-	-	-	2	3	3
CO5	3	3	3	3	-	1	1	-	-	-	-	2	3	3

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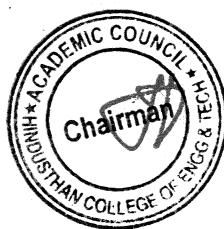
Programme	Course Code	Name of the Course	L	T	P	C
B.TECH	22MA3106	DISCRETE MATHEMATICS (AIML)	3	1	0	4

Course Objective	**The learner should be able to** 1. Introduce logical theory and proportional calculus techniques that will create logical thinking. 2. Generalize counting problems using mathematical induction, inclusion and exclusion principles. 3. Study the Boolean algebra which is used in the Boolean logics and circuits. 4. Apply formal mathematical methods to prove properties of languages, and Context free grammar. 5. To impart discrete knowledge in computer engineering through finite automata theory.

Unit	Description	Instructional Hours
I	**MATHEMATICAL LOGIC** Propositional logic - Tautology and Contradiction - Propositional equivalences - Normal forms - Principal normal forms - Theory of Inference.	12
II	**COMBINATORICS** Mathematical induction – Recurrence relations – Solving linear recurrence relations - generating functions – principle of inclusion and exclusion – applications.	12
III	**LATTICES AND BOOLEAN ALGEBRA** Lattices – Properties of lattices – Lattices as algebraic system – Sub lattices - some special lattices – Boolean algebra – Definition and simple properties.	12
IV	**FORMAL LANGUAGES** Languages and Grammars-Classification of Grammars-Pumping Lemma For Regular Languages-Context Free Languages, Push down automata and Turing machine.	12
V	**FINITE STATE AUTOMATA** Concepts of Automata Theory – Finite Automata – Types of finite Automata - Deterministic Finite State Automata(DFA), Non Deterministic Finite State Automata (NFA) – Transition Diagrams - Equivalence of DFA and NFA.	12
	Total Instructional Hours	60

Course Outcome	**At the end of the course, the learner will be able to** CO1: Study the notion of mathematical thinking, mathematical proofs, and algorithmic thinking and be able to apply them in problem solving. CO2: Solve problems using counting techniques and recurrence relations. CO3: Gain knowledge about Lattices and Boolean Algebra. CO4: Understand the knowledge of formal languages like Compiler Design. CO5: Understand the knowledge of finite automata theory and design discrete problems.

TEXT BOOKS:

T1 - Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, Delhi, 2016.

T2-. , Kenneth H rosen , "Discrete Mathematics and its Application", Tata McGraw Hill,New Delhi,2018.

REFERENCE BOOKS :

R1 - Jean Paul Trembley ,RManohar, "Discrete Mathematical Structures with Application to Computer Science", McGraw Hill,Inc. New York, 30th reprint, 2008.

R2- Kenneth H.Rosen, "Discrete Mathematics and its Applications", seventh Edition,TataMcGraw Hill
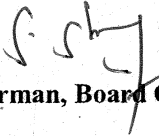
Pub.Co.Ltd.,New Delhi, 2013.

R3- John. C. Martin ,Introduction to Languages and the Theory of Computation, , Tata McGraw-Hill, 2003.

R4 - Hopcroft J.E and Ullman,J.D, "Introduction to Automata Theory, Languages and Computation", Narosa Publishing House, Delhi, 2002.

R5 - Jean-Paul Tremblay and R. Manohar – "Discrete Mathematical Structures with Applications to Computer Science" Tata – McGraw Hill Publications – 2008.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	3	1	1	2	1	-	-	-	2	2	3
CO2	2	2	3	3	1	1	2	1	-	-	-	2	2	3
CO3	2	3	3	2	1	1	2	1	-	-	-	2	2	3
CO4	3	3	3	3	1	1	2	1	-	-	-	2	3	2
CO5	3	3	2	2	1	1	2	1	-	-	-	2	3	3

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Programme	Course code	Name of the course	L	T	P	C
B.TECH	22MC3191	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	2	0	0	0

The student should be able

Course Objective	1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
	2	To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.
	3	To impart basic principles of thought process, It has and Dharma Shastra and connecting society and nature.
	4	To understand the concept of Intellectual and intellectual property rights with special Reference.
	5	The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and Indian philosophy.

Unit	Description	Instructional Hours
I	**Introduction to traditional knowledge:** Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vs indigenous knowledge, traditional knowledge vs western knowledge	9
II	**Protection of traditional knowledge:** The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK	9
III	**Itihas and Dharma-**Shastra **Itihas:** The Mahabharata - The Puranas - The Ramayana **Dharma-**Shastra: Manu Needhi - The Tirukkural – Thiru Arutpa	9
IV	**Traditional knowledge and intellectual property:** Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge	9
V	**Indian philosophy** Jain – Buddhist – Charvaka – Samkhya - Yoga - Nyaya - Vaisheshika - Saiva	9
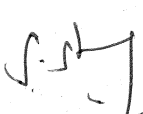
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Total Instructional Hours 45

	CO1	**Identify the concept of Traditional knowledge and its importance.**
	CO2	**Explain the need and importance of protecting traditional knowledge.**
Course Outcome	CO3	Explain the need and importance of Itihas and Dharma Shastra.
	CO4	**Interpret the concepts of Intellectual property to protect the traditional knowledge.**
	CO5	Interpret the concepts of indian philosophy to protect the traditional knowledge.

REFERENCES:

R1   Traditional Knowledge System in India, by Amit Jha, 2009.

R2   Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.

R3   "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

R4   V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.

R5   V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am.

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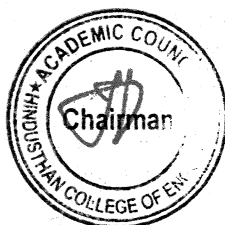
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Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE3071	Soft Skills and Aptitude - II	0	0	0	1

Course Objectives:	1. Solve Logical Reasoning questions of easy to intermediate level 2. Solve Quantitative Aptitude questions of easy to intermediate level 3. Solve Verbal Ability questions of easy to intermediate level 4. Display good writing skills while dealing with essays

Unit	Description	Instructional Hours
I	**Logical Reasoning** Clocks - Calendars - Direction Sense - Cubes - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	9
II	**Quantitative Aptitude** Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages - Time, Speed and Distance: Basics of time, speed and distance, Relative speed, Problems based on trains, Problems based on boats and streams, - Profit and loss, Basic terminologies in profit and loss - Averages - Weighted average	12
III	**Verbal Ability** Sentence Correction: Subject-Verb Agreement, Modifiers, Parallelism, Pronoun-Antecedent Agreement, Verb Time Sequences, Comparisons, Prepositions, Determiners - Sentence Completion and Para-jumbles: Pro-active thinking, Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues), Fixed jumbles, Anchored jumbles.	7
IV	**Writing skills for placements** Essay writing: Idea generation for topics, Best practices, Practice and feedback	2
	Total Instructional Hours	30
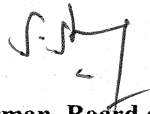
Course Outcome:	CO1:	Students will avoid the various fallacies that can arise through the misuse of logic.
	CO2:	Students would opt for alternate methods to solve the problems rather than conventional methods.
	CO3:	Students will heighten their awareness of correct usage of English grammar in writing and speaking
	CO4:	Students will be concise and clear, using professional language for placements.

REFERENCE BOOKS:
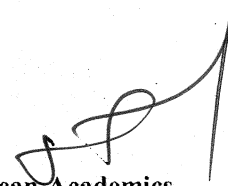
R1: A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali

R2: How to prepare for data interpretation for CAT by Arun Sharma.

R3: How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.

R4: Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

R5: Word Power Made Easy by Norman Lewis
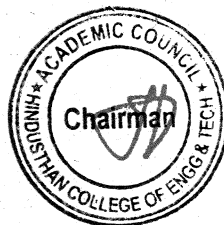
R:6 Six weeks to words of power by Wilfred Funk

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Hindusthan College of Engineering and Technology

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Accredited by NBA (AERO, AUTO, CIVIL, CSE, ECE, EEE, IT, MECH, MCTS)
Accredited by NAAC 'A++' Grade with CGPA of 3.69 out of 4 in Cycle 2

Valley Campus, Coimbatore – 641 032, Tamil Nadu, INDIA

2022 Regulation – 2023 Batch III semester- Syllabus revision

S. No	Year	Semester	Course Code and Course Name	Existing content (in academic Year 2023-24)	Revised Content (for 2024-25)	Percentage of Revision
				NIL		

New Course Introduced (2022 Regulation) – 2023 Batch III semester

S.No	Regulation	Course Code with Name	Credits
		NIL	

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HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)
(Approved by AICTE, New Delhi, Accredited by NAAC with 'A++' Grade)
Coimbatore - 641 032.

B.TECH. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST

HICET

CHOICE BASED CREDIT SYSTEM

Hindusthan College of Engineering and Technology
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Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.
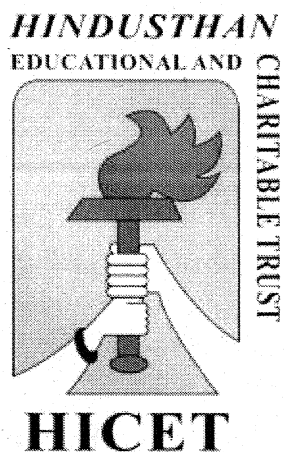
DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (UG)

REGULATION-2022

For the students admitted during the academic year 2022-2023 and onwards

SEMESTER I (Credit : 19)										
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT											
2	22HE1151	English for Engineers	HSC	2	0	2	3	4	50	50	100
3	22CY1151	Chemistry for Circuit Engineers	BSC	2	0	2	3	4	50	50	100
4	22CS1152	Object Oriented Programming using Python	ICC	2	0	2	3	4	50	50	100
5	22IT1152	Introduction to Web Application Development	ESC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6	22HE1071	Universal Human Values	AEC	2	0	0	2	3	40	60	100
7	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
8	22MC1091/ 22MC1092	அறிவியல் தமிழ்/ Indian Constitution	MC	2	0	0	0	2	100	0	100
			TOTAL	16	1	8	19	26	480	320	800

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SEMESTER II (Credits – 22)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA2103	Differential Equations And Linear Algebra	BSC	3	1	0	4	4	40	60	100
2	22PH2101	Basics of Material Science	BSC	2	0	0	2	3	40	60	100
THEORY WITH LAB COMPONENT											
4	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
5	22PH2151	Physics For Circuit Engineering Programme	BSC	2	0	2	3	4	50	50	100
6	22CS2253	Java Fundamentals	ICC	2	0	2	3	4	50	50	100
7	22IT2253	Dynamic Web Design	PCC	2	0	1	2	3	50	50	100
PRACTICAL											
7	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8	22HE2071	Design Thinking	AEC	1	0	2	2	2	100	0	100
9	22HE2072	SOFT SKILLS AND APTITUDE-1	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2091/ 22MC2092	தமிழர்மரபு/ *Heritage of Tamils*	MC	2	0	0	0	2	100	0	100
11	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, inanyone of the personality and character development programmes and undergo training for about 80 hours							
			TOTAL	18	1	12	22	29	630	370	1000

SEMESTER III (Credits – 25)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22MA3106	Discrete Mathematics	BSC	3	1	0	4	4	40	60	100
2	22AI3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22AI3202	Foundations of Artificial Intelligence	PCC	3	1	0	4	4	40	60	100
4	22AI3203	Microprocessor and Embedded Systems	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22AI3253	Clean Coding and Devops	ICC	3	0	2	4	4	50	50	100
PRACTICAL											
6	22AI3001	Microprocessor and Embedded Systems Laboratory	ESC	0	0	4	2	4	60	40	100
7	22AI3002	Foundations of Artificial Intelligence Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills And Aptitude -2	SEC	1	0	0	1	1	100	0	100
9	22AI3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
10	22MC3191	Essence of Indian Traditional Knowledge	MC	2	0	0	0	2	100	0	100
			TOTAL	17	2	14	25	34	590	410	1000

SEMESTER IV (Credits – 23)

S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2	22AI4201	Database Management Systems	PCC	3	0	0	3	3	40	60	100
3	22AI4202	Data Visualization	ICC	3	0	0	3	3	40	60	100
4	22AI4203	Software Design with UML	PCC	3	0	0	3	3	40	60	100
5	22MA4102	Applied Statistics and Queuing Theory	BSC	2	1	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
6	22AI4251	Operating Systems	PCC	3	0	2	4	4	50	50	100

PRACTICAL

				L	T	P	C	TCP	CIA	ESE	Total
7	22AI4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22AI4002	Data Visualization Laboratory	ICC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
			TOTAL	17	0	12	23	31	480	420	900

SEMESTER V (Credits – 22)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI5201	Machine Learning Techniques & Tools	PCC	3	1	0	4	4	40	60	100
2	22AI5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22AI53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22AI53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22AI53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22AI5251	Introduction to Design Thinking	ICC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22AI5001	Machine Learning Techniques & Tools Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE5071	Soft Skills -4/Foreign Languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	18	1	6	22	25	410	390	800

SEMESTER VI (Credits – 24)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI6201	Compiler Design	PCC	3	0	0	3	3	40	60	100
2	22HE6101	Professional Ethics	HSC	3	0	0	3	3	40	60	100
3	22AI63XX	Professional Elective-4/ Development of Machine Learning Models	PEC/ICC	3	0	0	3	3	40	60	100

4	22AI63XX	Professional Elective-5/ Predictive Modeling	PEC/ICC	3	0	0	3	3	40	60	100
5	22AI64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22AI64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
7	22CY6101	Environmental Studies	BSC	2	0	0	2	3	40	60	100
PRACTICAL											
8	22AI6001	Mini Project	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	**22HE6071**	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
			TOTAL	22	0	4	24	27	440	460	900

SEMESTER VII (Credits – 20)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1	22AI7201	Big Data Analytics	PCC	3	0	0	3	3	40	60	100
2	22AI7202	Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22AI73XX	Professional Elective-6 /AI Analyst	PEC/ICC	3	0	0	3	3	40	60	100
4	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
PRACTICAL											
6	22AI7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22AI7701	Internship - II*	SEC	0	0	0	2	2	100	0	100
			TOTAL	15	1	4	20	22	360	340	700

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII (Credits – 10)											
S No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1	22AI8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
			TOTAL	0	0	20	10	20	100	100	200

Note:

1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extracredits printed in the Consolidated Mark sheet as per the regulation.

2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.

3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2022 – 23.

SEMESTER WISE CREDIT DISTRIBUTION

		B.E. / B.TECH.PROGRAMMES								
S.No.	**Course Area**	**Credits per Semester**								**Total Credits**
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	3	-	2	-	-	25
3	ESC	6	2	5	-	-	-	-	-	13
4	PCC	-	5	13	17	12	5	9	-	61
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	3	3	3	1	1	2	2	10	25
8	MC	✓	✓							
	Total	**19**	**22**	**25**	**23**	**22**	**24**	**20**	**10**	**165**

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI6451	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6451	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6451	Cyber security	OEC	2	0	2	4	3

4	22EC6452	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6451	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6451	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE
I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3

10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
3	22AI7401	Fundamentals Of Management For Engineers	OEC	3	0	0	3	3

OPEN ELECTIVE IV

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3

3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Data Science	Vertical II Generic AI	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And AR / VR	Vertical VI Full Stack Development
22AI5301 Data warehouse and Mining	22AI5304 Intelligent Multi Agent and Expert systems	22AI5307 Principles of Cloud Computing	22AI5310 Modern Cryptography and Network Security	22AI5313 Computer Graphics	22AI5316 Web Technology
22AI5302 Python for Data Science	22AI5305 Network Science and Modeling	22AI5308 Virtualization	22AI5311 Ethical Hacking	22AI5314 Image and video analytics	22AI5317 Front End Development with REACT and TYPESCRIPT
22AI5303 Exploratory Data Analysis and Time series	22AI5306 Business Intelligence	22AI5309 Cloud Computing Architecture & Deployment Models	22AI5312 Digital and Mobile Forensics	22AI5315 Game Programming	22AI5318 Node JS
22AI6301 Information Retrieval	22AI6303 Knowledge Engineering	22AI6305 Cloud Services Management	22AI6307 Cyber forensics and information security	22AI6309 Computer Vision	22AI6311 NoSql Databases with Mongo DB
22AI6302 Data Security	22AI6304 Explainable AI	22AI6306 Cloud Application Development	22AI6308 Secured Network Protocols and Standards	22AI6310 Introduction to Augmented Reality	22AI6312 DevOps
22AI7301 Recommender Systems	22AI7302 Ethics and Policy issues in AI	22AI7303 Cloud Security	22AI7304 Data privacy preservation	22AI7305 Virtual Reality	22AI7306 Web Application Security

Note:
Students are permitted to choose all professional electives from any of the verticals.

Vertical I
Data Science

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5301	Data warehouse and Mining	PEC	3	0	0	3	3
2	22AI5302	Python for Data Science	PEC	3	0	0	3	3

3	22AI5303	Exploratory Data Analysis and Time series	PEC	3	0	0	3	3
4	22AI6301	Information Retrieval	PEC	3	0	0	3	3
5	22AI6302	Data Security	PEC	3	0	0	3	3
6	22AI7301	Recommender Systems	PEC	3	0	0	3	3

Vertical II
Generic AI

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5304	Intelligent Multi Agent and Expert systems	PEC	3	0	0	3	3
2	22AI5305	Network Science and Modeling	PEC	3	0	0	3	3
3	22AI5306	Business Intelligence	PEC	3	0	0	3	3
4	22AI6303	Knowledge Engineering	PEC	3	0	0	3	3
5	22AI6304	Explainable AI	PEC	3	0	0	3	3
6	22AI7302	Ethics and Policy issues in AI	PEC	3	0	0	3	3

Vertical III
Cloud Computing

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5307	Principles of Cloud Computing	PEC	3	0	0	3	3
2	22AI5308	Virtualization	PEC	3	0	0	3	3
3	22AI5309	Cloud Computing Architecture & Deployment Models	PEC	3	0	0	3	3
4	22AI6305	Cloud Services Management	PEC	3	0	0	3	3
5	22AI6306	Cloud Application Development	PEC	3	0	0	3	3
6	22AI7303	Cloud Security	PEC	3	0	0	3	3

Vertical IV
Cyber Security and Data Privacy

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5310	Modern Cryptography and Network Security	PEC	3	0	0	3	3

2	22AI5311	Ethical Hacking	PEC	3	0	0	3	3
3	22AI5312	Digital and Mobile Forensics	PEC	3	0	0	3	3
4	22AI6307	Cyber forensics and information security	PEC	3	0	0	3	3
5	22AI6308	Secured Network Protocols and Standards	PEC	3	0	0	3	3
6	22AI7304	Data privacy preservation	PEC	3	0	0	3	3

Vertical V
Computer Vision And AR / VR

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5313	Computer Graphics	PEC	3	0	0	3	3
2	22AI5314	Image and video analytics	PEC	3	0	0	3	3
3	22AI5315	Game Programming	PEC	3	0	0	3	3
4	22AI6309	Computer Vision	PEC	3	0	0	3	3
5	22AI6310	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	22AI7305	Virtual Reality	PEC	3	0	0	3	3

Vertical VI
FULL STACK DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5316	Web Technology	PEC	3	0	0	3	3
2	22AI5317	Front End Development with REACT and TYPESCRIPT	PEC	3	0	0	3	3
3	22AI5318	Node JS	PEC	3	0	0	3	3
4	22AI6311	NoSql Databases with Mongo DB	PEC	3	0	0	3	3
5	22AI6312	DevOps	PEC	3	0	0	3	3
6	22AI7306	Web Application Security	PEC	3	0	0	3	3

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree. For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For a minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

AIML OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5601	Sem 5: Data structures using C Programming	MDC	3	0	0	3	3
2	22AI6601	Sem 6: Introduction to Databases	MDC	3	0	0	3	3
3	22AI6602	Sem6: Foundation of Artificial Intelligence & Machine Learning	MDC	3	0	0	3	3
4	22AI7601	Sem 7: Introduction to Robotics	MDC	3	0	0	3	3
5	22AI7602	Sem 7: Foundations of Data Analytics	MDC	3	0	0	3	3
6	22AI8601	Sem 8: Deep Learning -Principles& Practices	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I
Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5231	Financial Management	MDC	3	0	0	3	3
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II
Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	22MB72334	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III
Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3

B. TECH (HONS) AI & ML SPECIALIZATION WITH ROBOTICS

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5204	Sem 5: Foundations of Robotics	PC	3	0	0	3	3
2	22AI6203	Sem 6: Sensors and Actuators	PC	3	0	0	3	3
3	22AI6204	Sem 6: Robots, bots and communication	PC	3	0	0	3	3
4	22AI7203	Sem 7: Human-Robot Interaction	PC	3	0	0	3	3
5	22AI7204	Sem 7: Medical Robotics	PC	3	0	0	3	3
6	22AI8201	Sem 8: Fundamentals of Autonomous Systems	PC	3	0	0	3	3

B. TECH (HONS) AI & ML SPECIALIZATION WITH BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22AI6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22AI6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22AI7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22AI7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3

3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B. TECH (HONS) AI & ML

Vertical I ROBOTICS	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III CYBER PHYSICAL SYSTEMS
22AI5203 Foundations of Robotics	22AI5204 Public Key Infrastructure and Trust Management	22AI5205 Principles of Cyber Physical Systems
22AI6203 Sensors and Actuators	22AI6205 Introduction to block chain	22AI6207 Communication for CPS
22AI6204 Robots, bots and communication	22AI6206 Cryptocurrency	22AI6208 CPS System Design
22AI7203 Human-Robot Interaction	22AI7205 Smart Contracts and Solidity	22AI7207 CPS for Internal and External Security
22AI7204 Medical Robotics	22AI7206 Block chain and distributed ledger technology	22AI7208 Biomedical Instrumentation for Cyber Physical Systems
22AI8201 Fundamentals of Autonomous Systems	22AI8202 Bitcoin Essentials and Use-Cases	22AI8203 Security and Privacy of CPS

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
6	22AI8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B. TECH (HONS) AI & ML SPECIALIZATION WITH CYBER PHYSICAL SYSTEMS

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22AI5206	Sem 5: Principles of Cyber Physical Systems	PC	3	0	0	3	3
2	22AI6207	Sem 6: Communication for CPS	PC	3	0	0	3	3
3	22AI6208	Sem 6: CPS System Design	PC	3	0	0	3	3
4	22AI7207	Sem 7: CPS for Internal and External Security	PC	3	0	0	3	3
5	22AI7208	Sem 7: Biomedical Instrumentation for Cyber Physical Systems	PC	3	0	0	3	3
6	22AI8203	Sem 8: Security and Privacy of CPS	PC	3	0	0	3	3

Credit Distribution R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19	22	25	23	22	24	20	10	165
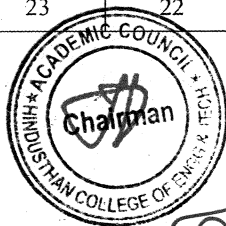
Chairman BoS

Chairman - BoS
AIML - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5201	Machine Learning Techniques & Tools	3	1	0	4

Course Objective	• To equip foundational knowledge and practical skills needed to understand, implement, and evaluate various machine learning algorithms • To provide understanding of various machine learning algorithms, including decision tree learning, instance-based learning, and recommender systems • To equip theoretical understanding and practical skills necessary to apply probabilistic, Bayesian learning methods, and support vector machines • To provide understanding of artificial neural networks (ANN), including their biological motivation, architecture, and learning algorithms, with a focus on practical implementation using the perceptron and backpropagation • To ensemble learning techniques and clustering methods, providing both theoretical insights and practical experience with algorithms such as bagging, boosting, random forests, and k-means clustering

Unit	Description	Instructional Hours
I	**Introduction:** Introduction to Machine Learning: Introduction. Different types of learning, Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance. **Linear Regression:** Introduction, Linear regression, Simple and Multiple Linear regression, Polynomial regression, evaluating regression fit.	12
II	**Decision tree learning:** Introduction, Decision tree representation, appropriate problems for decision tree learning, the basic decision tree algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Python exercise on Decision Tree. **Instance based Learning:** K nearest neighbor, the Curse of Dimensionality, Feature Selection: forward search, backward search, univariate , multivariate feature selection approach, Feature reduction (Principal Component Analysis) , Python exercise on kNN and PCA. **Recommender System:** Content based system, Collaborative filtering based.	12
III	**Probability and Bayes Learning:** Bayesian Learning, Naïve Bayes, Python exercise on Naïve Bayes, Logistic Regression. **Support Vector Machine:** Introduction, the Dual formulation, Maximum margin with noise, nonlinear SVM and Kernel function, solution to dual problem.	12
IV	**Neural Networks:** Introduction ,Neural Networks, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer Perceptron and the back propagation algorithm- Convolution Neural Networks – Recurrent Neural Networks	12

V	**Ensembles:** Introduction, Bagging and boosting, Random forest, Discussion on some research papers. **Clustering:** Introduction, K-mean clustering, agglomerative hierarchical clustering, Python exercise on k-mean clustering.	12
	Total Instructional Hours	60

Course Outcome	CO1:	Implement and evaluate linear regression models, and apply techniques to prevent overfitting and underfitting, ensuring robust model performance.
	CO2:	Implement and evaluate decision trees, k-nearest neighbors, and recommender systems, as well as apply feature selection and reduction techniques, ensuring effective model performance.
	CO3:	Apply Naïve Bayes, logistic regression, and support vector machine models with various kernel functions to address and solve classification challenges.
	CO4:	Design, train, and optimize artificial neural networks, including perceptrons and multilayer networks, using backpropagation for various problem-solving applications.
	CO5:	Apply ensemble methods like bagging, boosting, and random forests, and perform clustering using k-means and agglomerative hierarchical approaches to analyze and interpret data.

TEXT BOOKS:

T1: Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.

T2: Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020.

REFERENCE BOOKS:

R1: Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
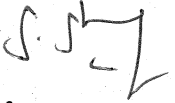
R2: Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
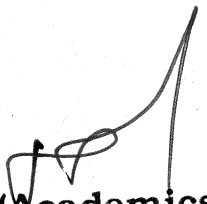
SUGGESTED ACTIVITIES:

1. Give an example from our daily life for each type of machine learning problem

2. Study at least 3 Tools available for Machine Learning and discuss pros & cons of each

3. Take an example of a classification problem. Draw different decision trees for the example and explain the pros and cons of each decision variable at each level of the tree

4. Outline 10 machine learning applications in healthcare

5. Give 5 examples where sequential models are suitable.

6. Give at least 5 recent applications of CNN

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	3	-	-	-	1	1	2	1	1	3
CO2	1	1	3	-	3	-	-	-	1	1	2	1	1	3
CO3	2	2	3	3	3	-	-	-	1	1	2	1	1	3
CO4	2	2	3	-	3	-	-	-	1	1	3	1	1	3
CO5	2	2	1	1	1	-	-	1	2	2	3	2	2	1

Chairman - BoS
AIML - HiCET

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5001	Machine Learning Techniques & Tools Laboratory	0	0	4	2

Course Objective	1. To introduce fundamental Python machine learning packages such as Numpy, Pandas, and Matplotlib.
	2. To develop skills to compute covariance, correlation, and their matrices from datasets.
	3. To equip students with techniques for fitting hyperplanes using linear regression and calculating residual errors.
	4. To teach implementation of classification algorithms like decision trees, k-nearest neighbors, and SVM.
	5. To enable understanding and application of clustering techniques and neural networks, including feature reduction using PCA.

S. No.	Description of the Experiments
1.	Basic exercises on Python Machine Learning Packages such as Numpy, Pandas and matplotlib.
2.	Given a dataset. Write a program to compute the Covariance, Correlation between a pair of attributes. Extend the program to compute the Covariance Matrix and Correlation Matrix.
3.	Implement a Linear Regression with a Real Dataset (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyper parameters.
4.	Implement the FIND-S algorithm. Verify that it successfully produces the trace in for the Enjoy sport example.(Tom Mitchell Reference)
5.	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
6.	Implement a decision tree algorithm for sales prediction/classification in retail sector
7.	Write a program to implement feature reduction using Principle Component Analysis
8.	Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset
9.	Given a dataset for classification task. Write a program to implement Support Vector Machine and estimate it test performance.
10.	Write a program to implement perceptron for different learning task.
11.	Write programs to implement ADALINE and MADALINE for given learning task.
12.	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
13.	**Project - (in Pairs)** Your project must implement one or more machine learning algorithms and apply them to some data. a. Your project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach. b. You can either pick a project of your own design, or you can choose from the set of pre- defined projects. c. You are free to use any third-party ideas or code that you wish as long as it is publicly available. d. You must properly provide references to any work that is not your own in the write up. e. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read. **List of Projects (datasets available)** 1. Sentiment Analysis of Product Reviews 2. Stock Prediction 3. Sales Forecasting 4. Music Recommendation 5. Handwriting Digit Classification 6. Fake News Detection 7. Sports Prediction 8. Object Detection 9. Disease Prediction

	Total hours	45
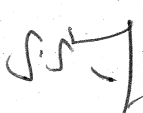
	Course Outcome	
Course Outcome	CO1:	Proficient in using Python machine learning packages for data manipulation and visualization.
	CO2:	Compute and interpret covariance and correlation matrices from datasets.
	CO3:	Capable to fit linear regression models and calculating residual errors.
	CO4:	Apply and evaluate classification algorithms such as decision trees, k-nearest neighbors, and SVMs.
	CO5:	Implement clustering algorithms and neural network models, including feature reduction using PCA, and analyze results.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	3	1	-	-	-	1	2	2	1	1	2
CO2	1	1	3	1	1	-	-	-	1	3	2	1	1	2
CO3	2	2	3	2	2	-	-	-	1	3	2	1	1	2
CO4	2	2	3	2	2	-	-	-	1	3	3	1	1	3
CO5	2	2	1	2	2	-	-	-	2	1	3	2	2	3

References:

Datasets for the above exercises available in Kaggle and UCI repository mentioned below

1. https://www.kaggle.com

2. http://archive.ics.uci.edu/ml/datasets.html

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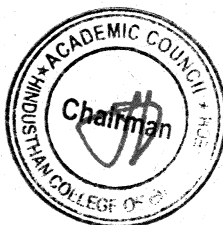
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Programme	CourseCode	Name of the Course	L	T	P	C
B.Tech	22AI5202	COMPUTER NETWORKS	3	0	0	3

<table>
<tr><td rowspan="5">Course Objective</td><td>1. To understand the basic concepts of networks</td></tr>
<tr><td>2. To understand the Data Communication System and the purpose of Layered Architecture.</td></tr>
<tr><td>3. To analyze the concepts of Routing Methods and Sub-netting.</td></tr>
<tr><td>4. To learn the functions of Network Layer and the various Routing Protocols.</td></tr>
<tr><td>5. To familiarize the functions and Protocols of the Transport Layer.</td></tr>
</table>

Unit	Description	Instructional hours
I	**NETWORKING CONCEPTS & PHYSICAL LAYER** Peer To Peer Vs Client-Server Networks. Network Devices. Network Terminology. Network Speeds. Network throughput, delay. Osi Model. Packets, Frames, And Headers. Collision And Broadcast Domains. LAN Vs WAN. Network Adapter. Hub. Switch. Router.Gateway. Firewall, IP addressing. **Physical Layer:** Performance – Transmission Media – Switching – Circuit-switched Networks – Packet Switching.	9
II	**DATA LINK LAYER** Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC– PPP - Media Access Control - Wired LANs: Ethernet - Wireless access techniques- IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be, QoS – Bluetooth – Protocol Stack – Security – Profiles – zigbee	9
III	**NETWORK AND ROUTING** Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets - Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms –Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.	9
IV	**TRANSPORT LAYER** Process to process delivery, User datagram protocol (UDP), Transmission control protocol (TCP), Data traffic, Congestion, Congestion control, Quality of service, Techniques to improve QOS, Integrated services, Differentiated services, QOS in switched networks.	9
V	**APPLICATION LAYER** Socket interface, Name space, Domain name space, Distribution of name space, DNS in the internet, Resolution, DNS messages, DDNS, Encapsulation,Electronic mail, File transfer, HTTP, World wide web (WWW), Case study: MOBILE DATA NETWORKS-4G Networks – Concepts of 5G-Introduction to 6G.	9

Hours	**Total Instructional**	**45**

<table>
<tr><td rowspan="7">Course Outcome</td><td>Upon completion of this course, the Students will be able to</td></tr>
<tr><td>CO1: Learn about the Protocol Layering and Physical Level Communication</td></tr>
<tr><td>CO2: Understand the Data Communication System and the purpose of Layered Architecture.</td></tr>
<tr><td>CO3: Analyze the concepts of Routing Methods and Subnetting.</td></tr>
<tr><td>CO4: Design protocols for various functions in the Network.</td></tr>
<tr><td>CO5: Understand the functions and Protocols of the Transport Layer.</td></tr>
</table>

TEXT BOOK:

T1: Larry Peterson, Bruce Davie, "Computer Networks: A Systems Approach", Elsevier, Online Edition, 2019.

T2: Paul Goransson, Chuck Black and Timothy Culver, "Software Defined Networks - A ComprehensiveApproach", Elsevier, Second Edition, 2017.

REFERENCES:

R1: James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet",Pearson Education, Seventh Edition, 2017.
R2: Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, Second Edition,2015.
R3: Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw – Hill, Fifth Edition, 2013. R4: Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGrawHill Publishers, 2011.
R4:Saad Z. Asif – "5G Mobile Communications Concepts and Technologies" CRC press – 2019 (UNIT 3)
R5: Erik Dahlman, Stefan Parkvall, Johan Skold, "4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013 (UNIT 3)
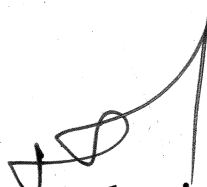
PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	2	2	-	-	-	2	-	-	2	2	2
CO2	-	3	2	3	2	2	-	-	2	2	-	2	3	3
CO3	-	3	3	2	3	2	-	-	2	2	-	2	3	3
CO4	-	1	1	2	3	2	2	1	2	2	1	2	3	3
CO5	-	1	1	2	3	2	2	2	2	-	3	2	3	2

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105

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5251	INTRODUCTION TO DESIGN THINKING	2	0	2	3

Course Objective

1. Expose students to the design process as a tool for innovation.
2. Develop students' professional skills in client management and communication.
3. Students develop a portfolio of work to set them apart in the job market.
4. Provide an authentic opportunity for students to develop teamwork and leadership skills.
5. Demonstrate the value of developing a local network and assist students in making
6. lasting connections with the business community

Unit	Description	Instructional Hours
I	**DESIGN THINKING HISTORY AND OVERVIEW** Understand what came before Design thinking-Identify who did what to bring it about-Learn how it built upon previous approaches-How design thinking is introduced in an organization-Understand the transformation required-What outcomes are possible-Understand the whole approach to design thinking-Determine what is most important. *Illustrative program: Listening and HMW*	9
II	**KEY HABITS** Introduction to key habits-types-avoid common anti-patterns-Optimize for success with these habits-Introduction to loop-Importance of iteration-How to observe, Reflect &Make-Drill down. *Illustrative program: USER RESEARCH and PRACTICE MAPPING INSIGHTS FROM USER RESEARCH*	7+2(P)
III	**USER RESEARCH AND MAKE** Importance of user research-Appreciate empathy through listening-Key methods of user research-How make fits into the loop-Leverage observe information-Ideation, storyboarding, & Prototyping. *Illustrative program: PRACTICE IDEATION AND PRIORITIZATION, COLLABORATIVELY CONSOLIDATE STORYBOARDS*	5+4(P)
IV	**USER FEEDBACK AND TEACHING** User feedback and the loop-Different types of user feedback-How to carryout getting feedback-Understand the challenges of teaching EDT-Valuable hints and tips-Ready to teach the course. *Illustrative program: DEVELOP A SUMMARY HILL STATEMENT AND BUILD YOUR STORY BOARD AND HILL INTO A PROTOTYPE*	3+6(P)

LOGISTICS AND APPLICATIONS

V Understand what type of room you need-Learn what materials and supplies you need-Learn how to setup the room-Domains that are applicable-Digital versus physical-Explore some technology specialization. *Illustrative program: PRACTICE TEACHING SELECTED SECTION AND USER FEEDBACK* 5+4(P)

Total Instructional Hours (29 + 16) 45

	CO1:	Students develop a strong understanding of the Design Process and how it can be applied in a variety of business settings
	CO2:	Students learn to build empathy for target audiences from different "cultures"
Course Outcome	CO3:	Students learn to research and understand the unique needs of a company around specific challenges
	CO4:	Students learn to develop and test innovative ideas through a rapid iteration cycle
	CO4:	Students learn how to map insights from user research.

TEXT BOOKS:

T1 :IBM CourseWare

REFERENCE BOOKS:

R1:Creative Confidence-Tom Kelley.,2013

R2:Change by Design-Tim Brown.,2009

R3:Design Thinking-Nigel Cross.,Kindle Edition

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Programme	Course Code	Course Title	L	T	P	C
B.TECH	22HE5071	Soft Skills - IV	1	0	0	1

Course Objectives:	1. To employ soft skills to enhance employability and ensure workplace and career success. 2. To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

Unit	Description	Instructional Hours
I	**Introduction to Soft Skills:** Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self management-Critical thinking-Reflective thinking and writing- p2p Interaction	10
II	**Art of Communication:** Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non Verbal Communication – Roles-Types-How nonverbal communication can go wrong- How to Improve non verbal Communication - Importance of feelings in communication - dealing with feelings in communication.	10
III	**World of Teams:** Self Enhancement - importance of developing assertive skills-developing self confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.	10
	Total Instruction Hours	30

Course Outcome:	CO1:	Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path.
	CO2:	Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others
	CO3:	Students will understand how teamwork can support leadership skills

REFERENCE BOOKS:

R1:	Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H. Wentz
R2:	Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent – by Bruce Tulgan
R3:	Soft Skills Training: A Workbook to Develop Skills for Employment – by Frederick H. Wentz

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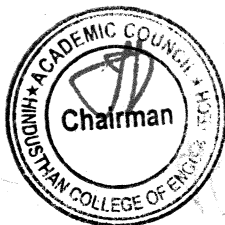
PROFESSIONAL ELECTIVE – AIML

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5301	Data warehouse and Mining	3	0	0	3

Course Objective	1. To understand data warehouse concepts, architecture, business analysis and tools.
	2. To understand data pre-processing and data visualization techniques.
	3. To study algorithms for finding hidden and interesting patterns in data.
	4. To understand and apply various classification and clustering techniques using tools.
	5. To understand Multidimensional Analysis and Descriptive Mining.

Unit	Description	Instructional Hours
I	**DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP)** Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.	9
II	**DATA MINING – INTRODUCTION** Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.	9
III	**DATA MINING - FREQUENT PATTERN ANALYSIS** Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns	9
IV	**CLASSIFICATION AND CLUSTERING** Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines. Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering.	9
V	**MINING OBJECT, SPATIAL, MULTIMEDIA, TEXT AND WEB DATA** Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web - Applications and Trends in Data Mining.	9

Total Instructional Hours   45

Upon completion of this course, the students will be able to

Course Outcome

CO1: Demonstrate the basics of designing a Data warehouse system and perform business analysis with OLAP tools

CO2 - Discuss about various data preprocessing techniques.

CO3: Explain various techniques applied for mining frequent patterns

CO4: Summarize the working of various classification algorithms

CO5: Apply various clustering methods applicable for mining different types of dataset

CO6: To demonstrate how to apply data mining principles and techniques for real time applications
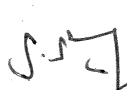
TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques‖, Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
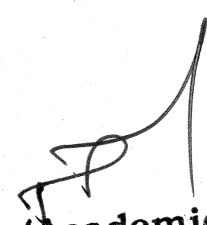
REFERENCE BOOKS::

1. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice‖, Eastern Economy Edition, Prentice Hall of India, 2006.

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	-	-	-	-	-	-	-	2	-	2	2
CO2	3	-	2	-	3	-	-	-	1	-	1	-	2	2
CO3	3	3	3	2	3	-	-	-	1	-	2	-	2	2
CO4	3	3	3	2	2	-	-	-	1	-	3	-	2	-
CO5	3	3	3	2	2	-	-	-	1	-	1	-	2	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5302	PYTHON FOR DATA SCIENCE	3	0	0	3

Course Objective	1. To understand the fundamental and complex data structures in Python 2. To clean, scale and normalize the data sets. 3. To develop skill sets and represent data effectively. 4. To build prediction models using the various functions. 5. To Analyse and Visualize the model using appropriate packages

Unit	Description	Instructional Hours
I	**PYTHON FUNDAMENTALS** Basic data types and variables – Operators - Complex data structures – Control flow - Loops -Functions and methods - Classes - Objects - Modules - Import packages - Documentation.	9
II	**PACKAGES FOR DATA SCIENCE** NumPy: NumPy Arrays – Random array module – Data distribution – Pandas:Pandas series, Pandas dataframe, Read CSV, JSON – Analyze data – Pandas correlation	9
III	**DATA PREPROCESSING USING PYTHON** Python data operations - Python data cleansing - Python processing CSV data, JSON data, XLS data -Scaling – Normalization - Relational databases - NoSQL Databases - Date and Time - Data wrangling -Data aggregation - Reading HTML pages - Processing unstructured data - Word tokenization -Stemming and lemmatization.	9
IV	**MODELLING PROCESS USING SCIKIT LEARN** Scikitlearn : Splitting the dataset - Train the Model - Model Persistence: Dump and Load – Estimator API : Choose a class of model Choose model hyperparameters Arranging the data Model Fitting Applying the model – Predict(), Transform() - Refitting and Updating Parameters.	9
V	**ANALYSING AND VISUALIZING DATA** Data Analysis: Filtering - Cleaning data group by operations - Pivot tables -Data visualization -Plotting with Matplotlib - Bar charts - Scatter plots - Histograms - Customizing visualizations –Visualization of normal, binomial, poisson, uniform, logistic, multinomial, exponential, distribution	9
	Total Instructional Hours	45

Course Outcome		
	CO1:	Understand and gain knowledge of various packages
	CO2:	Implement preprocessing techniques effectively
	CO3:	Represent data efficiently.
	CO4:	Analyze the data at higher levels.
	CO5:	Build a model using the various functions.
	CO6:	Visualize the model using appropriate packages.

TEXT BOOKS:
T1 William Mc Kinney, —Python for Data Analysis, O'Reilly, 2017.
T2 Chris Albon, —Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learningl, O'Reilly, 2017.

REFERENCE BOOKS:
R1: Al Sweigart, —Automate the Boring Stuff with Python: Practical Programming for Total
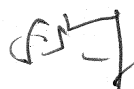
Beginners‖, No Starch Press, 2015
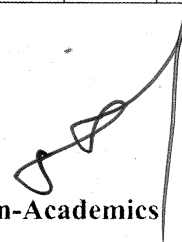
R2: https://www.tutorialspoint.com/scikit_learn/index.htm.

R3: https://www.tutorialspoint.com/python_data_science/index.htm

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	2	2	-	-	-	2	-	-	2	2	2
CO2	-	3	2	3	2	2	-	-	2	2	-	2	3	3
CO3	-	3	3	2	3	2	-	-	2	2	-	2	3	3
CO4	-	1	1	2	3	2	2	1	2	2	1	2	3	3
CO5	-	1	1	2	3	2	2	2	2	-	3	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5303	Exploratory Data Analysis and Time series	3	0	0	3

Course Objective	1. To outline an overview of exploratory data analysis.
	2. To implement data visualization using Matplotlib
	3. To perform univariate data exploration and analysis
	4. To apply bivariate data exploration and analysis.
	5. To use Data exploration and visualization techniques for multivariate and time series data.

Unit	Description	Instructional Hours
I	**EXPLORATORY DATA ANALYSIS** EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data –Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.	9
II	**EDA USING PYTHON** Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.	9
III	**UNIVARIATE ANALYSIS** Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread -Scaling and Standardizing – Inequality.	9
IV	**BIVARIATE ANALYSIS** Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables -Handling Several Batches - Scatterplots and Resistant Lines.	9
V	**MULTIVARIATE AND TIME SERIES ANALYSIS** Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.	9
	Total Instructional Hours	45

Course Outcome	CO1:	Understand the fundamentals of exploratory data analysis.
	CO2:	Implement the data visualization using Matplotlib.
	CO3:	Perform univariate data exploration and analysis.
	CO4:	Apply bivariate data exploration and analysis.
	CO5:	Use Data exploration and visualization techniques for multivariate and time series data

TEXT BOOKS:

T1 : Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python",Packt Publishing, 2020. (Unit 1)

T2: Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)

T3: Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5).

REFERENCE BOOKS:

R1: Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017

R2: Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.

R3: Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	3					2	2	2	2	2
CO2	3	2	2	2	3					2	1	2	3	3
CO3	2	2	2	2	3					3	2	2	2	3
CO4	3	3	3	2	2					3	3	2	3	3
CO5	3	2	2	2	2					3	1	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5304	Intelligent Multi Agent and Expert systems	3	0	0	3

Course Objective	1.To learn the concept of how to learn patterns and concepts from data without being explicitly programmed 2.To know about Multi Agent in global Planning 3.To learn about knowledge based Agent to represents frame Representation. 4.To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances 5.To be familiar with the applications of Expert System

Unit	Description	Instructional Hours
I	**Introduction** : what is an agent?: agents and objects; agents and expert systems; agents and distributed systems; typical application areas for agent systems Intelligent Agents: the design of intelligent agents - reasoning agents (eg AgentO), agents as reactive systems (eg subsumption architecture); hybrid agents (eg PRS); layered agents (eg Interrap) a contemporary (Java-based) framework for programming agents (eg the Jack language, the JAM system)	9
II	**Multi-Agent Systems**: Classifying multi-agent interactions - cooperative versus non-cooperative; zero-sum and other interactions; what is cooperation? how cooperation occurs - the Prisoner's dilemma and Axelrod's experiments; Interactions between self-interested agents: auctions & voting systems: negotiation; Interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination;	9
III	**Knowledge Based Agent**-Knowledge Representation-Knowledge Representation Techniques-Logical, Semantic ,Frame Representation, Production Rules-Propositional Logic –Rules of Inference – Inductive and Deductive Reasoning	9
IV	Artificial intelligence in Manufacturing-Artificial Intelligence in Civil Engineering, Artificial Intelligence in Gaming Industry-Artificial Intelligence in HR-Artificial intelligence in Medicine	9
V	**Expert System**- Components of Expert System-Why Expert System-Capabilities of Expert system-Applications of Expert System	9
	Total Instructional Hours	45

Course Outcome	CO1:	Understanding of the theoretical aspects of computing with agents
	CO2:	Understand the foundation of multi agent system formation, measurement, and analysis.
	CO3:	Understand the common methods for Rules of Inference
	CO4:	Exploring real time applications in Industry
	CO5:	Understanding of various applications of Expert System

TEXT BOOKS:

T1: An Introduction to Multi Agent Systems - Second Edition. Michael Wooldridge (Wiley, 2009)

T2: Multiagent Systems by Gerhard Weiss, 2nd edition, The MIT Press

REFERENCE BOOKS:

R1 : Programming Multi-agent Systems in Agent Speak Using Jason. Rafael H. Bordini, Jomi Fred Hubner and Michael Wooldridge (Wiley, 2007)

Website1: https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	3					2	2	2	2	2
CO2	3	2	2	2	3					2	1	2	3	3
CO3	2	2	2	2	3					3	2	2	2	3
CO4	3	3	3	2	2					3	3	2	3	3
CO5	3	2	2	2	2					3	1	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B TECH	22AI5305	NETWORK SCIENCE AND MODELING	3	0	0	3

Course Objective	1. Be familiar with the Network science and modelling. 2. Have described the foundation of Graph theory and network modeling. 3. Have gained knowledge in Random networks by using scaling factors. 4. Have gained exposure to scientific and measuring approach. 5. To be familiar with the applications of network modeling.

Unit	Description	Instructional Hours
I	Introduction : The characteristics of network science-- Interdisciplinary Nature-Empirical Data Driven Nature, Quantitative and Mathematical Nature.Computational Nature- Societal Impact- Scientific Impact.	9
II	Graph theory, Networks and Graphs, Degree, Average Degree and Degree Distribution- Weighted Networks- Bipartite Networks- Paths and Distances Connectedness- Clustering Coefficient	9
III	Random networks- Binomial and poison distribution -Real Networks are Not Poisson-Small Worlds-Six Deegree of Separation- Clustering Coefficient-the scale free property- Power Laws and Scale-Free Networks- The Meaning of Scale-Free- Universality- Generating Networks with Arbitrary Degree Distribution	9
IV	The Bianconi-Barabási Model-Measuring Fitness-The Fitness of a Web Document-The Fitness of a Scientific Publication-Bose-Einstein Condensation-Scale-free Phase-Evolving Networks-Initial Attractiveness-Internal Links-Node Deletion	9
V	Modeling Cascading Failures- Failure Propagation Model- Branching Model- Building Robustness- Optimizing Attack and Failure Tolerance- Case Study: Estimating Robustness	9
	Total Instructional Hours	**45**

Course Outcome	CO1:	Understanding of the theoretical aspects of network science.
	CO2:	Understand the foundation of various network modeling.
	CO3:	Understand the common methods for robust network matching and analysis.
	CO4:	Exploring the scaling measuring details of various network models
	CO5:	Understanding of various applications of Computer network and model.
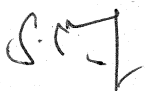
TEXT BOOKS:	
T1:	Albert-Laszlo Barabasi"Network Science" 21 July 2016.
T2:	TED G.Lewis "Network Science" –Theory and Applications"Wiley Publicatiions,2008

REFERENCE BOOKS:	
R1:	"Network Science: Analysis and Optimization Algorithms for Real-World Applications" Carlos Andre Reis Pinheiro,Wiley, 2022
R2:	Henry Hexmoor "Computational Network Science-An Algorithmic Approach"-2014

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	2	1	-	-	-	-	2	2	2	2	2
CO2	3	2	1	2	2	-	-	-	-	2	1	2	3	3
CO3	2	1	2	3	3	-	-	-	-	3	2	2	2	3
CO4	3	3	3	3	3	-	-	-	-	3	3	2	3	3
CO5	3	1	3	2	2	-	-	-	-	3	1	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B. Tech.	21AI5306	BUSINESS INTELLIGENCE	3	0	0	3

Course Objective

1. To understand the basics and advantages of business intelligence to collect, integrate, analyze, and apply BI concepts.
2. To summarize the technology and processes associated with Business Intelligence framework.
3. To implement Data Warehouse methodology and project life cycle in real world applications..
4. To learn about multi dimensional data modeling.
5. To design an enterprise dashboard as the key performance indicators to help in decision making

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BUSINESS INTELLIGENCE** Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities.	9
II	**BASICS OF DATAINTEGRATION** Information integration, Enterprise Application integration, Web services-Management Issues- Parallelism- Granularity-Dependence, Data Enhancement-Incremental Enhancement- Batch Enhancements-Standardization..	9
III	**EXTRACTION TRANSFORMATION LOADING** Introduction to ETL using SSIS, Data quality-Data Cleansing-data profiling - Knowledge Discovery and Data Mining-Public Data-Unstructured Data-Data Resources-Source data transformation-Reconciliation-ETL Testing.	9
IV	**INTRODUCTION TO MULTI-DIMENSIONALDATAMODELING** Introduction to data and dimension modelling, multidimensional data model, ER Modelling vs. multi-dimensional modelling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS	9
V	**ENTERPRISE REPORTING** Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Describe the concepts and components of Business Intelligence (BI).

CO2: Demonstrate the technology and processes associated with Business Intelligence framework

CO3: Implement Data Warehouse methodology and project life cycle in real world applications.

CO4: Construct a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal

CO5: Design an enterprise dashboard as the key performance indicators to help in decision making.

TEXT BOOKS:

T1: David Loshin , "Business Intelligence", First Edition, 2013

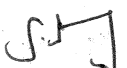T2: Mike Biere, "Business intelligence for the enterprise", Pearson Publication, First Edition

REFERENCE BOOKS:

R1: Larissa Terpeluk Moss, ShakuAtre , "Business intelligence roadmap" , First Edition
R2: CindiHowson, "Successful Business Intelligence: Secretsto making Killer BI Applications" McGraw-Hill Education, Second Edition, 2013
R3: Brain, Larson, "Delivering business intelligence with Microsoft SQL server 2008", McGraw-Hill Education, 2008.

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	1	-	2	1	1	2	1	1	2	1
CO2	3	3	2	-	-	2	-	1	2	2	-	1	3	1
CO3	3	2	2	1	1	1	1	1	1	3	-	-	3	3
CO4	2	1	2	2	3	1	1	1	-	3	-	1	3	3
CO5	2	1	1	3	3	1	1	3	1	3	1	1	2	2

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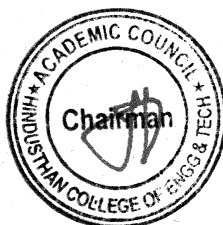
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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5307	Principles of Cloud Computing	3	0	0	3

Course Objective

1. To provide detailed and ample knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
2. To expose the students to the cutting edge areas of Cloud Computing
3. To provide practical in-sight to the students in developing cloud applications
4. To shed light on the concurrent computing in Cloud Computing.
5. To analyse on the Security issues in Cloud Computing.

Unit	Description	Instructional Hours
I	**Fundamentals of Distributed Computing and Cloud Evolution** History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds	9
II	**Introduction to Cloud Computing and Virtualization** Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics -Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) usingVirtualization, load balancing and migration of VMs .	9
III	**Cloud Application Programming** Cloud Programming and Software Environments- Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine- Aneka platform- Anatomy of Aneka Container- Building Aneka CloudsAneka SDK.	9
IV	**Concurrent Computing and Data-Intensive Computing** Concurrent Computing: Introducing parallelism for single-machine computation, Programming applications with threads, Multithreading with aneka, Programming applications with aneka threads. Data-Intensive Computing: What is data-intensive computing? Technologies for data-intensive computing, Aneka Map-Reduce programming.	9
V	**Cloud Security** Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data -Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.	9
	Total Instructional Hours	45

Course Outcome

CO1: Communicate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing

CO2: Categorise the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc

CO3: Elucidate the core issues of cloud computing such as security, privacy, and interoperability.

CO4: Provide the appropriate cloud computing solutions and recommendations according to the applications used.
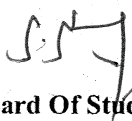
CO5: Investigate, identify security from cloud

TEXT BOOKS:

T1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012

T2. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, "Mastering Cloud Computing: Foundations and Applications Programming" Morgan Kaufmann, Elsevier.

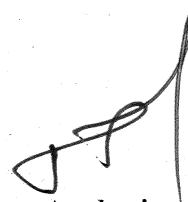T3. "Cloud Computing: A Hands-On Approach" by ArshdeepBahga And Vijay Madisetti

REFERENCE BOOKS:

R1: Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010

R2. Tim Mather, SubraKumaraswamy, and ShahedLatif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	3	2	1	2	2	2	2	2	2	2	2	1
CO2	3	3	3	3	3	3	2	2	2	2	1	2	3	1
CO3	3	3	2	3	1	2	2	3	1	3	2	2	3	3
CO4	3	1	2	2	3	3	2	3	2	3	3	2	3	3
CO5	1	2	2	3	2	1	2	3	3	3	1	2	2	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5308	VIRTUALIZATION	3	0	0	3

Course Objective
1. To Learn the basics and types of Virtualization
2. To understand the Hypervisors and its types
3. To Explore the Virtualization Solutions.
4. To Experiment the virtualization platforms.
5. To create tools in virtualization platforms

Unit	Description	Instructional Hours
I	**INTRODUCTION TO VIRTUALIZATION** Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment,reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization – partial virtualization – Para virtualization-Types of Hypervisors	9
II	**SERVER AND DESKTOP VIRTUALIZATION** Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation– Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization.	9
III	**NETWORK VIRTUALIZATION** Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLANWAN Architecture-WAN Virtualization	9
IV	**STORAGE VIRTUALIZATION** Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID	9
V	**VIRTUALIZATION TOOLS** VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study	9

Total Instructional Hours   45

Course Outcome

Upon completion of this course, the students will be able to
CO1: Analyse the virtualization concepts and Hypervisor
CO2 :Apply the Virtualization for real-world applications.
CO3: Install & Configure the different VM platforms
CO4: Experiment with the VM with various software
CO5: Implementation of virtualization tools

TEXT BOOKS:
1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011.
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

125

REFERENCE BOOKS::

1. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005
2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.
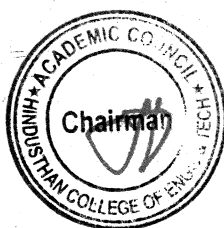
PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	-	-	-	-	-	-	-	-	-	2	-	2	2
CO2	3	-	2	-	3	-	-	-	1	-	1	-	2	2
CO3	3	3	3	2	3	-	-	-	1	-	2	-	2	2
CO4	3	3	3	2	2	-	-	-	1	-	3	-	2	-
CO5	3	3	3	2	2	-	-	-	1	-	1	-	2	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5309	Cloud Computing Architecture & Deployment Models	3	0	0	3

Course Objective	1. To study the architecture and deployment models 2. Learn cloud enabling technologies and get exposure to advanced clouds 3. Explore cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage 4. Understand the cloud security threats and protective mechanism for cloud computing 5. To develop a private cloud using the open standards tools such as open stack.

Unit	Description	Instructional Hours
I	**Introduction to Cloud Computing** Introduction: Definition of cloud computing, Delivery Models, Conceptual reference model, Cloud Computing solution components. Cloud computing Architecture: The conceptual reference model, Service Deployment, Cloud service management, cloud taxonomy, Cloud computing reference architecture (CCRA), Common cloud management platform. Case Study: IBM Smart Cloud Entry, VMware vClouddirector.	9
II	**Cloud vendor selection:** SLA, Security and privacy, periodic update and maintenance, data location and Jurisdiction, Measurability, Pricing, Interoperability and lock in , Exit process, track record.	9
III	**Open Stack:** Definition, Advantages, Releases, Architectural overview, Different components of Open Stack. Open stack- Hypervisors, Network Services, Storage -Block Storage, Object Storage, Choosing Storage Backends, Commodity Storage Backend Technologies: swift, Ceph, Gluster, LVM, ZFS.	9
IV	**Advance concepts in Openstack:** Multiserver Openstack, Tenant model architecture, Cloud orchestration using OpenStack using OpenStack Heat and Ubuntu Juju.	9
V	**private cloud tools** Eucalyptus: Introduction, Features and Functionality, Architecture, Basic and Advanced Components. Eucalyptus vs Openstack Open Nebula: Introduction, Features and Functionality, Architecture, Basic and Advanced Components. OpenNebula vs Openstack	9
	Total Instructional Hours	**45**

Course Outcome	CO1:	Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS and different clouds.
	CO2:	Explain the components of Conceptual Reference Models like NISTand IBM CCRA.
	CO3:	Understand the components and drafting of SLA.
	CO4:	Explain the Architecture and Components of Openstack.
	CO5:	Understand the private cloud tools like OpenNebula and Eucalyptus.

TEXT BOOKS:

T1 : Cloud Computing Architecture & Deployment Models (IBM Publications-), 2015.

T2 : Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, Cloud Computing: Principles and

paradigms, 2011.

REFERENCE BOOKS:
R1: Rittinghouse, John, W, "Cloud computing ": Implementation, management and security.
R2: Barrie Sosinsky , "Cloud Computing Bible", Wiley, 2011.

R3: Bumgardner, V. C., Open Stack in action. Manning Publications Company, 2016.

PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	3	3	2	2	2	2	2	2	2	2	2
CO2	3	2	2	2	3	3	2	2	2	2	1	2	3	3
CO3	2	2	2	2	3	2	2	3	1	3	2	2	2	3
CO4	3	3	3	2	2	3	2	3	2	3	3	2	3	3
CO5	3	2	2	2	2	1	2	3	3	3	1	2	3	2
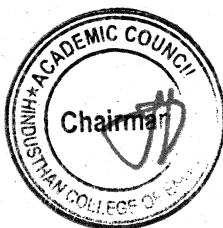
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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5310	Modern Cryptography and Network Security	3	0	0	3

Course Objective

1. To understand enhancement of Cryptography and Network Security.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. To understand various protocols for network security to protect against the threats in the networks
5. To explore different popular applications of cryptography

Unit	Description	Instructional Hours
I	**Introduction to Cryptography and Block Ciphers** Introduction to security attacks - services and mechanism - introduction to cryptography -Conventional Encryption: Conventional encryption model - classical encryption techniques -substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and blockciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - fiestal structure - data encryption standard(DES) - strength of DES – differential and linearcrypt analysis of DES - block cipher modes of operations - triple DES – AES.	9
II	**Confidentiality and Modular Arithmetic** Confidentiality using conventional encryption - traffic confidentiality - key distribution – random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm -Chinese Remainder theorem - discrete algorithms.	9
III	**Public key cryptography and Authentication requirements** Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.	9
IV	**Integrity checks and Authentication algorithms** MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME..	9
V	**IP Security and Key Management** IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.	9

Total Instructional Hours   45

Course Outcome

CO1:	Provide security of the data over the network.
CO2:	Do research in the emerging areas of cryptography and network security
CO3:	Implement various networking protocols.

CO4:   Protect any network from the threats in the world.
CO5:   Explore different popular applications of cryptography

TEXT BOOKS:
T1   William Stallings, "Cryptography and Network security Principles and Practices",
       Pearson/PHI.
T2   W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
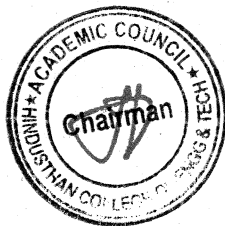
REFERENCE BOOKS:
R1:   Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding
       theory", Pearson.
R2:   Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing –
       Prentice Hall of India.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	2	2	-	-	-	2	-	-	2	2	2
CO2	-	3	2	3	2	2	-	-	2	2	-	2	3	3
CO3	-	3	3	2	3	2	-	-	2	2	-	2	3	3
CO4	-	1	1	2	3	2	2	1	2	2	1	2	3	3
CO5	-	1	1	2	3	2	2	2	2	-	3	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5311	ETHICAL HACKING	3	0	0	3

Course Objectives	1. To understand the basics of computer-based vulnerabilities, 2. To learn about the different foot printing, reconnaissance and scanning methods. 3. To explore the enumeration and vulnerability analysis methods, 4. To Acquire knowledge on hacking options available in web and wireless applications. 5. To explore the options for network protection, tools to perform ethical hacking to expose the vulnerabilities

Unit	Description	Instructional Hours
I	**INTRODUCTION** Ethical Hacking overview - Role of security and penetration testers. – Penetration - Testing Methodologies - Laws of the Land - Overview of TCP/IP - Application layer - Transport layer – Internet layer - IP Addressing. - Network and computer attacks - Malware - Protecting against malware attacks -Intruder attacks - Addressing physical security.	9
II	**FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS** Foot printing concepts – Foot printing through search engines, web services, social networking sites, website, Email - Competitive intelligence – Foot printing through social engineering – Foot printing tools -Network scanning concepts - Port-Scanning tools - Scanning techniques - Scanning beyond IDS and firewall.	9
III	**ENUMERATION AND VULNERABILITY ANALYSIS** Enumeration concepts - NetBIOS enumeration – SNMP, LDAP, NTP, SMTP and DNS enumeration -Vulnerability assessment concepts - Desktop and server OS vulnerabilities - Windows OS vulnerabilities - Tools for identifying vulnerabilities in windows- Linux OS vulnerabilities- Vulnerabilities of embedded OS.	9
IV	**SYSTEM HACKING** Hacking web servers - Web application components- Vulnerabilities - Tools for web attackers and security testers - Hacking wireless networks - Components of a wireless network – War driving-Wireless hacking - Tools of the trade.	9
V	**NETWORK PROTECTION SYSTEMS** Access control lists. - Cisco adaptive security appliance firewall - Configuration and risk analysis tools for firewalls and routers - Intrusion detection and prevention systems - Network based and host-based IDSs and IPSs - Web filtering - Security incident response teams – Honeypots	9
	Total Instructional Hours	**45**

Course Outcomes	CO1: Express knowledge on basics of computer-based vulnerabilities CO2: Understand the different foot printing, reconnaissance and scanning methods CO3: Demonstrate the enumeration and vulnerability analysis methods CO4: Gain knowledge on hacking options available in Web and wireless applications. CO5: Explore the options for network protection, tools to perform ethical hacking to expose the vulnerabilities

TEXT BOOKS:

T1 - Michael T. Simpson, Kent Backman, and James E. Corley, —Hands-On Ethical Hacking and Network Defense, Course Technology‖, Delmar Cengage Learning, 2010.
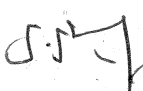
T2 – Patrick Engebretson, —The Basics of Hacking and Penetration Testing —, Syngress, Elsevier, 2013

REFERENCE BOOKS:

R1- Dafydd Stuttard and Marcus Pinto, —The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws‖, 2011

R2 - Justin Seitz, —Black Hat Python: Python Programming for Hackers and Pentesters‖, 2014

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	-	2	2	2	2	2	2	2	2
CO2	3	3	2	3	2	2	3	3	2	2	3	2	3	3
CO3	2	3	3	2	3	1	2	2	2	2	2	2	3	3
CO4	2	1	1	2	3	2	2	2	2	2	2	2	3	3
CO5	2	1	1	2	3	1	2	2	2	1	2	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5312	DIGITAL AND MOBILE FORENSICS	3	0	0	3

Course Objective	
	1. To understand basic digital forensics and techniques
	2. To understand digital crime and investigation.
	3. To understand how to be prepared for digital forensic readiness.
	4. To understand and use forensics tools for iOS devices.
	5. To understand and use forensics tools for Android devices.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO DIGITAL FORENSICS** Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase	9
II	**DIGITAL CRIME AND INVESTIGATION** Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.	9
III	**DIGITAL FORENSIC READINESS** Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics	9
IV	**iOS FORENSICS** Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System –Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud	9
V	**ANDROID FORENSICS** Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security –Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools –Oxygen Forensics – MobilEdit – Android App Decompiling	9
	Total Instructional Hours	45

Course Outcome		
	CO1:	Have knowledge on digital forensics.
	CO2:	Know about digital crime and investigations
	CO3:	Be forensic ready
	CO4:	Investigate, identify and extract digital evidence from iOS devices
	CO5:	Investigate, identify and extract digital evidence from Android devices

TEXT BOOKS:

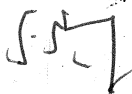T1 : Andre Arnes, "Digital Forensics", Wiley, 2018.

T2: Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.

REFERENCE BOOKS:

R1: Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
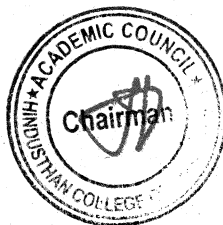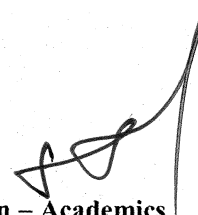
PO&PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	3	2	1	2	2	2	2	2	2	2	2	1
CO2	3	3	3	3	3	3	2	2	2	2	1	2	3	1
CO3	3	3	2	3	1	2	2	3	1	3	2	2	3	3
CO4	3	1	2	2	3	3	2	3	2	3	3	2	3	3
CO5	1	2	2	3	2	1	2	3	3	3	1	2	2	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5313	Computer Graphics	3	0	0	3

Course Objective	1. To understand the basics of geometry processing. 2. To understand the fundamentals of pipelined rasterization rendering of meshed objects and curved surfaces. 3. To understand and work with advanced rendering methods such as radiosity. 4. To gain knowledge about illumination methods, rendering and color models. 5. To design programs for advanced graphics methods

Unit	Description	Instructional Hours
I	**INTRODUCTION** Basics, Scope and Applications, Graphics Standards, Display systems, Image formation, Graphics Systems, Coordinate systems, Line-Drawing Algorithms, Parallel Line Algorithms, Circle drawing algorithms, Area Filling, Clipping Algorithms: Line and Polygon, Anti-aliasing.	9
II	**TRANSFORMATIONS** Affine Transformations (2D & 3D): Translation, Rotation, Scaling, Reflection and Shearing; Hierarchical Modeling & viewing: The Camera Transformation – Perspective, orthographic and Stereographic views;	9
III	**FRACTALS** Fractals and Self similarity – Peano curves – Creating image by iterated functions – Mandelbrot sets –Julia Sets – Random Fractals – Overview of Ray Tracing – Intersecting rays with other primitives –Reflections and Transparency – Boolean operations on Objects - its applications	9
IV	**VISIBLE SURFACE DETERMINATION, ILLUMINATION AND COLOR MODELS** Visible line determination algorithms, Illumination Models: Diffuse, Specular and Ambient Reflection. Polygon- Flat Shading, Gouraud Shading and Phong Shading. Color models: properties of light, XYZ, RGB, YIQ and CMY color models.	9
V	**ADVANCED RENDERING TECHNIQUE** Curves and Surfaces: Bezier, B-Splines and NURBS; Photorealistic rendering; Global Illumination; Ray tracing; Monte Carlo algorithm; Adding Surface texture- Texture Synthesis – BumpMapping, Environmental mapping; Advanced Lighting and Shading	9
	Total Instructional Hours	**45**

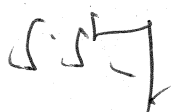|		
Course Outcome	CO1:	Understand the basics of geometry processing
	CO2:	Analyze the fundamentals of 2D and 3D computer graphics
	CO3:	Discuss the basic algorithms commonly used in 3D computer graphics..
	CO4:	Describe advanced computer graphics techniques and applications.
	CO5:	Analyze computer graphics and solid modelling techniques for various applications.

TEXT BOOKS:

T1   Edward Angel and Dave Shreiner, "Interactive Computer Graphics: A top-down approach with OpenGL", Sixth Edition Addison Wesley, 2012.

T2   Foley, van Dam, Feiner, Hughes, "Computer Graphics Principles and Practice", Third Edition in C. Addison Wesley, 2014.
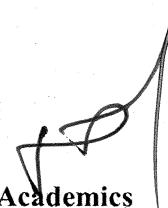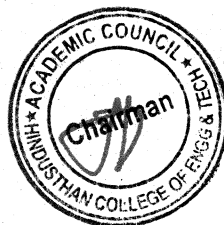
REFERENCE BOOKS:

R1: Alan Watt and Mark Watt, "Advanced Animation and Rendering Techniques: Theory and Practice", Addison-Wesley

R2: Rick Parent, "Computer Animation - Algorithms and Techniques", Third Edition Morgan Kaufman,

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	2	2	-	-	-	2	-	-	2	2	2
CO2	-	3	2	3	2	2	-	-	2	2	-	2	3	3
CO3	-	3	3	2	3	2	-	-	2	2	-	2	3	3
CO4	-	1	1	2	3	2	2	1	2	2	1	2	3	3
CO5	-	1	1	2	3	2	2	2	2	-	3	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5314	Image and video analytics	3	0	0	3

Course Objectives	1. To understand the basics of image processing techniques for computer vision. 2. To learn the techniques used for image pre-processing. 3.To discuss the various object detection techniques. 4. To understand the various Object recognition mechanisms. 5. To elaborate on the video analytics techniques.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.	9
II	**IMAGE PRE-PROCESSING** 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 multisperalct images - Local pre-processing in the frequency domain - Line detection by local preprocessing operators - Image restoration.	9
III	**OBJECT DETECTION USING MACHINE LEARNING** Object detection– Object detection methods – Deep Learning framework for Object detection–bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures	9
IV	**FACE RECOGNITION AND GESTURE RECOGNITION** Face Recognition-Introduction-Applications of Face Recognition-Process of Face RecognitionDeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNetGesture Recognition.	9
V	**VIDEO ANALYTICS** Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problemRestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architectureImprovement in Inception v2-Video analytics-RestNet and Inception v3.	9
	Total Instructional Hours	**45**

Course Outcomes	CO1: Understand the basics of image processing techniques for computer vision and video analysis. CO2: Explain the techniques used for image pre-processing. CO3: Develop various object detection techniques CO4: Understand the various face recognition mechanisms CO5: Elaborate on deep learning-based video analytics.

TEXT BOOKS:

T1:Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.

T2: Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)
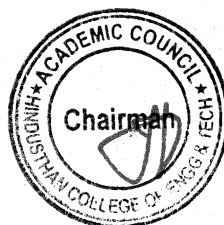
REFERENCE BOOKS:

R1- Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011

R2 - Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	-	2	2	2	2	2	2	2	2
CO2	3	3	2	3	2	2	3	3	2	2	3	2	3	3
CO3	2	3	3	2	3	1	2	2	2	2	2	2	3	3
CO4	2	1	1	2	3	2	2	2	2	2	2	2	3	3
CO5	2	1	1	2	3	1	2	2	2	1	2	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5315	**GAME PROGRAMMING**	3	0	0	3

Course Objectives
1. To Understand the concepts of Game design and development.
2. To Learn the processes, mechanics and issues in Game Design.
3. To Be exposed to the Core architectures of Game Programming
4. To Know about Game programming platforms, frame works and engines
5. To Learn to develop games.

Unit	Description	Instructional Hours
I	**3D GRAPHICS FOR GAME PROGRAMMING** 3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation,Physics-based Simulation, Scene Graphs.	9
II	**GAME ENGINE DESIGN** Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.	9
III	**GAME PROGRAMMING** Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.	9
IV	**GAMING PLATFORMS AND FRAMEWORKS** 2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - DX Studio, Unity	9
V	**GAME DEVELOPMENT** Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.	9
	Total Instructional Hours	45

Course Outcomes
CO1: Discuss the concepts of Game design and development.
CO2: Design the processes, and use mechanics for game development
CO3: Explain the Core architectures of Game Programming.
CO4: Use Game programming platforms, frame works and engines.
CO5: Create interactive Games.

TEXT BOOKS:
T1: Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.
T2: Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009
T3 : David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2nd Editions, Morgan Kaufmann, 2006.
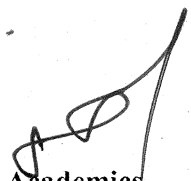
REFERENCE BOOKS:
R1- Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2nd Edition Prentice Hall / New Riders, 2009.
R2 - Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", 3rd Edition, Course Technology PTR, 2011.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	-	2				2	2	2	2
CO2	3	3	2	3	2	2	3				3	2	2	1
CO3	2	3	3	-	3	1	2				2	2	3	3
CO4	2	1	1	2	3		2				2	2	1	3
CO5	2	1	1	2	3	1	2				2	2	3	2

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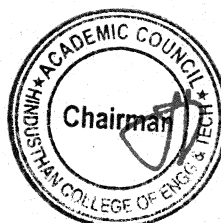
Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5316	WEB TECHNOLOGY	3	0	0	3

Course Objective
1. To comprehend the basic concepts of web programming
2. To understand about the client side scripting for data validation and manipulation
3. To learn about the creation of web application using java servlets with database access
4. To Construct simple web pages in PHP and to represent data in XML format
5. To Develop web applications using framework

Unit	Description	Instructional Hours
I	**WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0** Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations. Bootstrap Framework	9
II	**CLIENT SIDE PROGRAMMING** Java Script: An introduction to JavaScript–JavaScript DOM Model- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files	9
III	**SERVER SIDE PROGRAMMING** Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.	9
IV	**PHP and XML** An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL PHP Database Connectivity -Connecting to MySQL Server, Selecting Databases, Checking for Errors, Closing the MySQL Server connection	9
V	**INTRODUCTION TO ANGULAR and WEB APPLICATIONS FRAMEWORKS** Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules,Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- Django UI & UX.	9

Total Instructional Hours   45

Course Outcome

CO1: Construct a basic website using HTML and Cascading Style Sheets.

CO2: Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.

CO3: Develop server side programs using Servlets and JSP.

CO4: Construct simple web pages in PHP and to represent data in XML format.
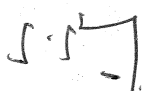
CO5: Develop interactive web applications.

TEXT BOOKS:
1.Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.
2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.
3. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, Packt Publishing

REFERENCE BOOK:
1 Stephen Wynkoop and John Burke "Running a Perfect Website", QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
4. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.
5. Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 1st edition, O'Reilly.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	2	1	-	2	2	1	2	1	3
CO2	3	3	2	1	3	1	1	-	2	2	1	2	2	3
CO3	3	3	2	1	3	2	2	1	1	1	1	2	2	3
CO4	3	3	2	1	3	1	1	2	2	2	1	2	1	1
CO5	3	3	2	1	3	2	1	-	2	2	1	2	1	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5317	FRONT END DEVELOPMENT WITH REACT AND TYPESCRIPT	3	0	0	3

Course Objective	1. To understand the fundamental concepts of React 2. To learn React Properties and Components. 3. To analyze the Redux and GraphQL. 4. To explore TypeScript functions. 5. To learn TypeScript and interaction with React.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO REACT** Introduction to React – Java script for React – React DOM – Components – Virtual DOM – Constructing Elements with Data –React Components – React. create Class –React. Component –Stateless Functional Components–DOM Rendering – Factories – React with JSX– Wep Pack – Web Pack Loaders	9
II	**REACT STATE AND COMPONENTS** React State Management – Building a Star Rating Component – The use State Hook – Refactoring for Advanced Reusability – State in Component Trees – Building Forms – Using Refs – Controlled Components – Creating Custom Hooks – Adding Colours to State – React Context– Enhancing Components with Hooks– Introducing use Effect – The Dependency Array – Deep Checking Dependencies – use Layout Effect – Rules to Follow with Hooks – Improving Code with use Reducer – use Reducer to Handle Complex State – Improving Component Performance	9
III	**REDUX AND GRAPHQL** Redux – State – Actions – Reducers – Colour Reducer – Sort Reducer – Store – Action Creators – Middleware –Explicitly passing the Store –Passing the Store via Context – Presentational Versus Container Components –GraphQL – GraphQL with React	9
IV	**INTRODUCTION TO TYPESCRIPT** Introduction – Basic Types – Functions – Declaring and Invoking Functions – Optional and Default Parameters– Rest Parameters – call, apply, and bind – Generator Functions – Iterators – Call Signatures –Contextual Typing – Overloaded Function Types – Polymorphism– Generic Type Inference – Generic Type Aliases – Bounded Polymorphism	9
V	**TYPESCRIPT CLASSES AND INTEROPERATING WITH JAVASCRIPT** TypeScript Classes – Inheritance – Interfaces –Advanced Types : Sub Type and Super Type–Type Widening -Refinement – Totality – Advanced Object Types– Advanced Function Types – Interoperating with JavaScript – Gradually Migrating from JavaScript to TypeScript –Type Lookup for JavaScript – Using Third-Party JavaScript Running TypeScript on the Server – Running TypeScript in the Browser – Publishing Your TypeScript Code to NPM	9
	Total Instructional Hours	45

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	CO1:	Explore the fundamental concepts of React
Course Outcome	CO2:	Develop applications in React Framework.
	CO3:	Develop applications using Redux and GraphQL.
	CO4:	Design Programs using TypeScript.
	CO5:	Implement applications using Typescript and React.

Text Books:
1. Alex Banks and Eve Porcello, "Learning React – Modern Patterns for Developing React Apps" , O'Reilly, 2020,Second Edition
2. Boris Cherny, "Programming TypeScript Making Your JavaScript Applications Scale", O'Reilly,2019, First Edition
3. Nate Murray, "Fullstack React with TypeScript", 2019, Learn Publishing

Reference Books:
1. Frank Zammetti Pottstow , "Modern Full-Stack Development - Using TypeScript, React, Node.js, Webpack, and Docker", 2020 , Apress
2. David Choi ,"Full-Stack React, TypeScript, and Node", Packt Publishing, 2020
3. Stoyan Stefanov, "React: Up & Running Building Web Applications", O'Reilly,Second Edition,2022

Extensive Reading:
• https://react.dev/
• https://legacy.reactjs.org/
• https://www.typescriptlang.org/

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	1	-	2	3	2	2	1	3
CO2	3	3	3	3	3	2	1	-	2	3	2	2	2	3
CO3	3	3	3	3	3	2	1	-	2	3	2	2	2	3
CO4	3	3	3	3	3	2	1	-	2	3	2	2	1	1
CO5	3	3	3	3	3	2	1	-	2	3	2	2	1	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5318	Node JS	3	0	0	3

Course Objective	1.To Understand the basics of javascript and Node JS 2.To learn and architect the server side of the web application 3.To Develop Connection to database 4.To Architect RESTful APIs , Express.js and Testing. 5. To focus on Containers, Dockers and Kubernetes

Unit	Description	Instructional Hours
I	**INTRODUCTION TO JAVASCRIPT AND NODEJS** Introduction to JavaScript - Introduction to Node JS - Asynchronous Programming in Node.js –Event loop in Node JS - Architecture of Node JS - Examples of Node JS	9
II	**SERVER SIDE PROGRAMMING WITH NODE JS** Introduction to Web Servers – Javascript in the Desktop with NodeJS – NPM – Serving files with the http module – Introduction to the Express framework – Server-side rendering with Templating Engines – Static Files - async/await - Fetching JSON from Express.js	9
III	**ADVANCED NODE JS AND CONNECTION TO DATABASE** Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS – Handling User Authentication with NodeJS - CRUD operations with Node.js and databases	9
IV	**RESTful APIs , Express.js and Testing** Designing RESTful APIs - Building RESTful APIs with Express.js - Consuming APIs with Node.js Testing - Writing unit tests with frameworks like Mocha and Chai - Debugging techniques in Node.js- Code quality tools	9
V	**CONTAINER, DOCKER & KUBERNETES** What are containers - Benefits of container - VM vs Containers - Dev vs Ops-Docker Mission-Docker Adoption -Docker Basic Concepts - Docker Architecture – Typical workflow - Container Ecosystem - Container Orchestration - What is kubernetes –Strength – Architecture – Components - Building blocks - Deploying application on kubernetes – Helm - Application centre components- Pod health checking – kubectl commands - Cloud application component architecture-Benefits of Kubernetes	9
	Total Instructional Hours	**45**

Course Outcome	CO1:	Understand the basics of javascript and Node JS
	CO2:	Implement and architect the server side of the web application

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CO3:	Develop Connection to database
CO4:	Architect RESTful APIs , Express.js and Testing.
CO5:	Design a microservices architecture with Docker, Containers

TEXT BOOKS:
T1."Node.js Design Patterns" by Mario Casciaro
T2.Learning Node.js: A Hands-On Guide to Building Web Applications in JavaScript" by Marc Wandschneider
T3. "Node.js Web Development" by David Herron
T4. "Professional Node.js: Building Javascript Based Scalable Software" by Pedro Teixeira

REFERENCE BOOKS:

1. David Flanagan, "Java Script: The Definitive Guide", O'Reilly Media, Inc, 7th Edition, 2020
2. Matt Frisbie, "Professional JavaScript for Web Developers", Wiley Publishing, Inc, 4th Edition, ISBN: 978-1-119-36656-0, 2019
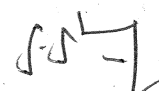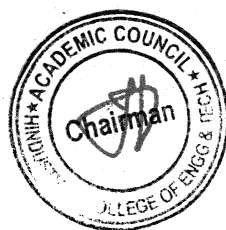3. Alex Banks, Eve Porcello, "Learning React", O'Reilly Media, Inc, 2nd Edition, 2020
4. Marc Wandschneider, "Learning Node", Addison-Wesley Professional, 2nd Edition, 2016
5. Joe Beda, Kelsey Hightower, Brendan Burns, "Kubernetes: Up and Running", O'Reilly Media, 1st edition, 2017
6. Paul Zikopoulos, Christopher Bienko, Chris Backer, Chris Konarski, Sai Vennam, "Cloud Without Compromise", O'Reilly Media, 1st edition, 2021.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	2	1	1	1	2	1	1	3	3	1	3
CO2	3	3	3	3	3	2	1	3	2	2	1	2	1	3
CO3	3	3	2	3	1	2	3	3	3	2	1	1	3	2
CO4	3	1	2	2	3	3	1	2	1	3	3	3	1	3
CO5	1	3	2	3	2	3	1	3	2	3	2	1	1	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	22AI5251	INTRODUCTION TO DESIGN THINKING	2	0	2	3

Course Objective	
	1. Expose students to the design process as a tool for innovation.
	2. Develop students' professional skills in client management and communication.
	3. Students develop a portfolio of work to set them apart in the job market.
	4. Provide an authentic opportunity for students to develop teamwork and leadership skills.
	5. Demonstrate the value of developing a local network and assist students in making
	6. lasting connections with the business community

Unit	Description	Instructional Hours
I	**DESIGN THINKING HISTORY AND OVERVIEW** Understand what came before Design thinking-Identify who did what to bring it about-Learn how it built upon previous approaches-How design thinking is introduced in an organization-Understand the transformation required-What outcomes are possible-Understand the whole approach to design thinking-Determine what is most important. *Illustrative program: Listening and HMW*	9
II	**KEY HABITS** Introduction to key habits-types-avoid common anti-patterns-Optimize for success with these habits-Introduction to loop-Importance of iteration-How to observe, Reflect &Make-Drill down. *Illustrative program: USER RESEARCH and PRACTICE MAPPING INSIGHTS FROM USER RESEARCH*	7+2(P)
III	**USER RESEARCH AND MAKE** Importance of user research-Appreciate empathy through listening-Key methods of user research-How make fits into the loop-Leverage observe information-Ideation, storyboarding, & Prototyping. *Illustrative program: PRACTICE IDEATION AND PRIORITIZATION, COLLABORATIVELY CONSOLIDATE STORYBOARDS*	5+4(P)
IV	**USER FEEDBACK AND TEACHING** User feedback and the loop-Different types of user feedback-How to carryout getting feedback-Understand the challenges of teaching EDT-Valuable hints and tips-Ready to teach the course. *Illustrative program: DEVELOP A SUMMARY HILL STATEMENT AND BUILD YOUR STORY BOARD AND HILL INTO A PROTOTYPE*	3+6(P)

LOGISTICS AND APPLICATIONS

V	Understand what type of room you need-Learn what materials and supplies you need-Learn how to setup the room-Domains that are applicable-Digital versus physical-Explore some technology specialization. *Illustrative program: PRACTICE TEACHING SELECTED SECTION AND USER FEEDBACK*	5+4(P)

Total Instructional Hours   (29 + 16) 45

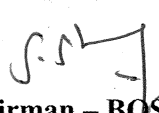|		
	CO1:	Students develop a strong understanding of the Design Process and how it can be applied in a variety of business settings
	CO2:	Students learn to build empathy for target audiences from different "cultures"
Course Outcome	CO3:	Students learn to research and understand the unique needs of a company around specific challenges
	CO4:	Students learn to develop and test innovative ideas through a rapid iteration cycle
	CO4:	Students learn how to map insights from user research.

TEXT BOOKS:

T1 :IBM CourseWare

REFERENCE BOOKS:

R1:Creative Confidence-Tom Kelley.,2013

R2:Change by Design-Tim Brown.,2009

R3:Design Thinking-Nigel Cross.,Kindle Edition

Chairman – BOS

Chairman - BOS
AIML - HiCET

Dean – Academics

**Dean (Academics)
HiCET**

Hindusthan College of Engineering and Technology

An Autonomous Institution, Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NBA (AERO, AUTO, CIVIL, CSE, ECE, EEE, IT, MECH, MCTS)
Accredited by NAAC 'A++' Grade with CGPA of 3.69 out of 4 in Cycle 2

Valley Campus, Coimbatore – 641 032, Tamil Nadu, INDIA

2022 Regulation – 2022 Batch V semester- Syllabus revision

S. No	Year	Semester	Course Code and Course Name	Existing content (in academic Year 2023-24)	Revised Content (for 2024-25)	Percentage of Revision
				NIL		

New Course Introduced (2022 Regulation) – 2022 Batch V semester

S.No	Regulation	Course Code with Name	Credits
		NIL	

Chairman-BoS

Chairman - BoS
AIML - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

149

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A++'Grade)

Coimbatore - 641032.

B.TECH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
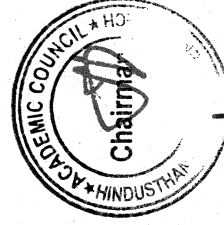
HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST

HICET
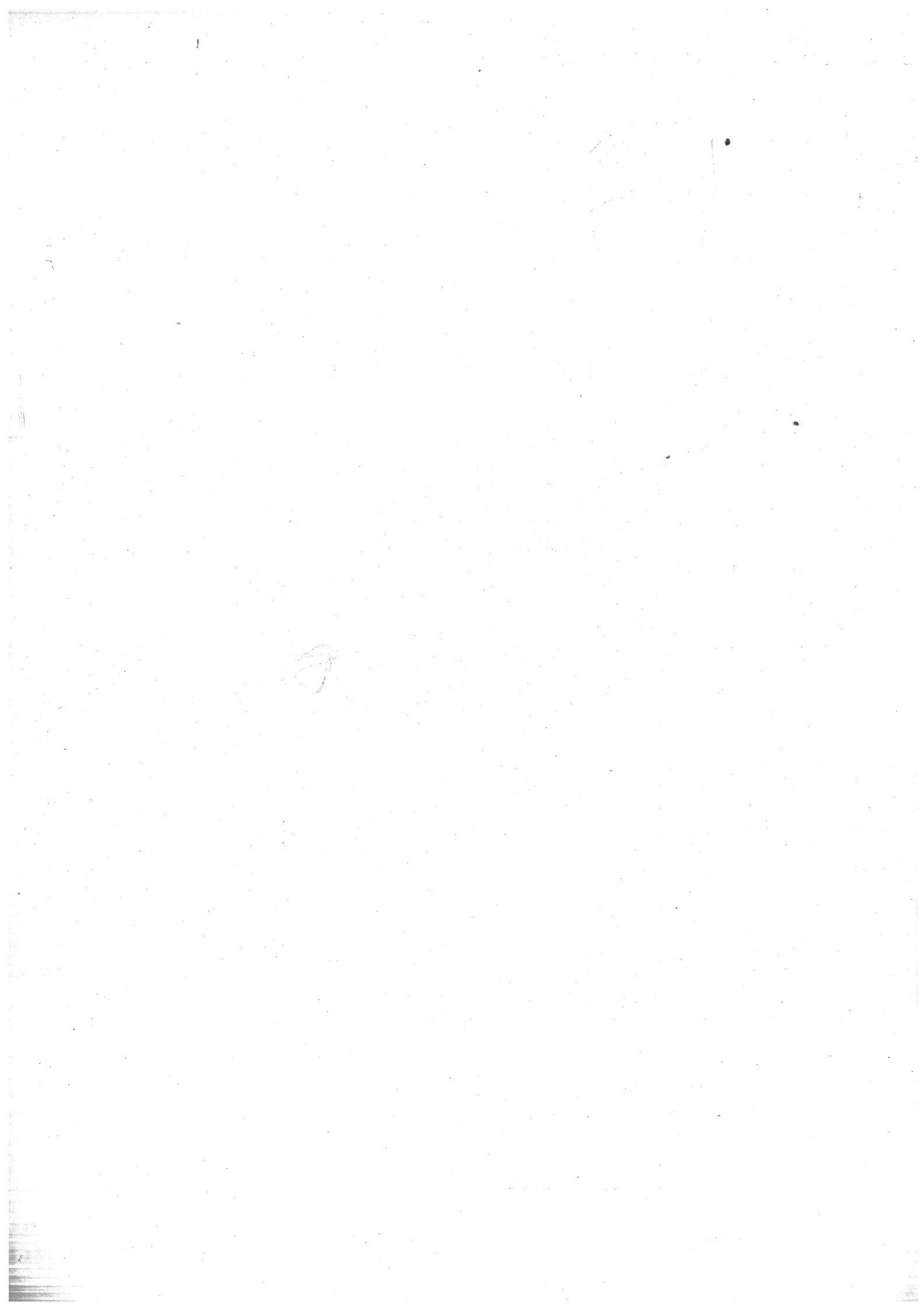
CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the odd semester

Academic year 2024-2025

(Academic Council Meeting Held on 21.06.2024)

Hindusthan College of Engineering and Technology
(An Autonomous Institution, Affiliated to Anna University, Chennai
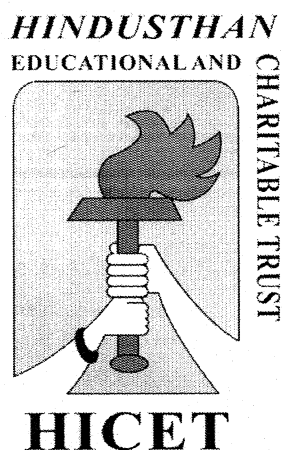Approved by AICTE, New Delhi& Accredited by NAAC with 'A++' Grade)
Valley Campus, Pollachi Highway, Coimbatore, Tamil Nadu.

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS
CBCS PATTERN
UNDERGRADUATE PROGRAMMES
B.TECH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING(UG)
REGULATION-2019
For the students admitted during the academic year 2021-2022 and onwards

SEMESTER I -20 Credits

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	2	1	0	3	40	60	100
2	21MA1101	Calculus	BS	3	1	0	4	40	60	100
THEORY & LAB COMPONENT										
3	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	21CS1152	Object oriented programming using Python	IC	2	0	2	3	50	50	100
6	21EC1154	Basics of Electron devices and Electric Circuits	ES	2	0	2	3	50	50	100
PRACTICAL										
7	21HE1001	Language Competency Enhancement Course - I	HS	0	0	2	1	100	0	100
MANDATORY										
8	21MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	21HE1072	Career Guidance – Level I	EEC	2	0	0	0	100	0	100
10	21HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
		Total Credits		16	2	10	20	580	320	900

SEMESTER II – 22 Credits

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HS	2	1	0	3	40	60	100
2	21MA2104	Differential Equations And Linear Algebra	BS	3	1	0	4	40	60	100
THEORY & LAB COMPONENT										
3	21PH2151	Material Science	BS	2	0	2	3	50	50	100
4	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100

5	21CS2153	Java Fundamentals	IC	2	0	2	3	50	50	100
6	21ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices	ES	0	0	4	2	60	40	100
8	21HE2001	Language Competency Enhancement Course - II	HS	0	0	2	1	100	0	100
MANDATORY										
9	21HE2072	Career Guidance – Level II	EEC	2	0	0	0	100	0	100
		Total Credits		14	2	16	22	540	360	900

SEMESTER III -21Credits

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21AI3201	Data Structures and Algorithms	PC	3	0	0	3	40	60	100
2	21AI3202	Foundations of Artificial Intelligence	PC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
3	21MA3152	Probability and Applied Statistics	BS	3	0	2	4	50	50	100
4	21AI3251	Digital Principles and System Design	PC	3	0	2	4	50	50	100
5	21AI3252	Clean Coding and Devops	IC	3	0	2	4	50	50	100
PRACTICAL										
6	21AI3001	Data Structures and Algorithms Laboratory	PC	0	0	3	1.5	60	40	100
7	21AI3002	Artificial Intelligence Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY										
8	21MC3191	India Constitution	AC	2	0	0	0	0	0	0
9	21HE3072	Career Guidance- Level III	EEC	2	0	0	0	100	0	100
10	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
		Total Credits		20	0	12	21	550	350	900

SEMESTER IV -19Credits

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA4105	Discrete Mathematical Structures	BS	2	1	0	3	40	60	100
2	21AI4201	Database Management System	PC	3	0	0	3	40	60	100
3	21AI4202	Data Visualization	IC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
4	21AI4251	Operating Systems	PC	2	0	2	3	50	50	100
5	21AI4252	Introduction to Machine Learning	PC	3	0	2	4	50	50	100

		PRACTICAL								
6	21AI4001	Database Management System Laboratory	PC	0	0	3	1.5	60	40	100
7	21AI4002	Data Visualization Laboratory	IC	0	0	3	1.5	60	40	100
		MANDATORY								
8	21MC4191	Value Education - Essence of Indian Traditional Knowledge	AC	2	0	0	0	0	0	0
9	21HE4072	Career Guidance- Level IV	EEC	2	0	0	0	100	0	100
10	21HE4073	Ideation Skills	EEC	1	0	0	0	100	0	100
		Total Credits		18	1	10	19	540	360	900

SEMESTER V -24 Credits

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
		THEORY								
1	21AI5201	Computer Networks	PC	3	0	0	3	40	60	100
2	21AI5202	Data Analytics	PC	3	0	0	3	40	60	100
3	21HE5181	Management Information System	HS	3	0	0	3	40	60	100
4	21AI53**	Professional Elective- I	PE	3	0	0	3	40	60	100
		THEORY & LAB COMPONENT								
5	21AI5251	Object Oriented Analysis and Design	PC	2	0	2	3	50	50	100
6	21AI5252	Introduction to Design Thinking	IC	2	0	2	3	50	50	100
		PRACTICAL								
7	21AI5001	Networks Lab	PC	0	0	3	1.5	60	40	100
8	21AI5002	Data Analytics Lab	PC	0	0	3	1.5	60	40	100
9	21AI5701	MOOC / Industrial Training / Seminar	EEC	0	0	2	1	100	0	100
10	21HE5071	Soft Skills-I	EEC	1	0	0	1	100	0	100
11	21HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
		Total Credits		18	0	12	24	680	420	1100

SEMESTER VI-24Credits

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
		THEORY								
1	21AI6201	Theory of Computation	PC	3	0	0	3	40	60	100
2	21AI6202	Development of Machine Learning Models	IC	3	0	0	3	40	60	100
3	21AI6203	Natural Language Processing	PC	3	0	0	3	40	60	100
4	21AI63**	Professional Elective- II	PE	3	0	0	3	40	60	100
5	21**64**	Open Elective I	OE	3	0	0	3	40	60	100
		THEORY & LAB COMPONENT								
6	21AI6251	Predictive Modeling	IC	3	0	2	4	50	50	100

		PRACTICAL								
7	21AI6001	Natural Language Processing Lab	PC	0	0	3	1.5	60	40	100
8	21AI6801	Mini Project	EEC	0	0	3	1.5	50	50	100
9	21HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
10	21HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
		Total Credits		20	0	8	24	560	380	1000

SEMESTER VII-21 Credits

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
		THEORY								
1	21AI7201	Cloud Computing	PC	3	0	0	3	40	60	100
2	21AI7202	AI Analyst	IC	3	0	0	3	40	60	100
3	21AI7203	Ethics and Policy Issues in AI Computing	PC	2	0	0	2	40	60	100
3	21AI73**	Professional Elective- III	PE	3	0	0	3	40	60	100
4	21**74**	Open Elective II	OE	3	0	0	3	40	60	100
		THEORY & LAB COMPONENT								
5	21AI7251	Deep Learning Techniques	PC	3	0	2	4	50	50	100
		PRACTICAL								
6	21AI7001	Cloud Computing Lab	PC	0	0	3	1.5	60	40	100
7	21AI7901	Project Phase -I	PC	0	0	3	1.5	60	40	100
		Total Credits		17	0	8	21	370	430	800

SEMESTER VIII-14 Credits

S.No	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
		THEORY								
1	21AI83**	Professional Elective- IV	PE	3	0	0	3	40	60	100
2	21AI83**	Professional Elective- V	PE	3	0	0	3	40	60	100
		PRACTICAL								
3	21AI8901	Project Phase - II	EEC	0	0	16	8	100	100	200
		Total Credits		6	0	16	14	180	220	400

Total Credits:165

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE I

Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
21AI5301	AI for Cyber Security	3	0	0	3	40	60	100
21AI5302	Internet of things	3	0	0	3	40	60	100
21AI5303	Advanced Machine Learning	3	0	0	3	40	60	100
21AI5304	Introduction to Robotics	3	0	0	3	40	60	100
21AI5305	Bioinformatics	3	0	0	3	40	60	100
21AI5306	Computer Architecture and Organization	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE II

Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
21AI6301	Neural Networks	3	0	0	3	40	60	100
21AI6302	Big data Computing	3	0	0	3	40	60	100
21AI6303	AI in Blockchain	3	0	0	3	40	60	100
21AI6304	Human Machine Interaction	3	0	0	3	40	60	100
21AI6305	Social Networks	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE III

Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
21AI7301	Computer Vision	3	0	0	3	40	60	100
21AI7302	Intelligent Multi Agent and Expert systems	3	0	0	3	40	60	100
21AI7303	Cognitive Systems	3	0	0	3	40	60	100
21AI7304	Quantum Computing	3	0	0	3	40	60	100
21AI7305	Web and Social media mining	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE IV

Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
21AI8301	Computational Neuroscience	3	0	0	3	40	60	100
21AI8302	Data Science	3	0	0	3	40	60	100
21AI8303	Network Science and Modeling	3	0	0	3	40	60	100
21AI8304	Reinforcement Learning	3	0	0	3	40	60	100
21AI8305	Stream Analytics	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE V

Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
21AI8306	Soft Computing in Medical Diagnostics	3	0	0	3	40	60	100
21AI8307	Pattern Recognition Algorithms	3	0	0	3	40	60	100
21AI8308	Graph Analytics for Big Data	3	0	0	3	40	60	100
21AI8309	Optimization in ML	3	0	0	3	40	60	100
21AI8310	5G Network	3	0	0	3	40	60	100

OPEN ELECTIVE

Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
21AI6401	Cyber Security and Intelligence	3	0	0	3	40	60	100
21AI7401	Business Analytics	3	0	0	3	40	60	100

List of Life Skill Courses under Open Elective

Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
21LSX401	General Studies for Competitive Examinations	3	0	0	3	40	60	100
21LSX402	Human Rights, Women Rights and Gender Equality	3	0	0	3	40	60	100
21LSX403	Indian Ethos and Human Values	3	0	0	3	40	60	100
21LSX404	Indian Constitution and Political System	3	0	0	3	40	60	100
21LSX405	Yoga for Human Excellence	3	0	0	3	40	60	100

As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Students who will be enrolled his name in HICET NCC are eligible to undergo these subjects. Earned extra credits printed in the ConsolidatedMarksheetaspertheregulation.NCCcourselevel1&Level2willbeadded in the open elective subject in the appropriate semester. Further, the students' who have optedNCCsubjectsinSemesterI,II,III&IVareeligibletoundergoNCCOpenElective Subjects.

Semester	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	NCC General and National Integration	1	0	0	1	100	0	100
2	Social services and community development	1	0	0	1	100	0	100
3	General awareness, communication and Aero engines	1	0	0	1	100	0	100

Heads are requested toprovide one vertical from their program to offerfor other programstudents to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech.MinorDegree.

AIML OFFERING MINOR DEGREE

S No	Course Code	CourseTitle	Category	PeriodsPer week			Total Contact Periods	Credits
				L	T	P		
1	21AI5601	Sem 5: Data structures using C Programming	MDC	3	0	0	3	3
2	21AI6601	Sem6: Introduction to Databases	MDC	3	0	0	3	3
3	21AI6602	Sem6: Foundation of Artificial Intelligence & Machine Learning	MDC	3	0	0	3	3
4	21AI7601	Sem7: Introduction to Robotics	MDC	3	0	0	3	3
5	21AI7602	Sem7: Foundations of Data Analytics	MDC	3	0	0	3	3
6	21AI8601	Sem8: Deep Learning-Principles &Practices	MDC	3	0	0	3	3

*MDC– Minor DegreeCourse

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I Fintech and Block Chain

S No	Course Code	CourseTitle	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21CS5602	FinancialManagement	MDC	3	0	0	3	3
2	21XXXX	Fundamentalsof Investment	MDC	3	0	0	3	3
3	21XXXX	Banking,Financial ServicesandInsurance	MDC	3	0	0	3	3
4	21XXXX	IntroductiontoBlockchain anditsApplications	MDC	3	0	0	3	3
5	21XXXX	FintechPersonalFinance andPayments	MDC	3	0	0	3	3
6	21XXXX	IntroductiontoFintech	MDC	3	0	0	3	3

Vertical II Entrepreneurship

S No	Course Code	CourseTitle	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21BA5601	Foundationsof Entrepreneurship	MDC	3	0	0	3	3
2	21XXXX	Team Building &LeadershipManageme nt forBusiness	MDC	3	0	0	3	3
3	21XXXX	Creativity&Innovationin Entrepreneurship	MDC	3	0	0	3	3
4	21XXXX	PrinciplesofMarketing ManagementForBusiness	MDC	3	0	0	3	3
5	21XXXX	HumanResource Management forEntrepreneur s	MDC	3	0	0	3	3
6	21XXXX	FinancingNewBusiness Ventures	MDC	3	0	0	3	3

Vertical III Environment and Sustainability

S No	Course Code	CourseTitle	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21CE5602	Sustainable infrastructureDevelopme nt	MDC	3	0	0	3	3
2	21XXXX	Sustainable AgricultureandEnviron mental Management	MDC	3	0	0	3	3
3	21XXXX	Sustainable BioMaterials	MDC	3	0	0	3	3

4	21XXXX	MaterialsforEnergy Sustainability	MDC	3	0	0	3	3
5	21XXXX	GreenTechnology	MDC	3	0	0	3	3
6	21XXXX	EnvironmentalQuality Monitoring andAnalysis	MDC	3	0	0	3	3

B.TECH (HONS)AI & ML

Vertical I ROBOTICS	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III CYBER PHYSICAL SYSTEMS
Sem5: 21AI5203 Foundations of Robotics	Sem5: 21AI5204 Public Key Infrastructure and Trust Management	Sem5: 21AI5205 Principles of Cyber Physical Systems
Sem6: 21AI6204 Sensors and Actuators	Sem6: 21AI6206 Introduction to block chain	Sem6: 21AI6208 Communication for CPS
Sem6: 21AI6205 Robots, bots and communication	Sem6: 21AI6207 Cryptocurrency	Sem6: 21AI6209 CPS System Design
Sem 7 21AI7204 Human-Robot Interaction	Sem 7 21AI7206 Smart Contracts and Solidity	Sem 7 21AI7208 CPS for Internal and External Security
Sem7: 21AI7205 Medical Robotics	Sem 7 21AI7207 Block chain and distributed ledger technology	Sem 7 21AI7209 Biomedical Instrumentation for Cyber Physical Systems
Sem8: 21AI8201 Fundamentals of Autonomous Systems	Sem8: 21AI8202 Bitcoin Essentials and Use-Cases	Sem8: 21AI8203 Security and Privacy of CPS

B.TECH (HONS)AI & ML SPECIALIZATION WITH ROBOTICS

S No	Course Code	CourseTitle	Category	PeriodsPer week			Total Contact Periods	Credits
				L	T	P		
1	21AI5203	Sem5: Foundations of Robotics	PC	3	0	0	3	3
2	21AI6204	Sem6: Sensors and Actuators	PC	3	0	0	3	3
3	21AI6205	Sem6: Robots, bots and communication	PC	3	0	0	3	3
4	21AI7204	Sem 7: Human-Robot Interaction	PC	3	0	0	3	3
5	21AI7205	Sem7: Medical Robotics	PC	3	0	0	3	3
6	21AI8201	Sem8: Fundamentals of Autonomous Systems	PC	3	0	0	3	3

B.TECH (HONS)AI & ML SPECIALIZATION WITH BLOCK CHAIN TECHNOLOGY

S No	Course Code	CourseTitle	Category	PeriodsPer week			Total Contact Periods	Credits
				L	T	P		
1	21AI5204	Sem5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	21AI6206	Sem6: Introduction to block chain	PC	3	0	0	3	3
3	21AI6207	Sem6: Cryptocurrency	PC	3	0	0	3	3
4	21AI7206	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	21AI7207	Sem7: Block chain and distributed ledger technology	PC	3	0	0	3	3
6	21AI8202	Sem8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B.TECH (HONS)AI & ML SPECIALIZATION WITH ROBOTICS

S No	Course Code	CourseTitle	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21AI5203	Sem5: Foundations of Robotics	PC	3	0	0	3	3
2	21AI6204	Sem6: Sensors and Actuators	PC	3	0	0	3	3
3	21AI6205	Sem6: Robots, bots and communication	PC	3	0	0	3	3
4	21AI7204	Sem 7: Human-Robot Interaction	PC	3	0	0	3	3
5	21AI7205	Sem7: Medical Robotics	PC	3	0	0	3	3
6	21AI8201	Sem8: Fundamentals of Autonomous Systems	PC	3	0	0	3	3

B.TECH (HONS)AI & ML SPECIALIZATION WITH BLOCK CHAIN TECHNOLOGY

S No	Course Code	CourseTitle	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21AI5204	Sem5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	21AI6206	Sem6: Introduction to block chain	PC	3	0	0	3	3
3	21AI6207	Sem6: Cryptocurrency	PC	3	0	0	3	3
4	21AI7206	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	21AI7207	Sem7: Block chain and distributed ledger technology	PC	3	0	0	3	3
6	21AI8202	Sem8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B.TECH (HONS)AI & ML SPECIALIZATION WITH CYBER PHYSICAL SYSTEMS

S No	Course Code	CourseTitle	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21AI5205	Sem5: Principles of Cyber Physical Systems	PC	3	0	0	3	3
2	21AI6208	Sem6: Communication for CPS	PC	3	0	0	3	3
3	21AI6209	Sem6: CPS System Design	PC	3	0	0	3	3
4	21AI7208	Sem 7: CPS for Internal and External Security	PC	3	0	0	3	3
5	21AI7209	Sem7: Biomedical Instrumentation for Cyber Physical Systems	PC	3	0	0	3	3
6	21AI8203	Sem8: Security and Privacy of CPS	PC	3	0	0	3	3

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	21	19	24	24	21	14	165
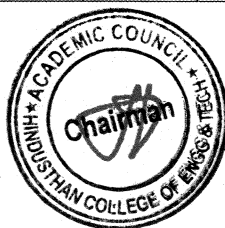
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Programme B.Tech	Course Code 21AI7201	Name of the Course CLOUD COMPUTING	L 3	T 0	P 0	C 3

Course Objective	1. To understand the concept of cloud computing. 2. To visualizes the different clouds models with respect to services and cloud eco system. 3. To learn about cloud offering and cloud management. 4. To learn about different cloud enabling technologies. 5. To understand about different implementations of virtualizations, management software.

Unit	Description	Instructional Hours
I	**INTRODUCTION:** Introduction - Essentials - Benefits - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics - Cloud Adoption. Cloud Models – Cloud Characteristics - Measured Service -Cloud deployment models Security in a Public Cloud - Public versus Private Clouds - Cloud Infrastructure Self Service.	9
II	**CLOUD SERVICES AND SOLUTIONS:** Principle Technologies - Cloud Strategy - Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined. Cloud Solutions - Introduction - Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Computing on Demand (CoD) – Cloud sourcing.	9
III	**CLOUD OFFERINGS AND CLOUD MANAGEMENT:** Cloud Offerings - Information Storage, Retrieval, Archive and Protection – Cloud Analytics - Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud. Cloud Management - Resiliency - Provisioning - Asset Management – Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Metering	9
IV	**CLOUD ENABLING TECHNOLOGIES:** Data center Technology – Virtualization Technology – Web Technology –Multitenant Technology – case study in AWS.	9
V	**CLOUD VIRTUALIZATION:** Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements - Storage virtualization - Storage Area Networks –Network Attached storage - Cloud Server Virtualization - Virtualized Data Center.	9

Total Instructional Hours   45

Course Outcome	CO1:	Understand the concept of cloud computing.
	CO2:	Visualizes the different clouds models with respect to services and cloud eco system.
	CO3:	Knowledge of cloud offering and cloud management.
	CO4:	Understand the different cloud enabling technologies.
	CO5:	Understand about different implementations of virtualizations, management software.

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TEXT BOOKS:

T1: Dr.Kumar Saurabh, Cloud Computing, Second Edition,Wiley-India,2012

T2: Thomas Erl, Zaigham Mahmood, Ricardo Puttini, —Cloud Computing: Concepts, Technology and Architecturel, Prentice Hall Service Technology Series

REFERENCE BOOKS:

R1: David Marshall, Wade A. Reynolds, - Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006

R2: Chris Wolf, Erick M. Halter, - Virtualization: From the Desktop to the Enterprise, Apress 2005

R3 Danielle Ruest, Nelson Ruest - Virtualization: A Beginner"s Guide, TMH, 2009

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2	3	1	1	-	-	-	-	-	2	3	3
CO2	3	3	3	3	1	1	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	1	-	-	-	-	-	2	2	2
CO4	3	3	3	3	1	1	-	-	-	-	-	2	3	2
CO5	3	2	2	2	1	1	-	-	-	-	-	2	3	3

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Programme B.Tech	Course Code 21AI7202	Name of the Course AI ANALYST	L	T	P	C
			3	0	0	3

Course Objective	1. To Familiarize the students about the evolution and relevance of AI in the world today.
	2. Analyze existing and future implementations of AI solutions across multiple industries.
	3. Discuss AI technology building blocks, including: natural language processing, machine and deep learning, neural networks, virtual agents, autonomics and computervision.
	4. Develop a deeper understanding of machine learning techniques and the algorithm
	5. Understanding the ethics and future workforce in AI

Unit	Description	Instructional Hours
I	**AI LANDSCAPES:** Definition and brief history of AI - AI Explained- AI Technologies -AI Industry Impact - Autonomous Vehicles - Smart Robotics -- Goals and applications of AI - Problem-solving techniques in AI	9
II	**INTRODUCTION TO MACHINE LEARNING:** Types and approaches of ML - Different ML algorithms - Basics of neural networks - evaluating a machine learning model - Introduction to IBM Watson - IBM Watson services offerings - capabilities of each Watson service - Introduction to IBM Watson Studio	9
III	**NATURAL LANGUAGE PROCESSING:NLP** Definition and scope of NLP - Applications of NLP - Challenges and limitations in NLP- Text Preprocessing- Tokenization - Stemming and Lemmatization - Language Modeling – N-gram modelling – Text Classification – Named Entity Recognition	9
IV	**COMPUTER VISION & DEEP LEARNING:** Computer Vision Overview- AI Vision through Deep Learning - Computer Vision for the Enterprise - Deep Learning Explained - Deep learning ecosystem	9
V	**FUTURE TRENDS FOR AI:** Evolution of AI and its current state - Overview of the impact of AI on various industries - Ethical issues and challenges in AI - Bias and fairness in AI algorithms - Responsible AI development practices - AI and Automation in the Workplace - AI and Automation in the Workplace - AI in Smart Cities and IoT	9
	Total Instructional Hours	**45**

Course Outcome	CO1:	Recognize various machine learning techniques utilized in designing AI systems and applications to address real-world problems.
	CO2:	Utilize these techniques in applications that involve perception, reasoning, and learning
	CO3:	Perform analysis and design of a real-world problem to facilitate implementation and gain comprehension of the dynamic behavior of a system.
	CO4:	Explain the role of agents and how it is related to the environment and the way of evaluating it and how agents can act by establishing goals

CO5: Acquire the knowledge of real-world Knowledge representation

TEXT BOOKS:
T1 :IBM Courseware
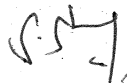
REFERENCE BOOKS:

R1: Artificial Intelligence: A Modern Approach - Stuart Russell and Peter Norvig

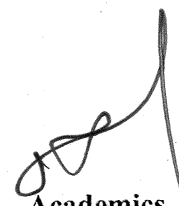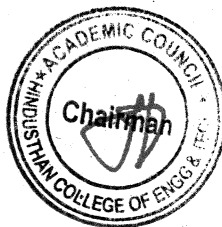R2: Deep Learning- Ian Goodfellow, Yoshua Bengio, and Aaron Courville

R3: Pattern Recognition and Machine Learning - Christopher M. Bishop

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	-	-	-	-	-	2	3	3
CO2	3	3	3	3	1	1	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	1	-	-	-	-	-	2	3	2
CO4	3	3	3	3	1	1	-	-	-	-	-	2	3	2
CO5	3	2	2	2	1	1	-	-	-	-	-	2	3	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21AI7203	Ethics and Policy Issues in AI Computing	2	0	0	2

Course Objective

1. Be familiar with the Current Initiatives in AI and Ethics
2. Discussed about the frameworks and models of AI
3. Demonstrate understanding of different grades of AI systems and their ethical implications
4. Understanding of perspectives and approaches of AI ethics.
5. To be familiar with the applications and use cases of AI.

Unit	Description	Instructional Hours
I	**Introduction To Ethics Of AI:** Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI. Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities	6
II	**Framework And Models:** AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral.	6
III	**Ethics of information and Ethics of AI:** Ethical issues - different strengths/grades of AI -AI algorithms- effects of its ontological differences.	6
IV	**Perspectives And Approaches:** Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents	6
V	**Cases And Application:** Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics.	6
	Total Instructional Hours	30

Course Outcome

CO1: Understanding of role of AI in human life
CO2: Analyze about the framework and models of AI
CO3: Understanding of ethical information of AI
CO4: Exploring about the perspectives and approaches on ethics of AI
CO5: Understand about the real time applications of AI

TEXT BOOKS:

T1: Paula Boddington, —Towards a Code of Ethics for Artificial Intelligence‖, Springer,2017

T2: Markus D. Dubber, Frank Pasquale, Sunit Das, —The Oxford Handbook of Ethics of AI‖, Oxford University Press Edited book, 2020

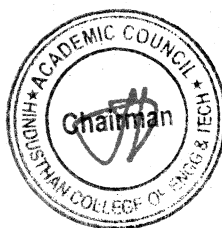T3: S. Matthew Liao, —Ethics of Artificial Intelligence‖, Oxford University Press Edited Book, 2020

REFERENCE BOOKS:	
R1:	Wallach, W., & Allen, C, —Moral machines: ceaching robots right from wrong OxfordUniversityPress,2008.
R2:	Bostrom and E. Yudkowsky. —The ethics of artificial intelligence. In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, Cambridge, 2014.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	2	1	-	-	2	-	-	2	3	3
CO2	3	3	3	3	2	1	-	-	2	-	-	2	3	3
CO3	3	3	3	2	2	1	-	-	2	-	-	2	3	2
CO4	3	3	3	3	2	1	-	-	2	-	-	2	3	2
CO5	3	2	2	2	2	1	-	-	2	-	-	2	3	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21AI7251	DEEP LEARNING TECHNIQUES	3	0	2	4

Course Objective

1. Remember the theoretical aspects Machine Learning and Math formulation
2. Understand the basics of Deep Learning and Neural Networks
3. Understand and Analyse the architecture of Deep Networks
4. Apply optimization strategies in Deep Learning Networks
5. Analyze various libraries and open source software for deep learning

Unit	Description	Instructional Hours
I	**A Review of Machine Learning** The Learning Machines- the Math behind Machine Learning-Techniques of Machine Learning: Regression-Classification-Clustering- Underfitting and Overfitting-Optimization-Gradient Descent-Logistic Regression-Evaluating Models- Case Study: Images segmentation – Object Detection. Illustrative Programs: Create a simple Neural Network Classifier Model on MNIST handwritten digital dataset using NumPy, Matplotlib and Keras Libraries- Implement YOLO algorithm to detect an object in an image input.	9+3
II	**Introduction to Deep Learning** Foundations of Neural Networks and Deep Learning: Neural Networks, Training Neural Networks: Backpropagation Learning- Importance of Activation Functions, Loss Functions and Hyper parameters- Fundamentals of Deep Networks: Definition of Deep Learning- Architectural Principles of Deep Networks- Building blocks of Deep Networks- Illustrative Programs: Implement Sentiment Analysis using Keras and TensorFlow Python libraries	9+3
III	**Architectures of Deep Learning Networks** Unsupervised Pretrained Networks-Convolutional Neural Networks (CNN)- Recurrent Neural Networks- Recursive Neural Networks- Case Study: Opinion Mining using Recurrent Neural Networks- Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks- Illustrative Programs: Build a CNN Image Classification Python Model to find whether the image consist of pneumonia.	9+3
IV	**Optimization of Deep Neural Networks** Optimization for Training Deep Models: How Learning Differs from Pure Optimization -Challenges in Neural Network Optimization - Basic Algorithms - Parameter Initialization Strategies - Algorithms with Adaptive Learning Rates - Approximate Second-Order Methods - Optimization Strategies and Meta-Algorithms- Case Study: Dialogue Generation with LSTMs- Illustrative Programs: Implement Time Series Forecasting with Deep Learning using PyTorch (LSTM-RNN).	9+3
V	**Python and Deep Learning** TensorFlow- Pytorch- NumPy- Scikit-Learn- Scipy- Pandas-Microsoft CNTK- Keras- Theano- MXNet- Features of Python Libraries in Deep Learning- Illustrative Programs: Implement an Opinion Mining in Recurrent Neural network- Implement a Transfer Learning concept in Image Classification.	9+3
	Total Instructional Hours	45+15

Course Outcome

CO1: Able to Remember the theoretical aspects Machine Learning and Math formulation
CO2: Able to Understand the basics of Deep Learning and Neural Networks
CO3: Able to Understand and Analyse the architecture of Deep Networks
CO4: Able to Apply optimization strategies in Deep Learning Networks
CO5: Able to Analyze various libraries and open source software for deep learning

TEXT BOOKS:

T1: Josh Patterson & Adam Gibson , Deep Learning A Practitioner's Approach, O'reilly, 2017.

T2: Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.

T3: Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.

REFERENCE BOOKS:

R1: Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress, 2017.

R2: Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.

R3: Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.

R4: Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	-	-	2	-	-	2	3	3
CO2	3	3	3	3	1	1	-	-	2	-	-	2	3	3
CO3	3	3	3	2	1	1	-	-	2	-	-	2	3	2
CO4	3	3	3	3	1	1	-	-	2	-	-	2	3	2
CO5	3	2	2	2	1	1	-	-	2	-	-	2	3	3

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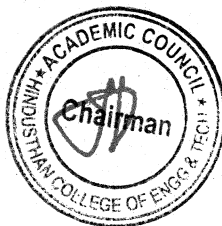
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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21AI7001	CLOUD COMPUTING LABORATORY	0	0	3	1.5

Course Objective

1. To configure various virtualization tools such as Virtual Box, VMware workstation.
2. To design and deploy a web application in a PaaS environment.
3. To learn how to simulate a cloud environment to implement new schedulers.
4. To install and use a generic cloud environment that can be used as a private cloud.
5. To manipulate large data sets in a parallel environment.

S. No.   **Description of the Experiments**
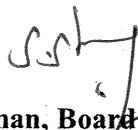
1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

Total hours   45

Course Outcome

CO1: Configure various virtualization tools such as Virtual Box, VMware workstation.
CO2: Design and deploy a web application in a PaaS environment.
CO3: Learn how to simulate a cloud environment to implement new schedulers.
CO4: Install and use a generic cloud environment that can be used as a private cloud.
CO5: Manipulate large data sets in a parallel environment.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	2	-	-	2	2	2	2	3	3
CO2	2	3	3	3	1	2	-	-	2	2	2	2	2	3
CO3	3	3	3	2	1	2	-	-	2	2	2	2	3	2
CO4	3	3	3	3	1	2	-	-	2	2	2	2	2	2
CO5	3	2	2	2	1	2	-	-	2	2	2	2	2	3

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PROFESSIONAL ELECTIVE III

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21AI7301	COMPUTER VISION	3	0	0	3

Course Objective

1.Be familiar with the theoretical aspects of computing with images.
2.Have described the foundation of image formation, measurement, and analysis.
3.Have implemented common methods for robust image matching and alignment.
4.Have gained exposure to object and scene recognition, categorization from images.
5.To be familiar with the applications of Computer Vision.

Unit	Description	Instructional Hours
I	Introduction : What is Computer Vision-The Many facts of Computer Vision-Exploring the Computer Vision World – Image Formation-Images, Image Model, Image Devices for Computer Vision- Geometric primitives and Images-Photometric image formation-The digital camera-Light and Shading -Color	9
II	Image Processing-: Images and Imaging Operations-Point operators- linear filtering, neighbourhood operators, fourier transforms, Pyramids and wavelets - Geometric transformations - Global optimization .	9
III	Feature Detection and Matching – points and patches, edges, lines,-Segmentation - Active contours, Split and, Mean shift and mode finding-Feature-based Alignment – 2D, 3D feature-based alignment, pose estimation, Geometric intrinsic calibration,Image Stitching	9
IV	Dense motion estimation – Optical flow – layered motion, parametric motion, Structure from Motion- Recognition – object detection, face recognition, instance recognition, category recognition, Stereo Correspondence – Epipolar geometry, correspondence, 3D reconstruction-Shape from X, Active range finding, Surface representations, Point-based representations, Volumetric representations.	9
V	Applications: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians	9
	Total Instructional Hours	**45**

Course Outcome

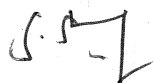|	
CO1:	Understanding of the theoretical aspects of computing with images.
CO2:	Understand the foundation of image formation, measurement, and analysis.
CO3:	Understand the common methods for robust image matching and alignment.
CO4:	Exploring object and scene recognition, categorization from images.
CO5:	Understanding of various applications of Computer Vision.

TEXT BOOKS:

T1: Forsyth D. A. and Ponce J., "Computer Vision – A Modern Approach", Second Edition, Pearson Education, 2012.

T2: Szeliski R., "Computer Vision: Algorithms and Applications", Springer, 2010.

REFERENCE BOOKS:

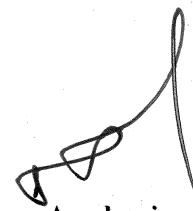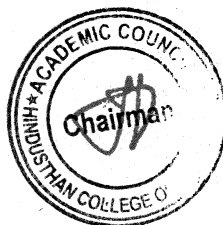R1: E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
R2: D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	-	-	-	-	-	2	3	3
CO2	3	3	3	3	1	1	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	1	-	-	-	-	-	2	3	2
CO4	3	3	3	3	1	1	-	-	-	-	-	2	3	2
CO5	3	2	2	2	1	1	-	-	-	-	-	2	3	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21AI7302	Intelligent Multi Agent and Expert systems	3	0	0	3

Course Objective

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed
2. To know about Multi Agent in global Planning
3. To learn about knowledge based Agent to represents frame Representation.
4. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances
5. To be familiar with the applications of Expert System

Unit	Description	Instructional Hours
I	Introduction : what is an agent?: agents and objects; agents and expert systems; agents and distributed systems; typical application areas for agent systems Intelligent Agents: the design of intelligent agents - reasoning agents (eg AgentO), agents as reactive systems (eg subsumption architecture); hybrid agents (eg PRS); layered agents (eg Interrap) a contemporary (Java-based) framework for programming agents (eg the Jack language, the JAM! system)	9
II	Multi-Agent Systems: Classifying multi-agent interactions - cooperative versus non-cooperative; zero-sum and other interactions; what is cooperation? how cooperation occurs - the Prisoner's dilemma and Axelrod's experiments; Interactions between self-interested agents: auctions & voting systems: negotiation; Interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination;	9
III	Knowledge Based Agent-Knowledge Representation-Knowledge Representation Techniques-Logical, Semantic ,Frame Representation, Production Rules-Propositional Logic –Rules of Inference – Inductive and Deductive Reasoning	9
IV	Artificial intelligence in Manufacturing-Artificial Intelligence in Civil Engineering, Artificial Intelligence in Gaming Industry-Artificial Intelligence in HR-Artificial intelligence in Medicine	9
V	Expert System- Components of Expert System-Why Expert System-Capabilities of Expert system-Applications of Expert System	9

Total Instructional Hours 45

Course Outcome

CO1: Understanding of the theoretical aspects of computing with agents
CO2: Understand the foundation of multi agent system formation, measurement, and analysis.
CO3: Understand the common methods for Rules of Inference
CO4: Exploring real time applications in Industry
CO5: Understanding of various applications of Expert System

TEXT BOOKS:

T1: An Introduction to Multi Agent Systems - Second Edition. Michael Wooldridge (Wiley, 2009)

T2: Multiagent Systems by Gerhard Weiss, 2nd edition, The MIT Press

REFERENCE BOOKS:

R1: Programming Multi-agent Systems in Agent Speak Using Jason. Rafael H. Bordini, Jomi Fred Hubner and Michael Wooldridge (Wiley, 2007)
Website1: https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	1	-	-	-	-	2	3	3
CO2	3	3	3	3	1	1	1	-	-	-	-	2	3	3
CO3	3	3	3	2	1	1	1	-	-	-	-	2	3	2
CO4	3	3	3	3	1	1	1	-	-	-	-	2	3	2
CO5	3	2	2	2	1	1	1	-	-	-	-	2	3	3
Avg	2.8	2.6	2.6	2.6	1	1	1	-	-	-	-	2	3	2.6

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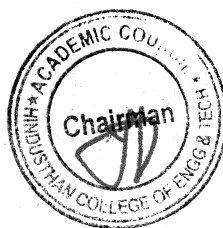
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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21AI7303	COGNITIVE SYSTEMS	3	0	0	3

Course Objective

1. To know the theoretical background of cognition.
2. To understand the link between cognition and computational intelligence.
3. To explore probabilistic programming language.
4. To study the computational inference models of cognition.
5. To study the computational learning models of cognition.

Unit	Description	Instructional Hours
I	**PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE** Philosophy: Mental-physical Relation – From Materialism to Mental Science – Detour before the naturalistic turn – The Philosophy of Science – The Mind in Cognitive Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing – Neurosciences: Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.	9
II	**COMPUTATIONAL INTELLIGENCE** Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Decision making under Uncertainty – Learning – Language – Vision – Robotics.	9
III	**PROBABILISTIC PROGRAMMING LANGUAGE** WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration – Other basic computation.	9
IV	**IMPLEMENTING THE INFERENCE MODELS OF COGNITION** Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.	9
V	**IMPLEMENTING THE LEARNING MODELS OF COGNITION** Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models – Occam's Razor – Learning (Deep) Continuous Functions – Mixture Models.	9
	Total Instructional Hours	45

Course Outcome

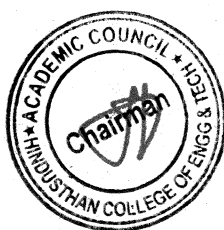|		
CO1:	Understand the underlying theory behind cognition.	
CO2:	Connect to the cognition elements computationally.	
CO3:	Implement mathematical functions through WebPPL.	
CO4:	Develop a cognitive inference model.	
CO5:	Develop a cognitive learning model.	

TEXT BOOKS:

T1: Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999.

REFERENCE BOOKS:

R1: Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, https://dippl.org/.

R2: Noah   D.   Goodman,   Joshua   B.   Tenenbaum,   The ProbMods   Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	-	-	-	-	-	2	2	3
CO2	3	3	3	3	1	1	-	-	-	-	-	2	2	3
CO3	3	3	3	2	1	1	-	-	-	-	-	2	3	2
CO4	3	3	3	3	1	1	-	-	-	-	-	2	3	2
CO5	3	2	2	2	1	1	-	-	-	-	-	2	2	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21AI7304	QUANTUM COMPUTING	3	0	0	3

<table>
<tr><td rowspan="5">Course Objective</td><td>1. To Study the structural units of quantum computers of the future, forming an understanding of the differences between quantum bits and classical bits.</td></tr>
<tr><td>2.To Study of basic quantum logical operations and algorithms for processing quantum information</td></tr>
<tr><td>3. To Master the basic knowledge about the practical use of quantum algorithms and quantum programming skills.</td></tr>
<tr><td>4. To Demonstrate quantum algorithms such as Shor's and Grover's search</td></tr>
<tr><td>5. To Analyze quantum algorithms including Deutsch's algorithm and Deutsch's-Jozsa algorithm . Quantum error correction and fault-tolerant computation.</td></tr>
</table>

Unit	Description	Instructional Hours
I	**Introduction to Quantum Computation** Quantum bits, Bloch sphere representation of a qubit, multiple qubits. Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.	9
II	**Quantum Circuits** single qubit gates, multiple qubit gates, design of quantum circuits.	8
III	**Quantum Information and Cryptography** Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.	10
IV	**Quantum Algorithms** Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Simon's algorithm, Shor factorization, Grover search.	9
V	**Noise and error correction** Graph states and codes, Quantum error correction three- and nine-qubit quantum codes, fault tolerant computation.	9
	Total Instructional Hours	**45**

<table>
<tr><td rowspan="5">Course Outcome</td><td>CO1:</td><td>Understanding quantum computation</td></tr>
<tr><td>CO2:</td><td>Understanding Hilber space, entanglement and basics of quantum mechanics</td></tr>
<tr><td>CO3:</td><td>Comparision between classical and quantum information theory</td></tr>
<tr><td>CO4:</td><td>Demonstrate quantum algorithms such as Shor's and Grover's</td></tr>
<tr><td>CO5:</td><td>Analyzing quantum algorithms including Deutsch's algorithm and Deutsch's-Jozsa algorithm . Quantum error correction and fault-tolerant computation.</td></tr>
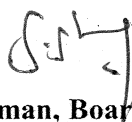</table>

TEXT BOOKS:

T1: Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press. 2002

T2: Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. 2004
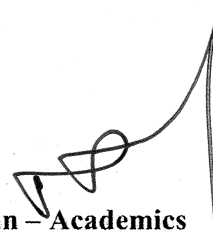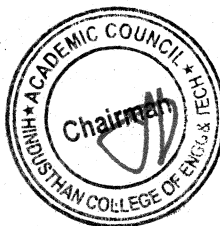
REFERENCE BOOKS:

R1: Pittenger A. O., An Introduction to Quantum Computing Algorithms, 2000

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	-	-	-	-	-	2	3	3
CO2	3	3	3	3	1	1	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	1	-	-	-	-	-	2	3	2
CO4	3	3	3	3	1	1	-	-	-	-	-	2	3	2
CO5	3	2	2	2	1	1	-	-	-	-	-	2	3	3

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Programme B.Tech	Course Code 21AI7305	Name of the Course WEB AND SOCIAL MEDIA MINING	L 3	T 0	P 0	C 3

Course Objective	1. To understand the social media mining and its essentials.
	2. To understand network measures and network models in social media mining.
	3. To understand data mining essentials, interactions and diffusion in social media.
	4. To understand mining twitter, Facebook and web pages.
	5. To understand Mining the Semantically Marked-Up Web and writing web crawlers.

Unit	Description	Instructional Hours
I	Introduction: What is Social Media Mining-New Challenges for Mining-Essentials: Graph Essentials-Graph Basics-Graph Representation-Types of Graphs-Connectivity in Graphs-Special Graphs-Graph Algorithms.	8
II	Network Measures: Centrality-Transitivity and Reciprocity-Balance and Status-Similarity-Network Models: Properties of Real-World Networks-Random Graphs-Small-World Model-Preferential Attachment Model.	9
III	Data Mining Essentials: Data-Data Preprocessing-Data Mining Algorithms-Supervised Learning-Unsupervised Learning-Communities and Interactions: Community Analysis-Community Detection-Community Evolution-Community Evaluation-Information Diffusion in Social Media: Herd Behavior-Information Cascades-Diffusion of Innovations-Epidemics.	10
IV	Mining Twitter: Overview-Why Is Twitter All the Rage?- Exploring Twitter's API-Analyzing the 140 Characters-Mining Facebook: Overview-Exploring Facebook's Social Graph API-Analyzing Social Graph Connections-Mining Web Pages: Overview-Scraping, Parsing, and Crawling the Web-Discovering Semantics by Decoding Syntax-Entity-Centric Analysis: A Paradigm Shift.	9
V	Mining the Semantically Marked-Up Web: Overview-Micro formats: Easy-to-Implement Metadata-From Semantic Markup to Semantic Web: A Brief Interlude-The Semantic Web: An Evolutionary Revolution-Writing Web Crawlers: Traversing a Single Domain-Crawling an Entire Site-Crawling Across the Internet.	9

Total Instructional Hours   45

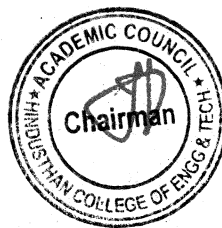|		
Course Outcome	CO1:	Understanding of the social media mining and its essentials.
	CO2:	Understand the network measures and network models in social media mining.
	CO3:	Understand the data mining essentials, interactions and diffusion in social media.
	CO4:	Understanding mining twitter, Facebook and web pages.
	CO5:	Understanding of Mining the Semantically Marked-Up Web and writing web crawlers.

TEXT BOOKS:

T1: Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, "Social Media Mining", Cambridge University Press, April 20, 2014.

T2: Matthew A. Russell, "Mining the Social Web", Second Edition, O'Reilly, 2013.

REFERENCE BOOKS:

R1: Ryan Mitchell, "Web Scraping with Python", Second Edition, O'Reilly, 2020.

R2: Lam Thuy Vo, "Mining Social Media: Finding Stories in Internet Data", Paperback – Illustrated, 25 November 2019.

R3: Shalin Hai-Jew, "Social Media Data Extraction and Content Analysis", IGI Global, Hardcover Import, 2016.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	-	-	-	-	-	2	2	3
CO2	3	3	3	3	1	1	-	-	-	-	-	2	2	3
CO3	3	3	3	2	1	1	-	-	-	-	-	2	2	2
CO4	3	3	3	3	1	1	-	-	-	-	-	2	3	2
CO5	3	2	2	2	1	1	-	-	-	-	-	2	2	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	21AI7401	BUSINESS ANALYTICS	3	0	0	3

Course Objective	1. Be familiar with the various aspects of Business analytics.
	2. Use business analytics in decision-making.
	3. To apply the appropriate analytics and generate solutions
	4. Model and analyze the business situation using analytics.
	5. To summarise about Enterprise reporting

Unit	Description	Instructional Hours
I	**BUSINESS VIEW OF IT, DIGITAL DATA:** Business Process, Baldrige Framework, IT in Business, IT Applications, Characteristics, Information users and their requirements, Digital Data – Introduction, Good Life Database, Structured Data, Unstructured Data, Semi-Structured Data	9
II	**OLTP AND OLAP, GETTING STARTED WITH BUSINESS INTELLIGENCE** OLTP,OLAP, OLAP Architectures, Data Models of OLTP and OLAP, Data Models, Role of OLAP tools, OLAP – Multidimensional Data, ERP Data, Decision Support, BI, Data, Definition, Purpose of BI, Evolution, Need for BI, Usage of BI, BI in various stages, Value Chain, Business Analytics	9
III	**BI DEFINITION, CONCEPTS, DATA INTEGRATION** BI Component Framework, Usage of BI, BI users, Applications of BI, BI Roles, Responsibilities, Practices , Skills for BI, BI tools, Data Warehouse, Goals, Data Mart, ODS, Approaches, Data Sources, Mapping , Staging, Data Integration (DI), DI Technologies, Data Quality, Data Profiling, Case Study	9
IV	**MULTIDIMENSIONAL DATA MODELING** Data Modeling, Types, Techniques, Fact Table, Dimension table, Models, Life cycle, Measures, Metrics, KPIs, Performance management	9
V	**ENTERPRISE REPORTING** Perspectives, Report, Enterprise Reporting, Scorecard, Dashboards, Creating Dashboards, Scorecard vs Dashboards, Different Analysis types, Statistics in analytics, Data description, Statistical tests, hypothesis and t-test Correlation, regression, ANOVA, F- test, Time Series Analysis, BI and cloud computing, BI for ERP systems.	9
	Total Instructional Hours	**45**

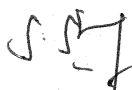|		
Course Outcome	CO1:	To understand the role of Business Analytics in decision making
	CO2:	Identify the appropriate tool for the analytics scenario
	CO3:	To apply the tools and generate solutions
	CO4:	Analyze & interpret the results
	CO5:	Summarise about enterprise reporting

TEXT BOOKS:

T1:   R.N .Prasad and Seema Acharya ,"Fundamentals of Business Analytics",Wiley 2nd Edition, 2021

T2:   James R. Evans, "Business Analytics-Methods, Models and Decisions ",Pearson Ed, 2012
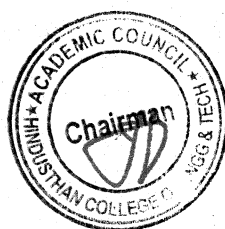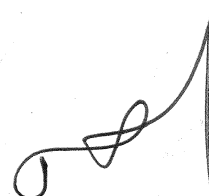
REFERENCE BOOKS:

R1   Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, "Business Analytics Principles, Concepts, and Applications - What, Why, and How" , Pearson Ed, 2014

R2   Christian Albright S and Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", Fifth edition, Cengage Learning, 2015.

PO& PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	1	1	-	-	-	-	-	2	3	3
CO2	3	3	3	3	1	1	-	-	-	-	-	2	2	3
CO3	3	3	3	2	1	1	-	-	-	-	-	2	2	2
CO4	3	3	3	3	1	1	-	-	-	-	-	2	3	2
CO5	3	2	2	2	1	1	-	-	-	-	-	2	3	3

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Accredited by NBA (AERO, AUTO, CIVIL, CSE, ECE, EEE, IT, MECH, MCTS)
Accredited by NAAC 'A++' Grade with CGPA of 3.69 out of 4 in Cycle 2
Valley Campus, Coimbatore – 641 032, Tamil Nadu, INDIA

2022 Regulation – 2021 Batch VII semester- Syllabus revision

S. No	Year	Semester	Course Code and Course Name	Existing content (in academic Year 2023-24)	Revised Content (for 2024-25)	Percentage of Revision
				NIL		

New Course Introduced (2022 Regulation) – 2021 Batch VII semester

S.No	Regulation	Course Code with Name	Credits
1	2019	21AI7601 - Introduction to Robotics	3
2	2019	21AI7602 - Foundations of Data Analytics	3
3	2019	21AI7204 - Human-Robot Interaction	3
4	2019	21AI7205 - Medical Robotics	3
5	2019	21AI7206 - Smart Contracts and Solidity	3
6	2019	21AI7207- Block chain and distributed ledger technology	3
7	2019	21AI7208- CPS for Internal and External Security	3
8	2019	21AI7209 -Biomedical Instrumentation for Cyber Physical Systems	3

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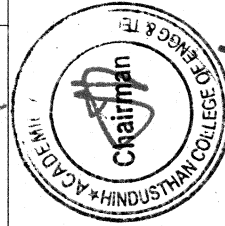
B.Tech (AIML)

SEMESTER - 5

HONOURS

(CYBER PHYSICAL SYSTEMS)

Programme	Course Code	Name of the Course	L	T	P	C
B. Tech.	22AI5205	Principles of CYBER PHYSICAL SYSTEM	3	0	0	3

Course Objective

1. Obtain cyber physical systems fundamentals and principles knowledge as building blocks to promote further design and implementation of more complex real time systems.
2. Understand cyber physical systems design for synchronous model with specific case study for arm processor
3. In what way cyber physical systems are crucial for the optimal performance of asynchronous model
4. Comprehend the cyber physical systems design and implementation in dynamical models
5. Hybridization of cyber physical systems which will help the students to anticipate upcoming technologies
6. Gain overall understand of the cyber physical systems for that will suit practical, engineering and industrial needs

Unit	Description	Instructional Hours
I	**INTRODUCTION TO CYBER PHYSICAL SYSTEMS** Introduction- Cyber-Physical Systems Design Recommendations-Cyber-Physical System Requirements-Requirements Engineering-Interoperability-Real Time System-GPU Computing-internet Of Things (IOT)- Radio Frequency Identification Technology-Wireless Sensor Networks Technology-Powerline Communication-Ubiquitous Computing Fundamentals-CASE STUDY: Cyber Physical Vehicle Tracking System	9
II	**SYNCHRONOUS MODEL** Reactive Components-Variables, Valuations, And Expression-Execution, Extended-State Machines-Properties Of Components-Finite State Components-Combinational Components-Nondeterministic Components-Input Enabled Components-Task Graphs And Await Dependencies-Parallel Composition-Synchronous Designs-Synchronous Circuits-Synchronous Networks.	10
III	**ASYNCHRONOUS MODEL** Asynchronous Process-States, Internal Actions-Executions, Extended State Machines-Operation On Process-Asynchronous Design Primitives-Blocking Vs Non-Blocking Synchronization-Deadlocks-Shared Memory-Asynchronous Coordination Protocols-Reliable Transmission-Safety Specifications-Invariants Of Transition Systems.	8
IV	**DYNAMICAL SYSTEM** Continuous Time Model-Continuously Evolving Inputs And Outputs -Models With Disturbance-Composing Components Stability-Linear Systems Linearity-Solutions Of Linear Differential Equations Stability-Designing Controllers-Stabilizing Controller-PID Controllers-Analysis Techniques	8
V	**HYBRID SYSTEMS** Hybrid Dynamical Model-Hybrid Process, Process Composition-Zeno Behavior-Stability-Designing Hybrid Systems-Automated Guided Vehicle-Obstacle Avoidance With Multi Robot Coordination-Multi Hop Control Networks-Linear Hybrid Automata-Example Pursuit Game-Formal Model-Symbolic Reachability Analysis-Timed Automata	10

Total Instructional Hours 45

Course Outcome

CO1: Understand the basics of cyber physical systems
CO2: Design synchronous models for Real Time applications
CO3: Design Asynchronous models for Real Time applications.
CO4: Develop Deep Understanding on selection of hardware and software's for designing dynamical systems
CO5: Design and implement cyber physical system and address the problems and limitations for real world problems.
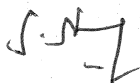
TEXT BOOKS:

T1: Rajeev Alur, Principles Of Cyber Physical Systems, 1st Edition, MITPress 2015.

T2: Raj Rajkumar , "Cyber Physical Systems," 2nd Edition, Elsevier 2015 3. Edward D Lamie, "Computing Fundamentals Of Cyber Physical Systems " , 2nd Edition, Newnes Elsevier Publication.
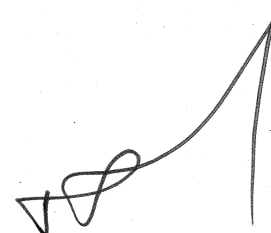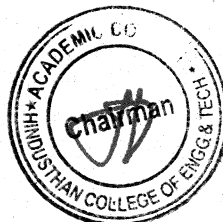
REFERENCE BOOKS:

R1: "Introduction to Embedded Systems — A Cyber— Physical Systems Approach" - E. A. Lee, Sanjit Seshia

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	3	-	-	-	1	1	2	1	1	3
CO2	1	1	3	-	3	-	-	-	1	1	2	1	1	3
CO3	2	2	3	3	3	-	-	-	1	1	2	1	1	3
CO4	2	2	3	-	3	-	-	-	1	1	3	1	1	3
CO5	2	2	1	1	1	-	-	1	2	2	3	2	2	1

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HONOURS WITH SPECIALIZATION

(ROBOTICS)

Programme	Course Code	Name of the Course	L	T	P	C
B. Tech.	22AI5203	FOUNDATIONS OF ROBOTICS	3	0	0	3

Course Objective	1. To understand the functions of the basic components of a Robot. 2. To study the use of various types of End Effectors and Sensors. 3. To impart knowledge in Robot Kinematics and Programming. 4. To learn Robot safety issues and economics. 5. To impart knowledge in Robot cell design.

Unit	Description	Instructional Hours
I	**INTRODUCTION AND ROBOT KINEMATICS** Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.	9
II	**ROBOT DRIVES AND CONTROL** Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.	9
III	**ROBOT SENSORS** Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.	9
IV	**ROBOT CELL DESIGN AND APPLICATION** Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.	9
V	**ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS** Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.	9
	Total Instructional Hours	45

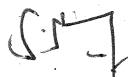|		
Course Outcome	CO1:	Understand the functions of the basic components of a Robot.
	CO2:	Study the use of various types of End Effectors and Sensors.
	CO3:	Gain knowledge in Robot Kinematics and Programming.
	CO4:	Impart knowledge on the use Robot safety issues and economics.
	CO5:	Impart knowledge in Robot cell design

TEXT BOOKS:

T1:   Fu.K.S., R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill, 1987.

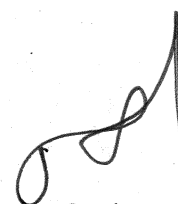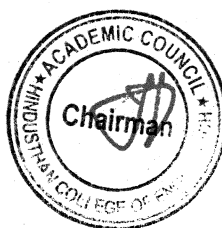T2:   Yoram Koren," Robotics for Engineers' Mc Graw-Hill, 1987.

REFERENCE BOOKS:

R1:   Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw-Hill, Int. 1986.

R2:   Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.

R3:   Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	3	1	-	-	-	1	2	2	1	1	2
CO2	1	1	3	1	1	-	-	-	1	3	2	1	1	2
CO3	2	2	3	2	2	-	-	-	1	3	2	1	1	2
CO4	2	2	3	2	2	-	-	-	1	3	3	1	1	3
CO5	2	2	1	2	2	-	-	-	2	1	3	2	2	3

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HONOURS WITH SPECIALIZATION
(BLOCKCHAIN TECHNOLOGY)

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH	22AI5204	PUBLIC KEY INFRASTRUCTURE AND TRUST MANAGEMENT	3	0	0	3

Course Objective	1. To understand about public key technology and a public key infrastructure. 2. To Understand the relationship of identity management to PKI 3. To Understand the components of a public key infrastructure.. 4. To Understand the issues related to Trust management mechanisms 5. To Understand Secure Crypto protocols like SSL and so on

Unit	Description	Instructional Hours
I	**INTRODUCTION** Uses of cryptography, the concept devil and Alice. Principle of Cryptography. PKCS standards IEEE P1363, Block cipher modes of operation and data transformation for asymmetrical algorithms, Data transformation for RSA algorithm, Cryptographic Protocols, Protocol properties, Attributes of cryptographic protocols.	9
II	**PUBLIC KEY INFRASTRUCTURE** Crypto Hardware and software, Smart cards, Universal Crypto interface, Real world attacks, Evaluation and certification, Public Key Infrastructure, PKI Works.	9
III	**DEVELOPING PKI** Directory service, Requesting certificate revocation information, Practical Aspects Of PKI Construction- The course of construction of PKI, Basic questions about PKI construction, The most important PKI suppliers.	9
IV	**IMPLEMENTATION** The internet and the OSI model The OSI model, Crypto standards for OSI Layers 1 and 2-Crypto extensions for ISDN (Layer 1), Cryptography in the GSM standard (Layer 1), Crypto extensions for PPP (Layer 2), Virtual private networks	9
V	**SECURE CRYPTO PROTOCOLS** IPsec and IKE, IPsec, IKE, SKIP, Critical assessment of IPsec, Virtual private network with IPsec, SSL, TLS AND WTLS (Layer 4)SSL working method, SSL protocol operation, Successful SSL, Technical comparison between IPsec and SSL, WTLS.	9
	Total Instructional Hours	45

Course Outcome	CO1:	Distinguish between public key technology and a public key infrastructure.
	CO2:	Understand the relationship of identity management to PKI
	CO3:	Understand the components of a public key infrastructure..

CO4:	Understand the issues related to Trust management mechanisms.
CO5:	Understand Secure Crypto protocols like SSL and so on.

TEXT BOOKS:

1. Klaus schmeh:"Cryptography and public key infrastructure on the internet", 1st Edition, Allied Publishers, 2004.

2. Kaufman, Perlman and Speciner, "Network Security: Private Communication in a public world", Prentice Hall of India/ Pearson Education, New Delhi, 2004.

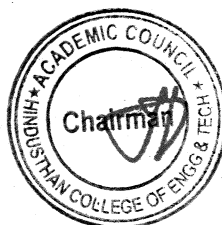3. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd

REFERENCE BOOK:

1. Wenbo Mao: "Modern Cryptography : theory and practice", 1st Edition, Pearson Education, 2005.

2. Behrouz Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill Publishing Company , New Delhi, 2010

3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	2	2	2	-	-	-	2	-	-	2	2	2
CO2	-	3	2	3	2	2	-	-	2	2	-	2	3	3
CO3	-	3	3	2	3	2	-	-	2	2	-	2	3	3
CO4	-	1	1	2	3	2	2	1	2	2	1	2	3	3
CO5	-	1	1	2	3	2	2	2	2	-	3	2	3	2

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MINOR DEGREE IN AIML

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH	22AI5601	DATA STRUCTURES USING C PROGRAMMING	3	0	0	3

Course Objective

1. Understand the fundamental concepts of Programming such as Pointers, Structures and union
2. Understand the concept of various linear data structures like Linked list
3. Understand the concept of stack and queue.
4. Understand the various non-linear data structures like binary tree, binary search tree, AVL
5. Understand graph algorithms for solving real world problems

Unit	Description	Instructional Hours
I	**FUNDAMENTAL CONCEPTS OF C PROGRAMMING** Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.	8
II	**LINKED LIST** Representation – Basic Operations – Types: Singly linked list – Doubly linked list – Circular linked list – Applications: Polynomial Addition, Sparse Matrices.	9
III	**STACK AND QUEUE** Stack: Array and Linked Stacks – Applications: Balancing Symbols, Expression conversion, Postfix evaluation, Recursion – Queue: Array and Linked Queue, Circular Queue – Double Ended Queue – Applications.	9
IV	**TREE** Tree Terminologies – Binary tree: Representation - Tree traversal: In-order, Pre-order, Post order, Level order – Binary Search Tree: Representation – Operations – AVL Tree – B-Tree – Applications: Expression tree.	9
V	**GRAPH AND HASHING** Graph: Terminologies – Representation of Graph - Graph traversal – Topological sort – Hashing: Hash table – Hash functions – Resolving Collision Techniques: Separate chaining – Open addressing – Double hashing.	10

Total Instructional Hours   45

Course Outcome

CO1: Comprehend the working of linear data structures and identify their applications.

CO2: Apply recursion on specific applications

CO3: Understand the various tree data structures for efficient storage and retrieval of data.

CO4: Employ graph data structure for solving real world problems

CO5: Apply suitable methods for efficient data access through hashing

TEXT BOOKS:

T1:   Mark A.Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2010.

T2:   Reema Thareja, —Programming in C, Oxford University Press, Second Edition, 2016.

REFERENCE BOOKS:

R1:   Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, 'Data structures using C', Pearson Education, 2008.

R2:   Stephen G. Kochan, "Programming in C", Fourth edition, Pearson Education, 2015.

R3:   Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	3	1	-	-	-	1	2	2	1	1	2
CO2	1	1	3	1	1	-	-	-	1	3	2	1	1	2
CO3	2	2	3	2	2	-	-	-	1	3	2	1	1	2
CO4	2	2	3	2	2	-	-	-	1	3	3	1	1	3
CO5	2	2	1	2	2	-	-	-	2	1	3	2	2	3
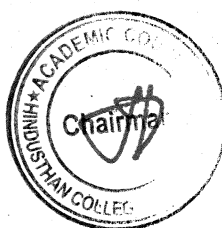
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HICET

B.TECH – ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (UG)

REGULATION-2019

HONOURS & MINOR SYLLABUS

For the students admitted during the academic year 2021-2022 and onwards

B.TECH (Hons) AIML

(CYBER PHYSICAL SYSTEM)

| B.TECH | 21AI7209 | Biomedical Instrumentation for Cyber Physical Systems | 3 | 0 | 0 | 3 |

Course Objective	1.To gain knowledge about the fundamental medical instrumentation system and various electrical and non-electrical biopotentials and the methods of recording these potentials. 2.To provide a thorough understanding of different medical imaging systems 3.To study about the various assist devices used in the healthcare services 4.To Elucidate the measurement of non-invasive diagnostic parametersTo Understand Secure Crypto protocols like SSL 5. To Apply on various life assisting and therapeutic devices that are vital parts in modern hospital care and trends in brain computer interfaces

Unit	Description	Instructional Hours
I	**Concept of Biomedical Instrumentation** Basic components of a biomedical system, Origin of biopotentials, Measurement of biopotentials, Examples of biopotential electrodes and signals, Noises and physiological interferences	9
II	**Bioelectrical Potential Acquisition and Analysis** Bio signals characteristics – frequency and amplitude ranges. Electrode lead systems and recording methods: Electrocardiography (ECG), Electroencephalography (EEG), Electromyography (EMG), Electroretinography (ERG).	9
III	**Medical Imaging Systems** Radiographic and fluoroscopic techniques, Computer tomography, Magnetic resonance imaging (MRI) system, Nuclear medicine system, Ultrasonography, Endoscopy and Thermography	9
IV	**Life Assisting and Therapeutic Devices** Cardiac pacemakers, Defibrillators, Ventilators, Heart lung machine, Dialysers, Elements of intensive care patient monitoring system	9
V	**Brain Computer Interfaces** Fundamentals of brain computer interfaces (BCI) - Structure of BCI system – Functional restoration using Neuro-prosthesis - Functional electrical stimulation - Visual feedback and control - External device controllers.	9
	Total Instructional Hours	45

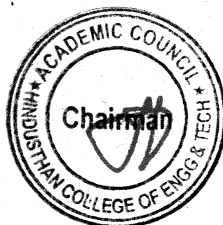|		
Course Outcome	CO1:	Clearly understand generalized medical instrumentation system and properties of biopotential electrodes
	CO2:	Impart the fundamentals of acquisition and recording of biopotentials
	CO3:	Elucidate the measurement of non-invasive diagnostic parameters
	CO4:	Identify and compare the imaging modalities and find the best appropriate method for different pathological diagnoses.
	CO5:	Give an exposure on various life assisting and therapeutic devices that are vital parts in modern hospital care and trends in brain computer interfaces

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", 2nd Edition, Prentice

Hall of India, New Delhi, 2015.

2. John G. Webster, "Medical Instrumentation: Application and Design", 4th Edition, Wiley India Edition, 2009.

3. Jonathan Wolpaw, Elizabeth Winter Wolpaw, "Brain Computer Interfaces: Principles and practice", 1st Edition, Oxford University Press, USA, 2012.

REFERENCE BOOK:

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", 3rd Edition, Mc Graw-Hill Education, New Delhi, 2014.

2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", 4 th Edition, Prentice Hall of India, 2008

3. S. Berkovsky, I. Cantador and D. Tikk, Collaborative Recommendations: Algorithms, Practical Challenges and Applications. UK: World Scientific Publishing Co, 2019.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	2	1	-	2	2	1	2	1	3
CO2	3	3	2	1	3	1	1	-	2	2	1	2	2	3
CO3	3	3	2	1	3	2	2	1	1	1	1	2	2	3
CO4	3	3	2	1	3	1	1	2	2	2	1	2	1	1
CO5	3	3	2	1	3	2	1	-	2	2	1	2	1	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.TECH	21AI7208	CPS for Internal and External Security	3	0	0	3

Course Objective	1. To describe what cyber-physical systems are.
	2. To demonstrate what makes cyber-physical systems hard to secure.
	3. To analyze common methods used to secure cyber-physical systems.
	4. To Design cyber-physical systems and architectures that are resilient to attack.
	5. To introduce the applications of security tools

Unit	Description	Instructional Hours
I	**Security and Vulnerabilities** Cyber Security Vulnerabilities-Overview, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Denial of Service Filters, Intrusion Detection Systems, Security policy, Threat Management.	9
II	**Attacks** MANET attacks - Identity based attacks - Security of sensor networks - access control - Physical attacks - detection of compromised nodes - Platform security	11
III	**Physical Security** Hardware supply chain - hardware support – Infrastructure maintenance and policy – Wireless ID – Card Security – Physical Security	9
IV	**Cloud Computing Security** Cloud computing and data security - Cloud computing and data security - Network and system monitoring - Sensor event analysis - Pervasive sensing and monitoring for situational awareness - Infrastructure attacks - Trusted Computing and secure modules	9
V	**Interconnection** Hardware platforms for Cyber Physical Systems – case study: Security for Cloud-Interconnected CPSs, Privacy Issues in CPSs, Local Network Security for CPSs, Privacy for CloudInterconnected CPSs	7
	Total Instructional Hours	45

Course Outcome	CO1:	Understand the basic concepts of distributed database and cryptography
	CO2:	Evaluate block chain systems and its applications.
	CO3:	Analyze the distributed consensus and energy utilization
	CO4:	Evaluate the crypto currency related performance measurements.
	CO5:	Apply the logics crypto currency and block chain technologies.

**TEXT BOOKS:**

T1: John R.Vacca, Computer and Information Security Handbook, Second Edition, Elsevier 2013.

T2: Richard E.Smith, Elementary Information Security, Second Edition, Jones and Bartlett Learning, 2016.

REFERENCE BOOKS:

R1: Adam Shostack, Threat Modeling, Designing for Security, John Wiley and Sons, 2014.

R2: Thomas R. Peltier, Information Security Policies and Procedures, 2nd Edition, Auerbach Publications, 2004.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	3	2	2	2	2	3	2	2	2	1	3
CO2	2	2	2	3	3	2	3	3	1	2	3	3	2	3
CO3	2	1	1	3	2	1	1	1	1	2	1	1	2	3
CO4	3	3	3	3	2	3	1	1	1	1	1	1	1	1
CO5	1	3	2	2	2	2	1	1	1	1	1	1	1	2

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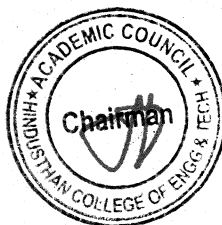
B.TECH (Hons) AIML
(BLOCK CHAIN TECHNOLOGY)

Programme	Course code	Name of the course	L	T	P	C
B.TECH	21AI7206	**Smart Contracts and Solidity**	3	0	0	3

Course Objective

The student should be able

1. To Understand the Basic concepts of Smart Contracts.
2. To learn about different Smart Contracts programming languages and their execution environments
3. To Implement Smart Contracts in Ethereum using Solidity
4. To study about Truffle Framework and Ganache
5. To learn the Basics of smart contracts, decentralized apps, and decentralized anonymous organizations (DAOs)

Unit	Description	Instructional Hours
I	**Smart Contracts** Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract, Introduction to Ethereum Higher-Level Languages.	9
II	**Development Environment** Building A Simple Smart Contract with Solidity, Solc -Compiler, Ethereum Contract ABI, Remix-IDE for Smart Contract Development.	9
III	**Introduction to Solidity** Contracts, Constructors & Functions, Variables, Getters & Setters, Arrays, Memory vs Storage, Mappings in Solidity Advanced Solidity - Structs, Error Handling & Restrictions, Libraries, Global Variables in Solidity, Abstract Contracts, Inheritance, And Interfaces, Events	9
IV	**Truffle Framework & Ganache** Environment Setup for Truffle & Ganache, Truffle Project Creation, Truffle Compile, Migrate and Create Commands	9
V	**Decentralized App Creation** Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying Dapp, Validation, And Testing of Dapp.	9
	Total Instructional Hours	45

Course Outcome

CO1	Basic concepts of Smart Contracts.
CO2	Recognize different Smart Contracts" programming languages and their execution environments
CO3	Identify the key features of different Smart Contracts" programming languages
CO4	Implement Smart Contracts in Ethereum using Solidity
CO5	Apply front end application ,validation and testing

Text Books

1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.

References

1. Building Blockchain Projects, Narayan Prusty, Packt Publishing.
2. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O'Reilly Publisher.

Corresponding Online Resources:

1. https://www.coursera.org/learn/smarter-contracts
2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-inethereumblockchain/
3. Introduction to Blockchain Technology and Application

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	3	1	0	0	0	3	0	0	0	1	2
CO2	3	2	1	2	1	3	0	0	2	0	0	2	1	3
CO3	3	2	1	2	1	3	0	0	2	0	0	2	2	3
CO4	3	1	1	2	1	3	0	0	0	0	0	2	2	3
CO5	3	2	1	1	1	0	0	0	0	0	0	3	2	3
Avg	3	2	1	2	1	2	0	0	1	0	0	2	2	3
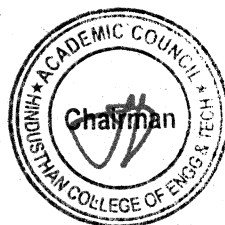
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Programme	Course code	Name of the course	L	T	P	C
B.TECH	21AI7207	BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGY	3	0	0	3

COURSE OBJECTIVES:

1. To understand Blockchain and Distributed Ledger Technologies.

2. To learn the development in Blockchain functionalities

3. To identify alternative techniques to proof of work for Blockchain protocols, proof of stake/space.

4. To learn the techniques for anonymity preservation

5. To resolve the Blockchain challenges

UNIT I   INTRODUCTION TO DISTRIBUTED LEDGERS   9

Block chain, Distributed Ledgers – Cryptographic basics for cryptocurrency – Hashing ,Signature Schemes, encryption schemes and elliptic curve cryptography – CAP Theorem and block chain – Categories of Block chain: Public ,Private block chains, Permissioned Ledger, Tokenized Block chains, Tokenless Block chains, Sidechains.

UNIT II   Essentials of Cryptocurrencies   9

Distributed identity: Public and Private keys, Digital identification and wallets :Decentralized network – Distributed Ledger: Permission framework, Block chain data structure -Double Spending , Network consensus – Sybil attacks, Block rewards and miners, Difficulty under competition, Forks and consenses chain, The 51% attack ,confirmations and finally – the limit of proof -of-work.

UNIT III   Blockchain Implementation   9

        Bitcoin and Merkle Root - Eventual Consistency and Bitcoin - Byzantine Fault Tolerance -Bitcoin and Secure Hashing - Bitcoin block-size - Bitcoin Mining - Blockchain Collaborative Implementations: Hyperledger, Corda - Ethereum's ERC 20 and token explosion-Decentralization using Blockchain: Blockchain and full ecosystem decentralization: Smart contract, Decentralized autonomous organization (DAO), Decentralized applications - Platforms for decentralization

UNIT IV   Zero Knowledge Proofs and Protocols in Blockchain   9

Pseudo-anonymity vs. anonymity - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - Zk-SNARKS for anonymity preservation

UNIT V   Blockchain Challenges   9

Blockchain Governance Challenges: Bitcoin Blocksize Debate, The Ethereum DAO Fork, Ethereum's Move to PoS and Scaling Challenges - Blockchain Technical Challenges: Denial-of-Service Attacks, Security in Smart Contracts, Scaling, Sharding

COURSE OUTCOMES:

CO1: Understand the basics of Blockchain and Distributed Ledger Technologies.

CO2: Comprehend the functionality of blockchain.

CO3: Choose a blockchain implementation based on real time scenario.

CO4: Examine the techniques for anonymity preservation

CO5: Determine the Blockchain challenges

TEXT BOOKS

1. Goldfeder, S., Bonneau, J., Miller, A., Felten, E., Narayanan, A. Bitcoin and Cryptocurrency Technologies, 2016, 1st edition, Princeton University Press, New Jersey
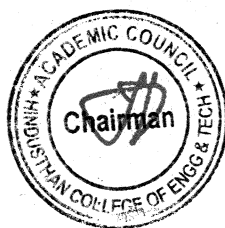
1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018.

REFERENCES

1. Iyer, Kedar, et al. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions., 2018, 1st edition, McGraw-Hill Education, United Kingdom

2. Wattenhofer, R. Distributed Ledger Technology: The Science of the Blockchain, 2017, 1st edition, CreateSpace Independent Publishing Platform, United States

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	-	-	-	1	2	1	2	3	2
CO2	3	2	3	2	2	-	-	-	2	1	2	1	3	2
CO3	2	2	3	2	2	-	-	-	3	2	2	2	3	2
CO4	2	2	3	1	1	-	-	-	2	2	2	2	3	2
CO5	2	2	2	1	1	-	-	-	2	1	1	1	3	2

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MINOR DEGREE

AIML

Programme	Course Code	Name of the Course	L	T	P	C
B. Tech.	21AI7601	Introduction to Robotics	3	0	0	3

Course Objective	1. To understand the functions of the basic components of a Robot. 2. To study the use of various types of End Effectors and Sensors. 3. To impart knowledge in Robot Kinematics and Programming. 4. To learn Robot safety issues and economics. 5. To impart knowledge in Robot cell design.

Unit	Description	Instructional Hours
I	**INTRODUCTION AND ROBOT KINEMATICS** Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.	9
II	**ROBOT DRIVES AND CONTROL** Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.	9
III	**ROBOT SENSORS** Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.	9
IV	**ROBOT CELL DESIGN AND APPLICATION** Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.	9
V	**ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS** Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.	9
	Total Instructional Hours	45

|		
Course Outcome	CO1:	Understand the functions of the basic components of a Robot.
	CO2:	Study the use of various types of End Effectors and Sensors.
	CO3:	Gain knowledge in Robot Kinematics and Programming.
	CO4:	Impart knowledge on the use Robot safety issues and economics.
	CO5:	Impart knowledge in Robot cell design

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TEXT BOOKS:

T1:   Fu.K.S., R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill, 1987.

T2:   Yoram Koren," Robotics for Engineers' Mc Graw-Hill, 1987.

REFERENCE BOOKS:

R1:   Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw-Hill, Int. 1986.

R2:   Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.

R3:   Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994,

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	-	-	-	1	2	1	1	3	2
CO2	3	2	3	2	2	-	-	-	2	1	2	2	3	2
CO3	2	2	3	2	2	-	-	-	3	2	2	2	3	2
CO4	2	2	3	1	2	-	-	-	2	2	1	2	3	2
CO5	2	2	2	1	2	-	-	-	2	1	1	2	3	2
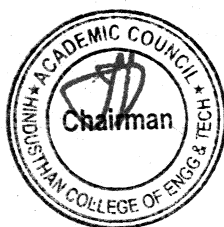
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Programme	Course code	Name of the course	L	T	P	C
B.TECH	21AI7602	Foundations of Data Analytics	3	0	0	3

COURSE OBJECTIVES:

1. To establish clearly the objectives and scope of the predictive analysis.

2. Use R programming language to identify suitable data sources to agree the methodological approach

3. Validate and review data accurately and identify anomalies.

4. To appreciate the current trends in data analysis procedure

5. Carry out rule-based analysis of the data in line with the analysis plan

6. Apply statistical models to perform Regression Analysis, Clustering and Classification

UNIT I   Introduction to Analytics   9

Analytics life cycle - Business analytics - lending analytics- recommendation analyticsHealthcare Analytics- financial analytics - sports analytics.

UNIT II   R programming Basics   9

Introduction to R, R Studio (GUI): R Windows Environment, introduction to various data types, Numeric, Character, date, data frame, array, matrix etc.,.

UNIT III   Working with datasets and files: 9

Reading Datasets, Working with different file types .txt,.csv , R studio, Files, Datasets, Extracting Datasets, Preparing datasets. Data Cleaning, Data imputation, Data conversion Analysis

UNIT IV   Introduction to statistical learning and R-Programming   9

Basic statistics: mean, median, standard deviation, variance, correlation, covariance - Outliers, Combining Datasets in R, Functions and loops. Summary Statistics - Summarizing data with R - Correlation and Regression

**UNIT V   Document Creation and Knowledge Sharing   9**

Access existing documents, language standards, templates and documentation tools from their organization's knowledge base. Confirm the content and structure of the documents with appropriate people, Create documents using standard templates and agreed language standards. Review documents with appropriate people and incorporate their inputs

COURSE OUTCOMES:

CO1: Understand R with Business Intelligence, Business Analytics, Data and Information.

CO2: Contextually integrate and correlate information automatically to gain faster insights.

CO3: Implement statistical analysis techniques for solving practical problems.

CO4: Graphically interpret data and Find a meaningful pattern in data

CO5: Perform statistical analysis on variety of data

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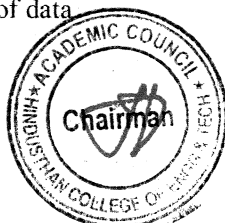
TEXT BOOKS

1. Trevor Hastie and Rob Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2017.

2. Mark van der Loo, Edwin de Jonge, "Learning R Studio for R Statistical Computing", Packt Publishing, 2012.

3. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. "Mining of Massive Datasets". Cambridge University Press. 2014.

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2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2008.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	-	-	-	1	2	1	2	3	2
CO2	3	2	3	2	2	-	-	-	2	1	2	1	3	2
CO3	2	2	3	2	2	-	-	-	3	2	2	2	3	2
CO4	2	2	3	1	1	-	-	-	2	2	2	2	3	2
CO5	2	2	2	1	1	-	-	-	2	1	1	1	3	2

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