HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICET

HINDUSTHAN

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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

(An Autonomous Institution Affiliated to Anna University, Chennai)

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

Coimbatore - 641 032.

B.E. COMPUTER SCIENCE AND ENGINEERING

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the odd semester

Academic year 2024-2025

2022 REGULATIONS

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
CSE - HiCET

Dean (Academics)
HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH ★ ACADEMIC COUNCIL ★ Chairman

VISION AND MISSION OF THE DEPARTMENT

VISION

To excel in developing technologically superior, highly competent and socially conscious professionals in computer science and engineering with cutting-edge research skills.

MISSION

DM1: To equip the students with technical knowledge and expertise essential for success in their professional career.

DM2: To develop highly qualified and creative computer science and engineering professionals proficient in cutting-edge technologies with leadership qualities.

DM3: To empower students to develop innovative solutions for industrial and societal challenges upholding ethical values.

Chairman - BoS
CSE - HiCET

Dean (Academics)
HiCET

HINDUSTHAN ACADEMIC COUNCIL OF ENGG. & TECH. Chairman HINDUSTHAN COLLEGE OF ENGG. & TECH.

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, being able to comprehend and write effective reports and design

Chairman - BoS
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HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

		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 utilize modern tools and techniques for efficient system design and implementation for computer-based systems in solving engineering problems.
PSO2	An ability in developing robust and secure software systems for diverse applications.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To acquire knowledge in the latest technologies and innovations with an ability to recognize, analyze, and solve problems in computer science and engineering.

PEO2: To develop highly skilled computer science and engineering professionals proficient in latest technologies with leadership qualities.

PEO3: To empower students to create innovative solutions for industrial challenges that meet societal needs

Chairman - BoS
CSE - HiCET

Dean (Academic)
HiCET

HINDUSTHAN ACADEMIC COUNCIL OF ENGG & TECH Chairman

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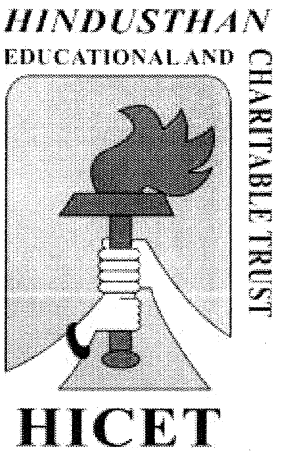
B.E. COMPUTER SCIENCE AND ENGINEERING



CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the odd semester

Academic year 2024-2025

(Academic Council Meeting Held on 21.06.2024)

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (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 Science	BSC	2	0	2	3	4	50	50	100
4	22CS1151	Problem solving using C Programming	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 (Common to all)	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											
3	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
4	22PH2151	Physics For Circuit Engineering Programme	BSC	2	0	2	3	4	50	50	100
5	22IT2251	Python programming and Practices	PCC	2	0	2	3	4	50	50	100
6	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	2	2	2	100	0	100
9	22HE2072	SOFT SKILLS AND APTITUDE-I	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2094/ 22MC2095	தமிழரும் தொழில்நுட்பமும் / 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, inanyone of the personality and character development programmes and undergo training for about 80 hours							
			TOTAL	**18**	**1**	**13**	**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	22MA3103	Discrete Mathematics and Graph Theory	BSC	3	1	0	4	4	40	60	100
2	22CS3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22CS3202	Operating Systems	PCC	3	1	0	4	4	40	60	100
4	22CS3203	Digital Principles And Computer Organization	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22CS3251	Object Oriented Programming Using Java	PCC	3	0	2	4	4	50	50	100
PRACTICAL											
6	22CS3001	Digital Principles And Computer Organization Laboratory	ESC	0	0	4	2	4	60	40	100
7	22CS3002	Operating Systems Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills And Aptitude -II	SEC	1	0	0	1	1	100	0	100
9	22CS3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
MANDATORY COURSE											
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	22CS4201	Database ManagementSystems	PCC	3	0	0	3	3	40	60	100
3	22CS4202	Microprocessor and Microcontrollers	PCC	3	0	0	3	3	40	60	100
4	22CS4203	Software Design with UML	PCC	3	0	0	3	3	40	60	100

THEORY WITH LAB COMPONENT											
5	22MA4152	Applied Statistics with R Programming and Queuing theory	BSC	2	0	2	3	4	50	50	100
6	22CS4251	Design and Analysis of Algorithms	PCC	3	0	2	4	4	50	50	100
PRACTICAL											
7	22CS4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22CS4002	Microprocessor and Microcontrollers Laboratory	PCC	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**	**1**	**12**	**23**	**28**	**480**	**420**	**900**

SEMESTER V (Credits – 22)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS5201	Theory Of Computation	PCC	3	1	0	4	4	40	60	100
2	22CS5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22CS53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22CS53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22CS53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22CS5252	Machine Learning	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22CS5001	Engineering Clinic	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	22CS6201	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	22CS63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4	22CS63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5	22CS64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22CS64XX	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	22CS6001	Project based Learning	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	22CS7201	Information storage and Management	PCC	3	0	0	3	3	40	60	100
2	22CS7202	Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22CS73XX	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	22CS7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22CS7701	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	22CS8901	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	2	4	3	1	1	2	2	10	**25**
8	MC	✓	✓							
	Total	**18**	**23**	**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	22CS7401	E-Commerce	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 AIML	Vertical II Creative Media	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And AR / VR	Vertical VI Full Stack Development
22CS5301 Artificial Intelligence	**22CS5304** Multimedia Data Compression and Storage	**22CS5307** Principles of Cloud Computing	**22CS5310** Modern Cryptography and Network Security	**22CS5313** Computer Graphics	**22CS5316** Web Technology
22CS5302 Big Data Analytics	**22CS5305** Multimedia and Animation	**22CS5308** Virtualization	**22CS5311** Ethical Hacking	**22CS5314** Image and video analytics	**22CS5317** Front End Development with REACT and TYPESCRIPT
22CS5303 Natural Language Processing	**22CS5306** Video Creation and Editing	**22CS5309** Cloud Computing Architecture & Deployment Models	**22CS5312** Digital and Mobile Forensics	**22CS5315** Game Programming	**22CS5318** Node JS
22CS6301 Soft Computing	**22CS6303** UI and UX Design	**22CS6305** Cloud Services Management	**22CS6307** Cyber forensics and information security	**22CS6309** Computer Vision	**22CS6311** Nosql Databases with Mongo DB

22CS6302 Quantum Computing	**22CS6304** Digital marketing	**22CS6306** Cloud Application Development	**22CS6308** Secured Network Protocols and Standards	**22CS6310** Introduction to Augmented Reality	**22CS6312** DevOps
22CS7301 Cognitive Science and Analytics	**22CS7302** Visual Effects	**22CS7303** Cloud Security	**22CS7304** Data privacy preservation	**22CS7305** Virtual Reality	**22CS7306** Web Application Security

Note:

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

Vertical I
AIML

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5301**	Artificial Intelligence	PEC	3	0	0	3	3
2	**22CS5302**	Big Data Analytics	PEC	3	0	0	3	3
3	**22CS5303**	Natural Language Processing	PEC	3	0	0	3	3
4	**22CS6301**	Soft Computing	PEC	3	0	0	3	3
5	**22CS6302**	Quantum Computing	PEC	3	0	0	3	3
6	**22CS7301**	Cognitive Science and Analytics	PEC	3	0	0	3	3

Vertical II
Creative Media

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5304**	Multimedia Data Compression and Storage	PEC	3	0	0	3	3
2	**22CS5305**	Multimedia and Animation	PEC	3	0	0	3	3
3	**22CS5306**	Video Creation and Editing	PEC	3	0	0	3	3
4	**22CS6303**	UI and UX Design	PEC	3	0	0	3	3
5	**22CS6304**	Digital marketing	PEC	3	0	0	3	3
6	**22CS7302**	Visual Effects	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	**22CS5307**	Principles of Cloud Computing	PEC	3	0	0	3	3
2	**22CS5308**	Virtualization	PEC	3	0	0	3	3

3	**22CS5309**	Cloud Computing Architecture & Deployment Models	PEC	3	0	0	3	3
4	**22CS6305**	Cloud Services Managment	PEC	3	0	0	3	3
5	**22CS6306**	Cloud Application Development	PEC	3	0	0	3	3
6	**22CS7303**	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	**22CS5310**	Modern Cryptography and Network Security	PEC	3	0	0	3	3
2	**22CS5311**	Ethical Hacking	PEC	3	0	0	3	3
3	**22CS5312**	Digital and Mobile Forensics	PEC	3	0	0	3	3
4	**22CS6307**	Cyber forensics and information security	PEC	3	0	0	3	3
5	**22CS6308**	Secured Network Protocols and Standards	PEC	3	0	0	3	3
6	**22CS7304**	Data privacy preservation	PEC	3	0	0	3	3

Vertical V
COMPUTER VISION AND VIRTUAL REALITY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5313**	Computer Graphics	PEC	3	0	0	3	3
2	**22CS5314**	Image and video analytics	PEC	3	0	0	3	3
3	**22CS5315**	Game Programming	PEC	3	0	0	3	3
4	**22CS6309**	Computer Vision	PEC	3	0	0	3	3
5	**22CS6310**	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	**22CS7305**	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	22CS5316	Web Technology	PEC	3	0	0	3	3
2	22CS5317	Front End Development with REACT and TYPESCRIPT	PEC	3	0	0	3	3
3	22CS5318	Node JS	PEC	3	0	0	3	3
4	22CS6311	Nosql Databases with Mongo DB	PEC	3	0	0	3	3
5	22CS6312	DevOps	PEC	3	0	0	3	3
6	22CS7306	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.

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2	22CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3	22CS6602	Sem6: Introduction to Internet Of Things	MDC	3	0	0	3	3
4	22CS7601	Sem 7: Introduction to Machine Learning	MDC	3	0	0	3	3

5	22CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6	22CS8601	Sem 8: Data Analytics	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	22CS5601	Financial Management	MDC	3	0	0	3	3
2	22XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	22XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22XXXX	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	22BA5601	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22BA6601	Introduction to Business Venture	MDC	3	0	0	3	3
3	22 BA6602	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	22 BA7601	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	22 BA7602	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	22 BA8601	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	22BA8602	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	22XXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22XXXX	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22XXXX	Green Technology	MDC	3	0	0	3	3
6	22XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING

Vertical I IOT	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III DATASCIENCE
22CS5204 Fundamentals Of IOT	22CS5205 Public Key Infrastructure and Trust Management	22CS5206 Data warehouse and Mining
22CS6203 IoT Design	22CS6205 Introduction to block chain	22CS6207 Python for Data Science
22CS6204 Introduction Of Raspberry Pi and Arduino	22CS6206 Cryptocurrency	22CS6208 Exploratory Data Analysis and Time series
22CS7203 IoT for smart cities	22CS7205 Smart Contracts and Solidity	22CS7207 Information Retrieval
22CS7204 Internet Of Medical Things	22CS7206 Block chain and distributed ledger technology	22CS7208 Data Security
22CS8201 Iot Cloud and Data Analytics	22CS8202 Bitcoin Essentials and Use-Cases	22CS8203 Recommender Systems

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN IOT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5204	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	3
2	22CS6203	Sem 6: IoT Design	PC	3	0	0	3	3
3	22CS6204	Sem 6: Introduction Of Raspberry Pi and Arduino	PC	3	0	0	3	3
4	22CS7203	Sem 7: IoT for smart cities	PC	3	0	0	3	3
5	22CS7204	Sem 7: Internet Of Medical Things	PC	3	0	0	3	3
6	22CS8201	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3
6	22CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING
SPECIALIZATION IN DATA SCIENCE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5206	Sem 5: Data warehouse and Mining	PC	3	0	0	3	3
2	22CS6207	Sem 6: Python for Data Science	PC	3	0	0	3	3
3	22CS6208	Sem 6: Exploratory Data Analysis and Time series	PC	3	0	0	3	3
4	22CS7207	Sem 7: Information Retrieval	PC	3	0	0	3	3
5	22CS7208	Sem 7: Data Security	PC	3	0	0	3	3
6	22CS8203	Sem 8: Recommender Systems	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"-5th editionCambridgeUniversityPress, 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
BE	22CS1151	PROBLEM SOLVING USING C PROGRAMMING	2	0	2	3

Course Objective	**The student should be able to**	
	1	To develop simple algorithms for arithmetic and logical problems
	2	To understand and implement the fundamental concepts in a program.
	3	To enable how to implement conditional branching, iteration and recursion
	4	To understand how to decompose a problem into functions and synthesize a complete program and to enable them to use arrays, pointers, strings and structures in solving problems.
	5	To understand the use files to perform read and write operations

Unit	Description	Instructional Hours
I	**INTRODUCTION TO COMPUTERS** Computer Systems – Computing Environments – Computer Language – Creating and Running programs – Computer Numbering System – Storing Integers and Real Numbers – Algorithms - Flowchart.	7
II	**INTRODUCTION TO C LANGUAGE** Character set - C Tokens, Identifiers and Keywords - Constants, Variables - Data types – Text Input / Output – Operators - Expressions – Precedence and Associativity – Evaluating Expressions – Type Conversions. *Illustrative program: 1) Josh went to the market to buy N apples. He found two shops, shop A and B, where apples were being sold in lots. He can buy any number of the complete lot(s) but not loose apples. He is confused with the price and wants you to figure out the minimum cost to buy exactly N apples. Write an algorithm for Josh to calculate the minimum cost to buy exactly N apples.* ***Input Format:*** • *The first line of the input consists of an integer – N, representing the total number of apples that Josh wants to buy.* • *The second line consists of two space-separated positive integers – M1 and P1, representing the number of apples in a lot and the lot's price at shop A, respectively.* • *The third line consists of two space-separated positive integers-M2 and P2, representing the number of apples in a lot and lot's price at shop B, respectively.* ***Output Format:*** *Print a positive integer representing the minimum price at which Josh can buy the apples.* *2) Chaman planned to choose a four-digit lucky number for his car. His lucky numbers are 3,5 and 7. Help him find the number, whose sum is divisible by 3 or 5 or 7. Provide a valid car number, fails to provide a valid input then display that number is not a valid car number. Note: The input other than 4 digit positive number[includes negative and 0] is considered as invalid.*	6+4

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III	**DECISION MAKING, ARRAYS, STRINGS AND POINTERS** Two-way selection – Multi-way selection – Concept of a Loop – Pre-test and Post-test Loops – Initialization and Updating – Controlled Loops – Other Statements Related to Looping – Looping Application - Arrays - Strings - Pointers – Pointer Applications – Processor Commands. *Illustrative program: 1) You are playing an online game. In the game, a list of N numbers is given. The player has to arrange the numbers so that all the odd numbers of the list come after the even numbers. Write an algorithm to arrange the given list such that all the odd numbers of the list come after the even numbers.* ***Input*** • *The first line of the input consists of an integer number, representing the size of the list(N).* • *The second line of the input consists of N space-separated integers representing the values of the list* ***Output*** *Print N space-separated integers such that all the odd numbers of the list come after the even numbers* *2) Given an integer matrix of size N x N. Traverse it in a spiral form.* *Input:* *The first line contains N, which represents the number of rows and columns of a matrix. The next N lines contain N values, each representing the values of the matrix.* *Output:* *A single line containing integers with space, representing the desired traversal. Constraints: 0 < N < 500* *3) A digital machine generates binary data which consists of a string of 0s and 1s. A maximum signal M, in the data, consists of the maximum number of either 1s or 0s appearing consecutively in the data but M can't be at the beginning or end of the string. Design a way to find the length of the maximum signal.* ***Input*** *The first line of the input consists of an integer N, representing the length of the binary string. The second line consists of a string of length N consisting of 0s and 1s only.* ***Output*** *Print an integer representing the length of the maximum signal.* *4) Given a string S(input consisting) of '*' and '#'. The length of the string is variable. The task is to find the minimum number of '*' or '#' to make it a valid string. The string is considered valid if the number of '*' and '#' are equal. The '*' and '#' can be at any position in the string.* *Note : The output will be a positive or negative integer based on number of '*' and '#' in the input string.* *(*>#): positive integer*	6+4

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	(#>): negative integer* *(#=*): 0*	
IV	**FUNCTIONS, STRUCTURES AND UNION** Designing Structured Programs – Functions in C – User defined functions – Inter-Function Communication – Standard Function – Passing Arrays to Functions – Passing Pointers to Function – Recursion – Passing an array to a function – typedef – Enumerated types - Structure – Union – Programming Application. *Illustrative program: 1) The Caesar cipher is a type of substitution cipher in which each alphabet in the plaintext or messages is shifted by a number of places down the alphabet. For example, with a shift of 1, P would be replaced by Q, Q would become R, and so on. To pass an encrypted message from one person to another, it is first necessary that both parties have the 'Key' for the cipher, so that the sender may encrypt and the receiver may decrypt it. Key is the number of OFFSET to shift the cipher alphabet. Key can have basic shifts from 1 to 25 positions as there are 26 total alphabets. As we are designing custom Caesar Cipher, in addition to alphabets, we are considering numeric digits from 0 to 9. Digits can also be shifted by key places. For Example, if a given plain text contains any digit with values 5 and keyy =2, then 5 will be replaced by 7, "-"(minus sign) will remain as it is. Key value less than 0 should result into "INVALID INPUT". Write a function CustomCaesarCipher(int key, String message) which will accept plaintext and key as input parameters and returns its cipher text as output.* *Enter your PlainText: All the best* *Enter the Key: 1* *The encrypted Text is: BmmuifCftu*	5+4
V	**BINARY INPUT / OUTPUT** Defining and Opening a file, closing a file - input/output operations on files - error handling during I/O operations - random access to files - Text versus Binary Streams – Standard Library Functions for Files – Converting File type. *Illustrative program: 1) Write a C Program to merge contents of two files into a third file. 2) Write a program in C to delete a specific line from a file.*	6+3
	Total Instructional Hours	**45**

Course Outcome	CO1	Develop simple algorithms for arithmetic and logical problems.
	CO2	Test and execute the programs and correct syntax and logical errors
	CO3	Implement conditional branching, iteration and recursion
	CO4	Decompose a problem into functions and synthesize a complete program and use arrays, pointers, strings and structures to formulate algorithms and programs.
	CO5	Use files to perform read and write operations

TEXT BOOKS:

T1	Behrouz A. Forouzan, Richard F. Gilberg, J. Jaya, S. Shankar, I. Jasmine Selvakumari Jeya, M. Ramya Devi, "Computer Programming in C", Cengage Learning, 2022.
T2	Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd edition, 2017.

REFERENCE BOOKS:

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R1	Schildt Herbert, "C: The Complete Reference". Tata McGraw Hill Education, 4th edition, 2014.
R2	R. S. Bichkar, "Programming with C", Universities Press, 2nd edition 2012.
R3	YashvantKanetkar, "Exploring C", BPB Publishers, 2nd edition, 2003.
R4	W. Kernighan Brian, Dennis M. Ritchie, "The C Programming Language", PHI Learning, 2nd edition, 1988

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	3	2	0	0	0	3	0	3	0	3	3
CO2	2	2	2	2	2	3	0	1	2	0	3	2	3	2
CO3	3	2	1	2	2	3	0	1	2	0	2	2	2	2
CO4	3	1	2	2	0	3	0	1	0	0	2	2	2	1
CO5	3	1	2	1	2	0	0	0	0	0	2	3	2	2

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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)	15
	Total Instructional Hours	45

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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Course Outcomes	**At the end of the course, the learner will be able to**	
	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/

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

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MANDATORY COURSES

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. TofacilitatethedevelopmentofaHolisticperspectiveamongstudentstowardslifeandprofession 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. TohighlightplausibleimplicationsofsuchaHolisticunderstandingIntermsofethicalhumanconduct, 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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Reference Books:

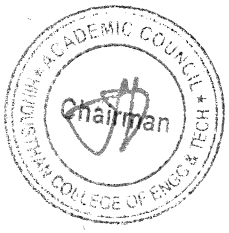
R1- A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

R2- Teachers' Manual for 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- 87034-53-2

R3-Jeevan Vidya: Ek Parichaya, 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/I	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. CO3Appreciate 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 தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் 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 ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

Chairman, Board of Studies

Dean - Academics

Chairman - BoS
CSE - HiCET

Dean (Academics)
HiCET

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
CSE - HiCET

Chairman

Dean - Academics

Dean (Academics)
HiCET

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 – Séries – 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

Chairman - BoS
CSE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean - Academics

Dean (Academics)
HiCET

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	

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG. & TECH

Chairman-BoS

Chairman - BoS
CSE - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

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.E. COMPUTER SCIENCE AND ENGINEERING

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)

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (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	Chemistry for Circuit Engineers	BSC	2	0	2	3	4	50	50	100
4	22CS1151	Problem solving using C Programming	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 (Common to all)	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											
3	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
4	22PH2151	Physics For Circuit Engineering Programme	BSC	2	0	2	3	4	50	50	100
5	22IT2251	Python programming and Practices	PCC	2	0	2	3	4	50	50	100
6	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	2	2	2	100	0	100
9	22HE2072	SOFT SKILLS AND APTITUDE-I	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC2094/ 22MC2095	தமிழரும் தொழில்நுட்பமும் / 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, inanyone of the personality and character development programmes and undergo training for about 80 hours							
			TOTAL	**18**	**1**	**13**	**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	22MA3103	Discrete Mathematics and Graph Theory	BSC	3	1	0	4	4	40	60	100
2	22CS3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22CS3202	Operating Systems	PCC	3	1	0	4	4	40	60	100
4	22CS3203	Digital Principles And Computer Organization	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22CS3251	Object Oriented Programming Using Java	PCC	3	0	2	4	4	50	50	100
PRACTICAL											
6	22CS3001	Digital Principles And Computer Organization Laboratory	ESC	0	0	4	2	4	60	40	100
7	22CS3002	Operating Systems Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills And Aptitude -II	SEC	1	0	0	1	1	100	0	100
9	22CS3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
MANDATORY COURSE											
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	22CS4201	Database ManagementSystems	PCC	3	0	0	3	3	40	60	100
3	22CS4202	Microprocessor and Microcontrollers	PCC	3	0	0	3	3	40	60	100
4	22CS4203	Software Design with UML	PCC	3	0	0	3	3	40	60	100

THEORY WITH LAB COMPONENT											
5	22MA4152	Applied Statistics with R Programming and Queuing theory	BSC	2	0	2	3	4	50	50	100
6	22CS4251	Design and Analysis of Algorithms	PCC	3	0	2	4	4	50	50	100
PRACTICAL											
7	22CS4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22CS4002	Microprocessor and Microcontrollers Laboratory	PCC	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**	**1**	**12**	**23**	**28**	**480**	**420**	**900**

SEMESTER V (Credits – 22)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS5201	Theory Of Computation	PCC	3	1	0	4	4	40	60	100
2	22CS5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22CS53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22CS53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22CS53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22CS5252	Machine Learning	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22CS5001	Engineering Clinic	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	22CS6201	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	22CS63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4	22CS63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5	22CS64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22CS64XX	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	22CS6001	Project based Learning	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	22CS7201	Information storage and Management	PCC	3	0	0	3	3	40	60	100
2	22CS7202	Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22CS73XX	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	22CS7001	Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22CS7701	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	22CS8901	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	2	4	3	1	1	2	2	10	**25**
8	MC	✓	✓							
	Total	**18**	**23**	**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	22CS7401	E-Commerce	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 AIML	Vertical II Creative Media	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And AR / VR	Vertical VI Full Stack Development
22CS5301 Artificial Intelligence	**22CS5304** Multimedia Data Compression and Storage	**22CS5307** Principles of Cloud Computing	**22CS5310** Modern Cryptography and Network Security	**22CS5313** ComputerGraphics	**22CS5316** Web Technology
22CS5302 Big Data Analytics	**22CS5305** Multimedia and Animation	**22CS5308** Virtualization	**22CS5311** Ethical Hacking	**22CS5314** Image and video analytics	**22CS5317** Front End Development with REACT and TYPESCRIPT
22CS5303 Natural Language Processing	**22CS5306** Video Creation and Editing	**22CS5309** Cloud Computing Architecture & Deployment Models	**22CS5312** Digital and Mobile Forensics	**22CS5315** Game Programming	**22CS5318** Node JS
22CS6301 Soft Computing	**22CS6303** UI and UX Design	**22CS6305** Cloud Services Management	**22CS6307** Cyber forensics and information security	**22CS6309** Computer Vision	**22CS6311** Nosql Databases with Mongo DB
22CS6302 Quantum Computing	**22CS6304** Digital marketing	**22CS6306** Cloud Application Development	**22CS6308** Secured Network Protocols and Standards	**22CS6310** Introduction to Augmented Reality	**22CS6312** DevOps
22CS7301 Cognitive Science and Analytics	**22CS7302** Visual Effects	**22CS7303** Cloud Security	**22CS7304** Data privacy preservation	**22CS7305** Virtual Reality	**22CS7306** Web Application Security

Vertical I AIML

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5301**	Artificial Intelligence	PEC	3	0	0	3	3
2	**22CS5302**	Big Data Analytics	PEC	3	0	0	3	3
3	**22CS5303**	Natural Language Processing	PEC	3	0	0	3	3
4	**22CS6301**	Soft Computing	PEC	3	0	0	3	3
5	**22CS6302**	Quantum Computing	PEC	3	0	0	3	3
6	**22CS7301**	Cognitive Science and Analytics	PEC	3	0	0	3	3

Vertical II
Creative Media

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5304**	Multimedia Data Compression and Storage	PEC	3	0	0	3	3
2	**22CS5305**	Multimedia and Animation	PEC	3	0	0	3	3
3	**22CS5306**	Video Creation and Editing	PEC	3	0	0	3	3
4	**22CS6303**	UI and UX Design	PEC	3	0	0	3	3
5	**22CS6304**	Digital marketing	PEC	3	0	0	3	3
6	**22CS7302**	Visual Effects	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	**22CS5307**	Principles of Cloud Computing	PEC	3	0	0	3	3
2	**22CS5308**	Virtualization	PEC	3	0	0	3	3

3	**22CS5309**	Cloud Computing Architecture & Deployment Models	PEC	3	0	0	3	3
4	**22CS6305**	Cloud Services Managment	PEC	3	0	0	3	3
5	**22CS6306**	Cloud Application Development	PEC	3	0	0	3	3
6	**22CS7303**	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	**22CS5310**	Modern Cryptography and Network Security	PEC	3	0	0	3	3
2	**22CS5311**	Ethical Hacking	PEC	3	0	0	3	3
3	**22CS5312**	Digital and Mobile Forensics	PEC	3	0	0	3	3
4	**22CS6307**	Cyber forensics and information security	PEC	3	0	0	3	3
5	**22CS6308**	Secured Network Protocols and Standards	PEC	3	0	0	3	3
6	**22CS7304**	Data privacy preservation	PEC	3	0	0	3	3

Vertical V

COMPUTER VISION AND VIRTUAL REALITY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5313**	Computer Graphics	PEC	3	0	0	3	3
2	**22CS5314**	Image and video analytics	PEC	3	0	0	3	3
3	**22CS5315**	Game Programming	PEC	3	0	0	3	3
4	**22CS6309**	Computer Vision	PEC	3	0	0	3	3
5	**22CS6310**	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	**22CS7305**	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	**22CS5316**	Web Technology	PEC	3	0	0	3	3
2	**22CS5317**	Front End Development with REACT and TYPESCRIPT	PEC	3	0	0	3	3
3	**22CS5318**	Node JS	PEC	3	0	0	3	3
4	**22CS6311**	Nosql Databases with Mongo DB	PEC	3	0	0	3	3
5	**22CS6312**	DevOps	PEC	3	0	0	3	3
6	**22CS7306**	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.

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2	22CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3	22CS6602	Sem6: Introduction to Internet Of Things	MDC	3	0	0	3	3
4	22CS7601	Sem 7: Introduction to Machine Learning	MDC	3	0	0	3	3

5	22CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6	22CS8601	Sem 8: Data Analytics	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	22CS5601	Financial Management	MDC	3	0	0	3	3
2	22XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	22XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22XXXX	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	22BA5601	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22BA6601	Introduction to Business Venture	MDC	3	0	0	3	3
3	22 BA6602	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	22 BA7601	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	22 BA7602	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	22 BA8601	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	22BA8602	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	22XXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22XXXX	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22XXXX	Green Technology	MDC	3	0	0	3	3
6	22XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING

Vertical I IOT	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III DATASCIENCE
22CS5204 Fundamentals Of IOT	22CS5205 Public Key Infrastructure and Trust Management	22CS5206 Data warehouse and Mining
22CS6203 IoT Design	22CS6205 Introduction to block chain	22CS6207 Python for Data Science
22CS6204 Introduction Of Raspberry Pi and Arduino	22CS6206 Cryptocurrency	22CS6208 Exploratory Data Analysis and Time series
22CS7203 IoT for smart cities	22CS7205 Smart Contracts and Solidity	22CS7207 Information Retrieval
22CS7204 Internet Of Medical Things	22CS7206 Block chain and distributed ledger technology	22CS7208 Data Security
22CS8201 Iot Cloud and Data Analytics	22CS8202 Bitcoin Essentials and Use-Cases	22CS8203 Recommender Systems

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN IOT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5204	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	3
2	22CS6203	Sem 6: IoT Design	PC	3	0	0	3	3
3	22CS6204	Sem 6: Introduction Of Raspberry Pi and Arduino	PC	3	0	0	3	3
4	22CS7203	Sem 7: IoT for smart cities	PC	3	0	0	3	3
5	22CS7204	Sem 7: Internet Of Medical Things	PC	3	0	0	3	3
6	22CS8201	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3
6	22CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING
SPECIALIZATION IN DATA SCIENCE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5206	Sem 5: Data warehouse and Mining	PC	3	0	0	3	3
2	22CS6207	Sem 6: Python for Data Science	PC	3	0	0	3	3
3	22CS6208	Sem 6: Exploratory Data Analysis and Time series	PC	3	0	0	3	3
4	22CS7207	Sem 7: Information Retrieval	PC	3	0	0	3	3
5	22CS7208	Sem 7: Data Security	PC	3	0	0	3	3
6	22CS8203	Sem 8: Recommender Systems	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**

Chairman BoS **Dean Academics** **Principal**

Chairman - BoS
CSE - HiCET

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22MA3103	DISCRETE MATHEMATICS AND GRAPH THEORY	3	1	0	4

Course Objectives

1. Illustrate logical theory and proportional calculus techniques that will create logical thinking.
2. Generate counting problems using mathematical induction, inclusion and exclusion principles.
3. Examine the Boolean algebra which is used in the Boolean logics and circuits.
4. Describe the basic knowledge of graph theory which is applied in Computer networks.
5. Recognize the concepts of trees in computer engineering.

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	**GRAPHS** Graphs – introduction – types of graphs – matrix representation of graphs – paths, cycles connectivity – connectedness in undirected graphs – Euler and Hamiltonian graphs – connectedness in directed graphs.	12
V	**TREES** Trees – properties of trees –spanning tree – minimum spanning tree – Rooted and binary trees – properties of binary trees - spanning trees in a weighted graph.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Evaluate 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: Understand the knowledge about Lattices and Boolean Algebra.
CO4: Apply the properties of graphs and related discrete structures in computer networks.
CO5: Analyze the various types of trees and their properties.

TEXT BOOKS:

T1 - Discrete Mathematics with proof-Eric Gossett-2nd Edition 2018.
T2- Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, Delhi, 2016.

REFERENCE BOOKS :

R1 - T.Veerarajan, "Discrete Mathematics with Graph Theory and Combinatorics", Tata. McGraw-Hill Education, 15th reprint, 2012

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

R3 - Thomas Koshy., "Discrete Mathematics with Applications", Elsevier Publications,2010.

R4 - 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	2	2	2	3	1	-	-	-	-	-	-	2	2	2
CO2	2	3	3	3	1	-	-	-	-	-	-	2	3	2
CO3	3	2	3	2	1	-	-	-	-	-	-	2	2	3
CO4	3	2	3	3	1	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	3

Chairman, Board of Studies

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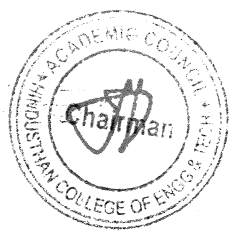

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3201	DATA STRUCTURES	3	0	0	3

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, splay tree and red black tree.
4. Understand the concepts of Sorting, Searching and Hashing techniques
5. Apply graph algorithms for solving real world problems

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF DATA STRUCTURES AND LINKED LIST** Introduction – Need for data structures – Types of data structures – List ADT-Single Linked List-Doubly Linked List-Circular Linked List- its operations.	9
II	**STACK AND QUEUE** 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
III	**TREES** Tree ADT-Binary Tree-Tree Traversal Algorithms-Search Tree: Binary Search Tree-AVL Tree- B+ trees- Priority Queues- Binary Heap	9
IV	**SEARCHING, SORTING AND HASHING** 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
V	**GRAPHS** 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	3	2	3	1	-	-	-	-	-	-	2	2	3
CO2	3	3	3	3	1	-	-	-	-	-	-	2	2	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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Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3202	OPERATING SYSTEMS	3	1	0	4

Course Objective

1. Study the basic concepts and Understand the structure of operating systems
2. Learn about Processes, Scheduling algorithms and Deadlocks.
3. Learn various memory management schemes.
4. Study I/O management and File systems.
5. Learn the Distributed operating systems

Unit	Description	Instructional Hours
I	**OPERATING SYSTEMS OVERVIEW** Computer System Overview - Basic Elements, Instruction Execution, Interrupts- operating systems overview- Evolution of Operating System.- Computer System Organization-Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot	12
II	**PROCESS MANAGEMENT** Processes-Process Concept, Process Scheduling, Interprocess Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Threads Overview, Multicore Programming, Multithreading Models. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; Deadlock-System model, Deadlock-Prevention, Avoidance and Recovery.	12
III	**STORAGE MANAGEMENT** Memory Hierarchy, Cache Memory, Main Memory-Swapping-Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory	12
IV	**FILE SYSTEM IMPLEMENTATION & MASS STORAGE STRUCTURE** Mass Storage Structure- Overview, Disk Structure, Disk Scheduling and Management; File System Interface- File Concepts, Access methods, Directory Structure, Organization and implementation, File System Structure - File System Implementation-, File Sharing and Protection; Allocation Methods, Free Space Management- I/O Systems.	12
V	**TYPES OF OPERATING SYSTEMS** Single processor systems – Multiprocessor Systems – Clustered Systems – Real Time Systems – Open source operating system- Distributed Systems –Distributed operating systems – Distributed file systems –Distributed Synchronization. Case study: Linux Systems Virtualization.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Design various Scheduling algorithms.
CO2: Design deadlock, prevention and avoidance algorithms.
CO3: Compare and contrast various memory management schemes.
CO4: Design and Implement a prototype file systems.
CO5: Study the distributed operating systems.

TEXT BOOKS:

T1: Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.

T2: Tom Adelstein, Bill Lubanovic , "Linux System Administration Solve Real-life Linux Problems Quickly", 2007, O'Reilly Media.

REFERENCE BOOKS:

R1: Andrew S. Tanenbaum, "Modern Operating Systems", 4/E, Pearson Publications, Paperback 2019.

R2: Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.

R3: D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Third Edition, TataMcGraw-Hill Education, 2017.

R4:William Stallings, "Operating Systems –Internals and Design Principles", 9/E, Pearson Publications, 2018.

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	3	1	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	1	-	-	-	-	-	-	2	2	2
CO5	2	3	2	2	1	-	-	-	-	-	-	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3251	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
I	**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 *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.*	12
II	**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.* ***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 interface.

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.

III *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.* 12

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

IV 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. 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 ***Programs:*** 12

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

Course Outcome

CO1: Apply Java based code for solving low complexity problems
CO2: Utilize Object Oriented Features in Java for solving medium complexity problems
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	2
CO2	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	3

Chairman, Board Of Studies **Dean-Academics**

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3203	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	3	0	0	3

Course Objective

1. To study combinational circuits.
2. To learn synchronous sequential circuits.
3. To understand the basic structure and operation of a digital computer.
4. To study the design of data path unit, control unit for processor and to familiarize with the hazards
5. To understand the concept of various memories and I/O interfacing.

Unit	Description	Instructional Hours
I	**COMBINATIONAL CIRCUITS** Circuits for arithmetic operations: adder: Half adder, Full adder, subtractor: Half subtractor, Fullsubtractor-BCD adder-Magnitude comparator-Encoders, Decoders-Multiplexers, Demultiplexers, Code converters: Binary to Gray, Gray to Binary	9
II	**SYNCHRONOUS SEQUENTIAL CIRCUITS** Flip flops: SR, JK, D,T - Design of synchronous sequential circuits: State diagram - State table – State minimization - State assignment. Shift registers: SISO,SIPO,PIPO,PISO –Counters: BCD, Up down counter.	9
III	**COMPUTER FUNDAMENTALS** Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.	9
IV	**PROCESSOR** Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.	9
V	**MEMORY AND I/O SYSTEMS** Memory Hierarchy - Memory Technologies – Cache Memory – Measuring and Improving Cache Performance – Virtual Memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus Structure – Bus Operation – Arbitration – Interface Circuits - USB	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Design various combinational digital circuits using logic gates
CO2: Design sequential circuits and analyze the design procedures
CO3: State the fundamentals of computer systems and analyze the execution of an instruction.
CO4: Explain the structure of processing architectures
CO5: Demonstrate knowledge about state-of-the-art I/O, memory , Interrupts and Interfaces

TEXT BOOKS:

T1 Morris Mano M. and Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL", V Edition, Pearson Education, 2013.**ISBN-13: 978-0-13-277420-8**

T2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

REFERENCE BOOKS :

R1-.S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design",FourthEdition, Vikas Publishing House Pvt. Ltd, New Delhi, 2012.**ISBN: 978-93-259-6041-1**

R2-.Thomas L. Floyd, "Digital Fundamentals", Pearson Education, Inc, New Delhi, 2013

R3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.

R4. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 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	-	-	-	-	-	-	2	2	2
CO2	2	3	3	3	1	-	-	-	-	-	-	2	2	3
CO3	3	3	3	2	1	-	-	-	-	-	-	2	3	2
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	2

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Programme	Course Code	Name of the Course	L	T	P	C
BE	22CS3003	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 Understand the concepts of Sorting, Searching and Hashing techniques
5. To Understand graph algorithms for solving real world problems

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, c) 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 **Write a C program to Implement Sorting Techniques**

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 **C)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.

Total Practical Hours: 60

Course Objective

1. Understand the methodical way of solving problem.
2. comprehend the different methods of organizing large amount of data.
3. Implement the different data structures.
4. Understand the concepts of Sorting, Searching and Hashing techniques
5. Understand graph algorithms for solving real world problems

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	2	2
CO2	3	3	3	3	1	-	-	-	-	-	-	2	3	2
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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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3001	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION LABORATORY	0	0	4	2

Course Objective

1. To study combinational circuits.
2. To learn synchronous sequential circuits.
3. To understand the basic structure and operation of a digital computer.
4. To study the design of data path unit, control unit for processor and to familiarize with the hazards
5. To understand the concept of various memories and I/O interfacing.

S. No.	Description of the Experiments
1	Verification of Boolean theorems using logic gates.
2	Design and implementation of combinational circuits using gates for arbitrary functions.
3	Experimental Design and implementation of Half Adder & Half Subtractor.
4	Experimental Design and implementation of Binary to Gray and Gray to Binary Conversion.
5	Implementation of BCD adder, encoder and decoder circuits
6	Experimental Design and implementation of Multiplexers
7	Experimental Design and implementation of Demultiplexers
8	Implementation of the synchronous counters
9	Experimental Design and implementation of Asynchronous Counters
10	Implementation of a Universal Shift register.

Total Practical Hours: 60

Course Outcome

CO1: Design various combinational digital circuits using logic gates
CO2: Design sequential circuits and analyze the design procedures
CO3: State the fundamentals of computer systems and analyze the execution of an instruction.
CO4: Explain the structure of processing architectures
CO5: Demonstrate knowledge about state-of-the-art I/O, memory , Interrupts and Interfaces

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	2	3
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	3
Avg	3	3	2.6	2.6	1	-	-	-	-	-	-	2	2.8	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS3002	OPERATING SYSTEMS LABORATORY	0	0	4	2

Course Objective

1. Introduce the key role of an Linux Operating system
2. Insist the File system Management of an Linux Operating system
3. Emphasize the importance of local Linux users and groups in Linux Operating system
4. Insist the Storage Management of a Linux operation System
5. Learn about Installing and updating software packages in Linux Operating system

S. No.	Description of the Experiments
1	Basic Linux commands
2	Manage files from the command lines
3	Getting help in Red Hat Enterprise Linux
4	Creating, viewing and editing text files
5	Managing local Linux users and groups
6	Controlling access to files with Linux file systems
7	Managing Red hat Enterprise Linux networking
8	Archiving and copying files between systems
9	Installing and updating software packages
10	Scheduling future Linux tasks

Total Practical Hours: 60

Course Outcome

CO1:	Identify the need of an Linux Operating system
CO2:	Know the Manage files of an Linux Operating system
CO3:	Understand the need of local Linux users and groups in Linux Operating system
CO4:	Know the Storage management method of a Linux Operating system
CO5:	Understand the Installation and updation of software packages in Linux Operating system

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	2
CO2	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	3
Avg	3	3	2.6	2.6	1	-	-	-	-	-	-	2	2.8	2.8

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

1: A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali

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

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

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

5: Word Power Made Easy by Norman Lewis

:6 Six weeks to words of power by Wilfred Funk

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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.E. COMPUTER SCIENCE AND ENGINEERING

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the ODD semester

Academic year 2024-2025

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (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	22CS1151 / 22CS1152	Problem solving using C Programming/ Object Oriented Programming using Python	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	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	தமிழரும் தொழில் நுட்பமும் / Indian Constitution	MC	2	0	0	0	2	100	0	100
			TOTAL	**16**	**1**	**8**	**19**	**26**	**480**	**320**	**800**

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											
3	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
4	22PH2151	Physics For Circuit Engineering Programme	BSC	2	0	2	3	4	50	50	100
5	22IT2251 / 22CS2253	Python programming and Practices / Java Fundamentals	PCC	2	0	2	3	4	50	50	100
6	22IT2253	Dynamic Web Design	PCC	2	0	2	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 -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	22MA3103	Discrete Mathematics and Graph Theory	BSC	3	1	0	4	4	40	60	100
2	22CS3201	Data Structures	PCC	3	0	0	3	4	40	60	100
3	22CS3202	Operating Systems	PCC	3	1	0	4	4	40	60	100
4	22CS3203	Digital Principles And Computer Organization	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5	22CS3251/ 22CS3253	Object Oriented Programming Using Java / Clean Coding and Devops	PCC	3	0	2	4	4	50	50	100
PRACTICAL											
6	22CS3001	Digital Principles And Computer Organization Laboratory	ESC	0	0	4	2	4	60	40	100
7	22CS3002	Operating Systems Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8	22HE3071	Soft Skills And Aptitude -II	SEC	1	0	0	1	1	100	0	100
9	22CS3003	Data Structures Laboratory	AEC	0	0	4	2	4	60	40	100
MANDATORY COURSE											
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	22CS4201	Database Management Systems	PCC	3	0	0	3	3	40	60	100
3	22CS4202/ 22CS4204	Microprocessor and Microcontrollers / Data Visualization	PCC	3	0	0	3	3	40	60	100
4	22CS4203	Software Design with UML	PCC	3	0	0	3	3	40	60	100

THEORY WITH LAB COMPONENT											
5	22MA4152	Applied Statistics with R Programming and Queuing theory	BSC	2	0	2	3	4	50	50	100
6	22CS4251	Design and Analysis of Algorithms	PCC	3	0	2	4	4	50	50	100
PRACTICAL											
7	22CS4001	Database Management Systems Laboratory	PCC	0	0	4	2	4	60	40	100
8	22CS4002/ 22CS4003	Microprocessor and Microcontrollers Laboratory / Data Visualization Lab	PCC	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**	**1**	**12**	**23**	**28**	**480**	**420**	**900**

SEMESTER V (Credits – 22)											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22CS5201	Theory Of Computation	PCC	3	1	0	4	4	40	60	100
2	22CS5202	Computer Networks	PCC	3	0	0	3	3	40	60	100
3	22CS53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22CS53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22CS53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22CS5252 /22CS5251	Machine Learning/ Introduction to Design Thinking	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22CS5001	Engineering Clinic	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	22CS6201	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	22CS63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4	22CS63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5	22CS64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22CS64XX	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	22CS6001	Project Based Learning	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	22CS7201	Data science and Analytics	PCC	3	0	0	3	3	40	60	100
2	22CS7202	Neural Networks and Deep Learning	PCC	3	1	0	4	4	40	60	100
3	22CS73XX	Professional Elective-6 / AI Analyst	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	22CS7001	Neural Networks and Deep Learning Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22CS7701	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	22CS8901	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 Agricultureand 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 forthe 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

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
3	22CS7401	E-Commerce	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 AIML	Vertical II Creative Media	Vertical III CLOUD COMPUTING	Vertical IV Cyber Security and Data Privacy	Vertical V Computer Vision And AR / VR	Vertical VI Full Stack Development
22CS5301 Artificial Intelligence	**22CS5304** Multimedia Data Compression and Storage	**22CS5307** Principles of Cloud Computing	**22CS5310** Modern Cryptography and Network Security	**22CS5313** Computer Graphics	**22CS5316** Web Technology
22CS5302 Big Data Analytics	**22CS5305** Multimedia and Animation	**22CS5308** Virtualization	**22CS5311** Ethical Hacking	**22CS5314** Image and video analytics	**22CS5317** Front End Development with REACT and TYPESCRIPT
22CS5303 Natural Language Processing	**22CS5306** Video Creation and Editing	**22CS5309** Cloud Computing Architecture & Deployment Models	**22CS5312** Digital and Mobile Forensics	**22CS5315** Game Programming	**22CS5318** Node JS
22CS6301 Soft Computing	**22CS6303** UI and UX Design	**22CS6305** Cloud Services Management	**22CS6307** Cyber forensics and information security	**22CS6309** Computer Vision	**22CS6311** Nosql Databases with Mongo DB
22CS6302 Quantum Computing	**22CS6304** Digital marketing	**22CS6306** Cloud Application Development	**22CS6308** Secured Network Protocols and Standards	**22CS6310** Introduction to Augmented Reality	**22CS6312** DevOps
22CS7301 Cognitive Science and Analytics	**22CS7302** Visual Effects	**22CS7303** Cloud Security	**22CS7304** Data privacy preservation	**22CS7305** Virtual Reality	**22CS7306** Web Application Security

Note:

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

Vertical I
AIML

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5301**	Artificial Intelligence	PEC	3	0	0	3	3
2	**22CS5302**	Big Data Analytics	PEC	3	0	0	3	3
3	**22CS5303**	Natural Language Processing	PEC	3	0	0	3	3
4	**22CS6301**	Soft Computing	PEC	3	0	0	3	3
5	**22CS6302**	Quantum Computing	PEC	3	0	0	3	3
6	**22CS7301**	Cognitive Science and Analytics	PEC	3	0	0	3	3

Vertical II
Creative Media

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5304**	Multimedia Data Compression and Storage	PEC	3	0	0	3	3
2	**22CS5305**	Multimedia and Animation	PEC	3	0	0	3	3
3	**22CS5306**	Video Creation and Editing	PEC	3	0	0	3	3
4	**22CS6303**	UI and UX Design	PEC	3	0	0	3	3
5	**22CS6304**	Digital marketing	PEC	3	0	0	3	3
6	**22CS7302**	Visual Effects	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	**22CS5307**	Principles of Cloud Computing	PEC	3	0	0	3	3
2	**22CS5308**	Virtualization	PEC	3	0	0	3	3

3	**22CS5309**	Cloud Computing Architecture & Deployment Models	PEC	3	0	0	3	3
4	**22CS6305**	Cloud Services Managment	PEC	3	0	0	3	3
5	**22CS6306**	Cloud Application Development	PEC	3	0	0	3	3
6	**22CS7303**	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	**22CS5310**	Modern Cryptography and Network Security	PEC	3	0	0	3	3
2	**22CS5311**	Ethical Hacking	PEC	3	0	0	3	3
3	**22CS5312**	Digital and Mobile Forensics	PEC	3	0	0	3	3
4	**22CS6307**	Cyber forensics and information security	PEC	3	0	0	3	3
5	**22CS6308**	Secured Network Protocols and Standards	PEC	3	0	0	3	3
6	**22CS7304**	Data privacy preservation	PEC	3	0	0	3	3

Vertical V

COMPUTER VISION AND VIRTUAL REALITY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	**22CS5313**	Computer Graphics	PEC	3	0	0	3	3
2	**22CS5314**	Image and video analytics	PEC	3	0	0	3	3
3	**22CS5315**	Game Programming	PEC	3	0	0	3	3
4	**22CS6309**	Computer Vision	PEC	3	0	0	3	3
5	**22CS6310**	Introduction to Augmented Reality	PEC	3	0	0	3	3
6	**22CS7305**	Virtual Reality	PEC	3	0	0	3	3

Vertical VI

Full Stack Development

S	Course	Course Title	Category	Periods Per	Total	Credits

No	Code			week			Contact Periods	
				L	T	P		
1	**22CS5316**	Web Technology	PEC	3	0	0	3	3
2	**22CS5317**	Front End Development with REACT and TYPESCRIPT	PEC	3	0	0	3	3
3	**22CS5318**	Node JS	PEC	3	0	0	3	3
4	**22CS6311**	Nosql Databases with Mongo DB	PEC	3	0	0	3	3
5	**22CS6312**	DevOps	PEC	3	0	0	3	3
6	**22CS7306**	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.

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2	22CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3	22CS6602	Sem6: Introduction to Internet Of Things	MDC	3	0	0	3	3
4	22CS7601	Sem 7: Introduction to Machine Learning	MDC	3	0	0	3	3

5	22CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6	22CS8601	Sem 8: Data Analytics	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	22CS5601	Financial Management	MDC	3	0	0	3	3
2	22XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	22XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22XXXX	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	22BA5601	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22BA6601	Introduction to Business Venture	MDC	3	0	0	3	3
3	22 BA6602	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	22 BA7601	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	22 BA7602	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	22 BA8601	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	22BA8602	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	22XXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22XXXX	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22XXXX	Green Technology	MDC	3	0	0	3	3
6	22XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING

Vertical I IOT	Vertical II BLOCK CHAIN TECHNOLOGY	Vertical III DATASCIENCE
22CS5204 Fundamentals Of IOT	22CS5205 Public Key Infrastructure and Trust Management	22CS5206 Data warehouse and Mining
22CS6203 IoT Design	22CS6205 Introduction to block chain	22CS6207 Python for Data Science
22CS6204 Introduction Of Raspberry Pi and Arduino	22CS6206 Cryptocurrency	22CS6208 Exploratory Data Analysis and Time series
22CS7203 IoT for smart cities	22CS7205 Smart Contracts and Solidity	22CS7207 Information Retrieval
22CS7204 Internet Of Medical Things	22CS7206 Block chain and distributed ledger technology	22CS7208 Data Security
22CS8201 Iot Cloud and Data Analytics	22CS8202 Bitcoin Essentials and Use-Cases	22CS8203 Recommender Systems

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN IOT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5204	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	3
2	22CS6203	Sem 6: IoT Design	PC	3	0	0	3	3
3	22CS6204	Sem 6: Introduction Of Raspberry Pi and Arduino	PC	3	0	0	3	3
4	22CS7203	Sem 7: IoT for smart cities	PC	3	0	0	3	3
5	22CS7204	Sem 7: Internet Of Medical Things	PC	3	0	0	3	3
6	22CS8201	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING SPECIALIZATION IN BLOCK CHAIN TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5205	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3
2	22CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3
3	22CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3
4	22CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3
5	22CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3
6	22CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3

B.E (HONS) COMPUTER SCIENCE AND ENGINEERING
SPECIALIZATION IN DATA SCIENCE

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5206	Sem 5: Data warehouse and Mining	PC	3	0	0	3	3
2	22CS6207	Sem 6: Python for Data Science	PC	3	0	0	3	3
3	22CS6208	Sem 6: Exploratory Data Analysis and Time series	PC	3	0	0	3	3
4	22CS7207	Sem 7: Information Retrieval	PC	3	0	0	3	3
5	22CS7208	Sem 7: Data Security	PC	3	0	0	3	3
6	22CS8203	Sem 8: Recommender Systems	PC	3	0	0	3	3

ICC COURSE

ICC. No.	Sem. No	Course Code	Name of the Course	L	T	P	C	CIA	ESE	TOTAL
ICC1	I	22CS1152	Object oriented programming using Python	2	0	2	3	50	50	100
ICC2	II	22CS2253	Java Fundamentals	2	0	2	3	50	50	100
ICC3	III	22CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	22CS4204	Data Visualization	3	0	0	3	40	60	100
ICC5	IV	22CS4003	Data Visualization Laboratory	0	0	3	1.5	60	40	100
ICC6	V	22CS5251	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	22CS62XX	Predictive Modeling	3	0	2	4	40	60	100
ICC8	VI	22CS6314	Development of Machine Learning models	3	0	0	3	40	60	100
ICC9	VII	22CS7307	AI Analyst	3	0	0	3	40	60	100

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

Dean Academics

Principal

Chairman - BoS
CSE - HiCET

Dean (Academics)
HiCET

Programme	CourseCode	Name of the Course	L	T	P	C
B. E.	22CS5202	COMPUTER NETWORKS	3	0	0	3

Course Objective

1. To understand the basic concepts of networks
2. To understand the Data Communication System and the purpose of Layered Architecture.
3. To analyze the concepts of Routing Methods and Sub-netting.
4. To learn the functions of Network Layer and the various Routing Protocols.
5. To familiarize the functions and Protocols of the Transport Layer.

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
Total Instructional Hours		**45**

Course Outcome

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

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

Chairman - BoS
CSE - HiCET

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS5201	THEORY OF COMPUTATION	3	1	0	4

Course Objective

1. To understand the basic concepts of automata theory and finite automaton
2. To extend the concepts of automata theory in regular languages and expressions
3. To study about context free grammars and the normalizations of CFG
4. To learn the essence of push down automata with stack presentations and modeling turing machines
5. To discover the knowledge in decidability and tractability and to study the complexity classes

Unit	Description	Instructional Hours
I	**Automata Theory** Introduction-Need of automata theory-Formal proof- Additional Forms of Proof-Inductive Proofs-Central Concepts of Automata Theory-DFA and NDFA-Finite Automaton with Є-Transitions-Equivalence of DFA and NFA-Applications of Finite Automata.	12
II	**Regular Expressions** Regular Languages-Regular Expressions-Equivalence of finite Automaton and regular expressions-Minimization of DFA-Closure Properties and Decision Properties of Regular Languages-Problems based on Pumping Lemma-Applications of Regular Expressions.	12
III	**Context Free Grammars** Chomsky hierarchy of languages-Context-Free Grammar (CFG)-Parse Trees- Ambiguity in grammars and languages-Normal forms for CFG-Chomsky Normal Form (CNF)-Greibach Normal Form (GNF)-Pumping Lemma for Context Free Language (CFL)-Applications of Context Free Grammar.	12
IV	**PushDown Automata and Turing Machines** Definition of the Pushdown automata-Types of PDA-Languages of a Pushdown Automata - Equivalence of Pushdown automata and CFG-Definitions of Turing machines-Models-Computable languages and functions-Techniques for Turing machine construction-Multi head and Multi tape Turing Machines.	12
V	**Undecidability** The Halting problem – Partial Solvability- Undecidability- Decidable and undecidable problems- Basic Definition and properties of Recursive (RL) and Recursively enumerable (REL) languages. Intractable Problems- the Class P and NP-Introduction to NP-Hardness and NP-Completeness	12
	Total Instructional Hours	**60**

Course Outcome

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

TEXT BOOKS:

T1: Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", ThirdEdition, Pearson Education, 2016.

T2: John C Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, Tata McGraw Hill Publishing Company, New Delhi, 2011.

REFERENCE BOOKS:

R1: Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", Third

Edition, Prentice Hall of India, 2016.

R2: Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation", Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2015.

R3: Peter Linz, "An Introduction to Formal Language and Automata", Sixth Edition, Jones & Bartlett Learning, 2016.

R4: Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education 2009

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	3	-	2	2	3	2	2	2
CO2	3	3	2	3	2	2	3	2	2	2	3	2	3	3
CO3	3	3	3	2	3	2	3	-	2	2	3	2	3	3
CO4	1	2	2	2	3	2	1	1	2	2	1	2	3	3
CO5	3	1	1	2	3	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.E.	22CS5252	MACHINE LEARNING	2	0	2	3

Course Objectives	**The learner should made** 1. To equip foundational knowledge and practical skills needed to understand, implement, and evaluate various machine learning algorithms. 2. To understand and build supervised learning models 3. To learn about artificial neural networks (ANN), including their biological motivation, architecture, and learning algorithms, with a focus on practical implementation using the perceptron and backpropagation. 4. To understand and build unsupervised learning models. 5. To learn different aspects of reinforcement learning model

Unit	Description	Instructional Hours
I	**Introduction** Need for Machine Learning, ML is the future & Applications - Machine Learning works -Difference between ML Vs AI Vs Deep Learning- Machine Learning Categories - Supervised Learning, Unsupervised Learning, Reinforcement Learning-Hypothesis spaces and inductive bias, Evaluation- Training and test sets, cross validation, Concept of over fitting, Bias and Variance ***Illustrative Programs:*** ***1a) Implementation of Python basic libraries such as Math, Numpy and Scipy*** ***1b) Implementation of Python libraries for ML application such as Pandas and Matplotlib*** ***1c) Creation and loading different datasets in python.*** ***2) Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.***	6+3
II	**Supervised Learning – I (Regression/Classification)** **Linear Regression:** Introduction, Linear regression, Simple and Multiple Linear regression, Bayesian Linear regression, Gradient Descent **Classification models**: Decision Trees, Naive Bayes, K-Nearest-Neighbours (KNN), Logistic Regression, Support Vector Machines (SVM) - Nonlinearity ***Illustrative Programs:*** ***1. Create a training dataset using SVM, implement decision boundary using SVM*** ***2. 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+4
III	**Supervised Learning – II (Neural Networks)** Neural Network Representation – Problems – Perceptrons , Activation Functions **Artificial Neural Networks:** Introduction, Biological motivation, ANN representation, appropriate problem for ANN learning, Perceptron, multilayer networks and the back propagation algorithm	9

IV	**Ensemble Techniques And Unsupervised Learning** **Ensemble Learning** - bagging, boosting, Random forest. **Unsupervised learning**: **Clustering:** Introduction, K-mean clustering, K-Modes , agglomerative hierarchical clustering **Instance based Learning:** K nearest neighbour (KNN) ***Illustrative Programs:*** ***1. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.*** ***2. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem***	6+4
V	**Reinforcement Learning (RL)** Basics of RL – RL Framework – Markov Decision Process- Q learning - The Q function - Algorithm for Q learning -Case Study: Implementation of Q learning algorithm/reinforcement learning for problems in automotive domain/games.	7
	Total Instructional Hours	**45**

Course Outcomes		
	At the end of the course, the learner will be able to	
	CO1	Understand and outline problems for each type of machine learning
	CO2	Apply Naïve Bayes, logistic regression, and support vector machine models with various kernel functions to address and solve classification challenges.
	CO3	Design, train, and optimize artificial neural networks, including perceptrons and multilayer networks, using backpropagation for various problem-solving applications.
	CO4	Apply ensemble methods like bagging, boosting, and random forests, and perform clustering using k-means and agglomerative hierarchical approaches to analyze and interpret data.
	CO5	Design and implement Reinforcement Learning model

TEXT BOOKS:

T1 - Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997
T2 - Alpaydin, Ethem. Introduction to machine learning. MIT press, 2020
T3 - Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERENCES:

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

WEB RESOURCES:

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

	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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Programme	Course Code	Course Title	L	T	P	C
BE	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 – CSE

Programme	Course Code	Name of the Course	L	T	P	C
BE	22CS5301	ARTIFICIAL INTELLIGENCE	3	0	0	3

Course Objective

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

Unit	Description	Instructional Hours
I	**INTRODUCTION TO ARTIFICIAL INTELLIGENC** Introduction–Definition – The Foundations of Artificial Intelligence - The History of Artificial Intelligence - Future of Artificial Intelligence – Agents and Environments - Good Behavior: The Concept of Rationality - The Nature of Environments - The Structure of Agents.	9
II	**SOLVING PROBLEMS BY SEARCHING** Problem - Solving Agents - Example Problems - Searching for Solutions - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Heuristic Functions. BEYOND CLASSICAL SEARCH: Local Search Algorithms and Optimization Problems - Local Searching Continuous Spaces - Searching with Non-deterministic Actions - Searching with Partial Observations. ADVERSARIAL SEARCH: Stochastic Games.	9
III	**KNOWLEDGE AND REASONING** Knowledge - Based Agents - The Wumpus World - Logic -Propositional Logic: A Very Simple Logic - Propositional Theorem Proving - Effective Propositional Model Checking - Agents Based on Propositional Logic. **FIRST ORDER LOGIC:** Representation Revisited - Syntax and Semantics of First - Order Logic - Using First - Order Logic - Knowledge Engineering in First - Order Logic.	9
IV	**PLANNING AND ACTING IN THE REAL WORLD** Time, Schedules, and Resources - Hierarchical Planning -Planning and Acting in Non-deterministic Domains - Multi-agent Planning. **KNOWLEDGE REPRESENTATION:** Ontological Engineering - Categories and Objects - Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information - The Internet Shopping World.	9
V	**APPLICATIONS** AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware –Perception – Planning – Moving	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the various characteristics of Intelligent agents
CO2: Learn the different search strategies in AI
CO3: Learn to represent knowledge in solving AI problems
CO4: Understand the different ways of designing software agents
CO5: Learn about the various applications of AI.

TEXT BOOKS:

T1: S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approachǁ, Prentice Hall, Third Edition, 2009.

T2: I. Bratko, —Prolog: Programming for Artificial Intelligenceǁ, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCE BOOKS:

R1: M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008

R2: Nils J. Nilsson, —The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.

R3: William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.

R4: Gerhard Weiss, —Multi Agent Systems‖, Second Edition, MIT Press, 2013.

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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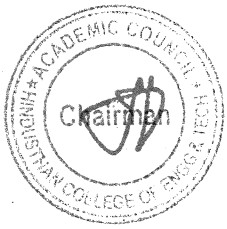

Programme	Course Code	Name of the Course	L	T	P	C
B. E.	22CS5302	BIG DATA ANALYTICS	3	0	0	3

Course Objective

1. To understand big data.
2. To learn and use NoSQL big data management..
3. To learn mapreduce analytics using Hadoop and related tools.
4. To work with map reduce applications.
5. To understand the usage of Hadoop related tools for Big Data Analytics

Unit	Description	Instructional Hours
I	**INTRODUCTION TO BIG DATA** Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.	9
II	**NOSQL DATA MANAGEMENT** Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients	9
III	**MAP REDUCE APPLICATIONS** MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – Map Reduce types – input formats – output formats.	9
IV	**BASICS OF HADOOP** Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.	9
V	**HADOOP RELATED TOOLS** Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.Case Study: Open Souce Tools-Stats IQ-Atlas.ti-Couch DB.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Describe big data and use cases from selected business domains.
CO2: Explain NoSQL big data management.
CO3: Install, configure, and run Hadoop and HDFS.
CO4: Perform map-reduce analytics using Hadoop
CO5: Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

TEXT BOOKS:

T1: Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013

T2: Eric Sammer, "Hadoop Operations", O'Reilley, 2012

T3: Sadalage, Pramod J. "NoSQL distilled", 2013

REFERENCE BOOKS:

R1: E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
R2: Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
R3: Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010

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	2	-	2	2
CO2	3	3	2	3	3	-	-	-	1	3	1	2	2	2
CO3	3	3	3	2	3	-	-	-	1	3	2	1	2	2
CO4	3	3	3	2	2	-	-	-	1	3	3	2	2	-
CO5	3	3	3	2	2	-	-	-	1	3	1	1	2	2

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Programme	Course Code	Name of the Course	L	T	P	C
B. E.	22CS5303	NATURAL LANGUAGE PROCESSING	3	0	0	3

Course Objective

1.To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology.
2.Tolerate mathematical foundations, Probability theory with Linguistic essentials such as syntactic and semantic analysis of text.
3.To apply the Statistical learning methods and cutting-edge research models from deep learning.
4.To Create CORPUS linguistics based on digestive approach (Text Corpus method)
5.To check the syntax and semantic used in NLP.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO NLP** Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is Difficult- Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory : Entropy, perplexity, The relation to language, Cross entropy	9
II	**TEXT PREPROCESSING AND MORPHOLOGY** Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.	9
III	**LANGUAGE MODELLING** Words: Collocations- Frequency-Mean and Variance –Hypothesis testing: The t test, Hypothesis testing of differences, Pearson's chi-square test, Likelihood ratios. Statistical Inference: n –gram Models over Sparse Data: Bins: Forming Equivalence Classes- N gram model - Statistical Estimators- Combining Estimators	9
IV	**WORD SENSE DISAMBIGUATION** Methodological Preliminaries, Supervised Disambiguation: Bayesian classification, An information- theoretic approach, Dictionary-Based Disambiguation: Disambiguation based on sense, Thesaurus-based disambiguation, Disambiguation based on translations in a second-language corpus.	9
V	**SYNTAX AND SEMANTICS** Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, WordNet, Thematic Roles, Semantic Role Labelling with CRFs. Statistical Alignment and Machine Translation, Text alignment, Word alignment, Information extraction, Text mining, Information Retrieval, NL interfaces, Sentimental Analysis, Question Answering Systems, Social network analysis. Case Study: Recent Trends in NLP-Chat GPT- Chat GPT Tools: Descript, HeyGen, Vidyo.ai, mid journey.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.
CO2: Realize semantics and pragmatics of English language for text processing
CO3: Create CORPUS linguistics based on digestive approach (Text Corpus method) and Check a current methods for statistical approaches to machine translation.
CO4: Develop a Statistical Methods for Real World Applications and explore deep learning based NLP.
CO5: Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology.

TEXT BOOKS:

T1: Christopher D. Manning and Hinrich Schutze, " Foundations of Natural Language Processing" , 6th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003

T2: Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2009.

REFERENCE BOOKS:

R1: NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010.

R2: James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012.

R3: Chris Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing",2nd edition, MITPress Cambridge, MA, 2003.

R4: Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action"MANNING Publications, 2019.

R5: Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2012

R6: Rajesh Arumugam, Rajalingappa Shanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application". PACKT publisher, 2018.

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	1	2	-	-	-	-	-	-	2	-	2	1
CO2	3	3	2	3	3	-	-	-	1	-	1	2	2	2
CO3	3	3	3	2	3	-	-	-	1	-	2	1	3	2
CO4	3	3	3	2	2	-	-	-	1	-	3	2	2	3
CO5	3	3	3	2	2	-	-	-	1	-	1	-	1	2

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS5304	Multimedia Data Compression and Storage	3	0	0	3

Course Objective

1. To understand the basics of compression techniques
2. To understand the categories of compression for text, image and video.
3. To explore the modalities of text, image and video compression algorithms
4. To know about basics of consistency of data availability in storage devices
5. To understand the concepts of data streaming services

Unit	Description	Instructional Hours
I	**BASICS OF DATA COMPRESSION** Introduction —Lossless and LossyCompression– Basics of Huffmann coding-Arithmetic codingDictionary techniques- Context based compression – Applications	9
II	**IMAGE COMPRESSION** Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages –Progressive Image Transmission – Lossless Image compression formats – Applications – Facsimile encoding.	9
III	**VIDEO COMPRESSION** Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2-H.263.	9
IV	**DATA PLACEMENT ON DISKS** Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system	9
V	**DISK SCHEDULING METHODS** Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: : Understand the basics of text, Image and Video compression

CO2 - Understand the various compression algorithms for multimedia content

CO3: Explore the applications of various compression techniques

CO4: Explore knowledge on multimedia storage on disks

CO5: Understand scheduling methods for request streams.

TEXT BOOKS:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in Multimedia Information and Systems, 2018, 5th Edition

2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

REFERENCE BOOKS::

1. . David Salomon, A concise introduction to data compression, 2008
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series, 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	-	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.E	22CS5305	MULTIMEDIA AND ANIMATION	3	0	0	3

Course Objective

1. To grasp the fundamental knowledge of Multimedia elements and systems
2. To get familiar with Multimedia file formats and standards.
3. To learn the process of Authoring multimedia presentations
4. To learn the techniques of animation in 2D and 3D and for the mobile UI
5. To explore different popular applications of multimedia

Unit	Description	Instructional Hours
I	**INTRODUCTION TO MULTIMEDIA** Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems,challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.	9
II	**MULTIMEDIA FILE FORMATS AND STANDARDS** File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.	9
III	**MULTIMEDIA AUTHORING** Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools,Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools,audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning,simulations	9
IV	**ANIMATION** Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.	9
V	**MULTIMEDIA APPLICATIONS** Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Get the bigger picture of the context of Multimedia and its applications
CO2: Use the different types of media elements of different formats on content pages
CO3: Author 2D and 3D creative and interactive presentations for different target multimedia applications.
CO4: Use different standard animation techniques for 2D, 21/2 D, 3D applications
CO5: Understand the complexity of multimedia applications in the context of cloud, security,bigdata streaming, social networking, CBIR etc.

TEXT BOOKS:

T1 Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

T2 John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.

T3 Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018

REFERENCE BOOKS:

R1: Prabhat K.Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1 st Edition, 2015

R2: Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1 st Edition, 2021

WEB REFERENCES:

1. https://itsfoss.com/

2. https://www.ucl.ac.uk/slade/know/3396

3. https://developer.android.com/training/animation/overview

4. https://developer.android.com/training/animation/overview (UNIT-IV)

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.E	22CS5306	VIDEO CREATION AND EDITING	3	0	0	3

Course Objective

1. To introduce the broad perspective of linear and nonlinear editing concepts.
2. To understand the concept of Storytelling styles.
3. To be familiar with audio and video recording. To apply different media tools.
4. To Explore about the advanced editing and training techniques
5. To learn and understand the concepts of AVID XPRESS DV 4.

Unit	Description	Instructional Hours
I	**FUNDAMENTALS** Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression – risks associated with altering reality through editing.	9
II	**STORYTELLING** Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.	9
III	**USING AUDIO AND VIDEO** Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.	9
IV	**WORKING WITH FINAL CUT PRO** Working with clips and the Viewer - working with sequences, the Timeline, and the canvas – Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques – Working with Audio - Using Media Tools - Viewing and Setting Preferences.	9
V	**WORKING WITH AVID XPRESS DV 4** Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage -Using Timeline and Working in Trim Mode - Working with Audio - Output Options.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Compare the strengths and limitations of Nonlinear editing
CO2: Identify the infrastructure and significance of storytelling.
CO3: Apply suitable methods for recording to CDs and VCDs.
CO4: Address the core issues of advanced editing and training techniques.
CO5: Design and develop projects using AVID XPRESS DV 4

TEXT BOOKS:

T1 Avid Xpress DV 4 User Guide, 2007.
T2 Final Cut Pro 6 User Manual, 2004

REFERENCE BOOKS:

R1: Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
R2: Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003.

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.E	22CS5307	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.E	22CS5308	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

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.E	22CS5309	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.E	22CS5310	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.E.	22CS5311	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.E	22CS5312	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.E	22CS5313	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.E.	22CS5314	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.E.	22CS5315	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.E	22CS5316	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.E	22CS5317	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**

Course Outcome	CO1:	Explore the fundamental concepts of React
	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.E	22CS5318	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
	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.E	22CS5251	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

Course Outcome

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"

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

Coimbatore - 641 032.

B.E. COMPUTER SCIENCE AND ENGINEERING

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CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the ODD semester

Academic year 2024-2025

(Academic Council Meeting Held on 21.6.2024)

CURRICULUM R2019 (Amendment)

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. COMPUTER SCIENCE AND ENGINEERING (UG)

REGULATION-2019

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

SEMESTER I – 20 Credits

S.No	Course Code	Name of the Course	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	21CS1151	Python Programming and Practices / ICC1	ES	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	21HE1071	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	21HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
10	21HE1072	Career Guidance – Level I	EEC	2	0	0	0	100	0	100
Total Credits				**16**	**2**	**10**	**20**	**580**	**320**	**900**

SEMESTER II – 22 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	BusinessEnglish 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	21CS2152	Essentials of C and C++ Programming / ICC2	ES	2	0	2	3	50	50	100
6	21ME2154	Engineering Graphics	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
8	21HE2071	Language Competency Enhancement Course - II	HS	0	0	2	1	100	0	100
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 – 20 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA3104	Discrete Mathematics and Graph Theory	BS	3	1	0	4	40	60	100
2	21CS3201	Data Structures	PC	3	0	0	3	40	60	100
3	21CS3202	Database Management Systems	PC	3	0	0	3	40	60	100
4	21CS3203	Computer Architecture	PC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
5	21CS3251	Digital Principles and System Design / ICC-3	PC	3	0	2	4	50	50	100
PRACTICAL										
6	21CS3001	Data Structures Laboratory	PC	0	0	3	1.5	60	40	100
7	21CS3002	Database Management Systems Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY										
8	21MC3191	Indian Constitution	MC	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**	**1**	**8**	**20**	**530**	**370**	**900**

SEMESTER IV – 21 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS4201	Java Programming / ICC4	PC	3	0	0	3	40	60	100
2	21CS4202	Software Engineering	PC	3	1	0	4	40	60	100
3	21CS4203R	Operating Systems	PC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
4	21MA4151	Probability, Statistics and Queuing Theory	BS	3	0	2	4	50	50	100
5	21CS4251	Design and Analysis of Algorithms	PC	3	0	2	4	50	50	100
PRACTICAL										
6	21CS4001	Java Programming Laboratory / ICC5	PC	0	0	3	1.5	60	40	100
7	21CS4002R	Operating Systems Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY										
8	21MC4191	Essence of Indian Traditional Knowledge	MC	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				**20**	**1**	**10**	**21**	**540**	**360**	**800**

SEMESTER V – 24 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS5201	Theory of Computing	PC	3	1	0	4	40	60	100
2	21CS5202	Computer Networks	PC	3	0	0	3	40	60	100
3	21EC5231	Principles of Microprocessors and Micro Controllers	PC	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
4	21CS5252	Object Oriented Analysis and Design / ICC6	PC	2	0	2	3	50	50	100
5	21CS5253	Data mining and warehousing	PC	2	0	2	3	50	50	100
6	21CS53**	Professional Elective I	PE	2	0	2	3	50	50	100
PRACTICAL										
7	21CS5001	Engineering Clinic	PC	0	0	3	1.5	60	40	100
8	21EC5031	Principles of Microprocessors and Micro-controllers Laboratory	PC	0	0	3	1.5	60	40	100
9	21HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	21HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
Total Credits				**18**	**1**	**10**	**24**	**580**	**420**	**1000**

SEMESTER VI – 24 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS6181	Principles of Management	HS	3	0	0	3	40	60	100
2	21CS6201	Artificial Intelligence / ICC7	PC	3	1	0	4	40	60	100
4	21**6401	Open Elective I	OE	3	0	0	3	40	60	100
5	21CS63**	Professional Elective II / ICC8	PE	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
6	21CS6251	Compiler Design	PC	2	0	3	3.5	50	50	100
7	21CS6252	Mobile Computing and Application Development	PC	2	0	2	3	50	50	100
PRACTICAL										
8	21IT6003	Project Based Learning	PC	0	0	3	1.5	50	50	100
9	HE6071	Soft Skill-II	EEC	1	0	0	1	100	0	100
10	HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
11	21CS6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
Total Credits				19	1	6	24	425	575	1000

SEMESTER VII – 20 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS7201	Cryptography and Network Security	PC	3	0	0	3	40	60	100
2	21CS7202	Cloud Computing	PC	3	0	0	3	40	60	100
3	21**7401	Open Elective II	OE	3	0	0	3	40	60	100

4	21CS73**	Professional Elective III / ICC9	PE	3	0	0	3	40	60	100
THEORY & LAB COMPONENT										
5	21CS7251	Machine Learning Techniques	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21CS7001	Cloud Computing Laboratory	PC	0	0	3	1.5	60	40	100
7	21CS7002	Security Laboratory	PC	0	0	3	1.5	60	40	100
8	21CS7901	Project Phase I	EEC	0	0	4	2	50	50	100
Total Credits				**14**	**0**	**12**	**20**	**380**	**420**	**800**

SEMESTER VIII – 14 Credits

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CS83**	Professional Elective IV	PE	3	0	0	3	40	60	100
2	21CS83**	Professional Elective V	PE	3	0	0	3	40	60	100
PRACTICAL										
3	21CS8901	Project Phase II	EEC	0	0	16	8	100	100	200
Total Credits				**6**	**0**	**16**	**14**	**180**	**220**	**400**

LIST OF PROFESSIONAL ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21CS5351	Internet and Web Technology	PE	2	0	2	3	50	50	100
2	21CS5352	Advanced Java Programming	PE	2	0	2	3	50	50	100
3	21CS5353	Fundamentals of Open Source Software	PE	2	0	2	3	50	50	100
4	21CS5354	R Programming	PE	2	0	2	3	50	50	100
5	21CS5355	Computer Graphics and Multimedia	PE	2	0	2	3	50	50	100

PROFESSIONAL ELECTIVE II

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS6301	Business Intelligence – Data Warehousing and Analytics	PE	3	0	0	3	40	60	100
2	21CS6302	Embedded Systems	PE	3	0	0	3	40	60	100
3	21CS6303	Internet of Things	PE	3	0	0	3	40	60	100
4	21CS6304	Big Data Analytics and Tools	PE	3	0	0	3	40	60	100
5	21CS6305	Soft Computing	PE	3	0	0	3	40	60	100
6	21IT6308	Web Development - I	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE III

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS7301	Multi-core Architecture and Programming	PE	3	0	0	3	40	60	100
2	21CS7302	Cyber Forensics	PE	3	0	0	3	40	60	100
3	21CS7303	Wireless Sensor Networks	PE	3	0	0	3	40	60	100
4	21CS7304	C# and .Net Programming	PE	3	0	0	3	40	60	100
5	21CS7305	Software Testing	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE IV

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS8301	Digital Image Processing	PE	3	0	0	3	40	60	100
2	21CS8302	High Speed Networks	PE	3	0	0	3	40	60	100
3	21CS8303	Information Security	PE	3	0	0	3	40	60	100
4	21CS8304	Human Computer Interaction	PE	3	0	0	3	40	60	100
5	21CS8305	Responsive Web Design	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE V

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21CS8306	Information Retrieval Techniques	PE	3	0	0	3	40	60	100
2	21CS8307	User Interface Design	PE	3	0	0	3	40	60	100
3	21CS8308	Visualization Techniques	PE	3	0	0	3	40	60	100
4	21CS8309	Deep Learning	PE	3	0	0	3	40	60	100
5	21CS8310	Block Chain Technology	PE	3	0	0	3	40	60	100

OPEN ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
OPEN ELECTIVE - I										
1	21CS6401	Introduction to Java Programming	OE	3	0	0	3	40	60	100
2	21CS6402	Green Computing	OE	3	0	0	3	40	60	100
OPEN ELECTIVE - II										
1	21CS7401	Foundation Skills in Information Technology (NASSCOM)	OE	3	0	0	3	40	60	100
2	21CS7402	Multimedia Systems	OE	3	0	0	3	40	60	100

➢ **Following are the Industry Core Courses (ICC) which will be offered as choice based course in the following semesters:**

ICC. No.	Sem. No	Course Code	Name of the Course	L	T	P	C	CIA	ESE	TOTAL
ICC1	I	21CS1152	Object oriented programming using Python	2	0	2	3	50	50	100
ICC2	II	21CS2153	Java Fundamentals	2	0	2	3	50	50	100
ICC3	III	21CS3253	Clean Coding and Devops	3	0	2	4	50	50	100
ICC4	IV	21CS4204	Data Visualization	3	0	0	3	40	60	100
ICC5	IV	21CS4003	Data Visualization Laboratory	0	0	3	1.5	60	40	100
ICC6	V	21CS5251	Introduction to Design Thinking	2	0	2	3	50	50	100
ICC7	VI	21CS6253	Predictive Modeling	3	0	2	4	40	60	100
ICC8	VI	21CS6306	Development of Machine Learning models	3	0	0	3	40	60	100
ICC9	VII	21CS7306	AI Analyst	3	0	0	3	40	60	100

Life Skill Courses									
S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	21LSZ401	General Studies for Competitive Examinations	3	0	0	3	40	60	100
2	21LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	40	60	100
3	21LSZ403	Indian Ethos and Human Values	3	0	0	3	40	60	100
4	21LSZ404	Indian Constitution and Political System	3	0	0	3	40	60	100
5	21LSZ405	Yoga for Human Excellence	3	0	0	3	40	60	100

(Note: Z stands for semester, students can't choose twice the course)

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 Consolidated Mark sheet as per the regulation. NCC course level 1 & Level 2 will be added in the open elective subject 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.

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

NCC COURSES

(Only for the students' who have opted NCC subjects in Semester I, II, III & IV are eligible)

1	21HEZ401	NCC course level 1	OE	3	0	0	3	40	60	100
2	21HEZ402	NCC course level 2	OE	3	0	0	3	40	60	100

Enrollment for B.E. / B. TECH. (HONORS) / 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. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), 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 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.
  Note: Each programme should provide verticals for minor degree

COMPUTER SCIENCE AND ENGINEERING OFFERING MINOR DEGREE

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	21CS5601	Sem 5: Data structures and Design	MDC	3	0	0	3	3
2.	21CS6601	Sem 6: Databases and SQL	MDC	3	0	0	3	3
3.	21CS6602	Sem6: Internet Of Things	MDC	3	0	0	3	3
4.	21CS7601	Sem 7: Introduction to Machine Learning	MDC	3	0	0	3	3
5.	21CS7602	Sem 7: Introduction to Cyber Security	MDC	3	0	0	3	3
6.	21CS8601	Sem 8: Data Analytics for Engineers	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	Vertical II Entrepreneurship	Vertical III Environment and Sustainability
21CS5602-Financial Management	21BA5601- Foundations of Entrepreneurship	21CE5602- Sustainable infrastructure Development

Fundamentals of Investment	Introduction to Business Venture	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Team Building & Leadership Management for Business	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Creativity & Innovation in Entrepreneurship	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Principles of Marketing Management for Business	Green Technology
Introduction to Fintech	Human Resource Management for Entrepreneurs	Environmental Quality Monitoring and Analysis
	Financing New Business Ventures	

Vertical I FINTECH AND BLOCK CHAIN

S No	Course Code	Course Title	Category	Periods Per week			TCP	Credits
				L	T	P		
1	21CS5602	Sem 5:Financial Management	MDC	3	0	0	3	3
2	21XXXX	Fundamentals of Investment	MDC	3	0	0	3	3
3	21XXXX	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	21XXXX	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	21XXXX	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	21XXXX	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			T C P	Credits
				L	T	P		
1	21BA5601	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	21XXXX	Introduction to Business Venture	MDC	3	0	0	3	3
3	21XXXX	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
4	21XXXX	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
5	21XXXX	Principles of Marketing Management for Business	MDC	3	0	0	3	3
6	21XXXX	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
7	21XXXX	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			TCP	Credits
				L	T	P		
1	21CE5602	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	21XXXX	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	21XXXX	Sustainable Bio Materials	MDC	3	0	0	3	3
4	21XXXX	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	21XXXX	Green Technology	MDC	3	0	0	3	3
6	21XXXX	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in IOT

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	**21CS5204**	Sem 5: Fundamentals Of IOT	PC	3	0	0	3	4	40	60	100
2.	**21CS6203**	Sem 6: IoT Design	PC	3	0	0	3	4	40	60	100
3.	**21CS6204**	Sem 6: Introduction Of Raspberry Pi and Arduino	PC	3	0	0	3	4	40	60	100
4.	**21CS7203**	Sem 7: IoT for smart cities	PC	3	0	0	3	4	40	60	100
5.	**21CS7204**	Sem 7: Internet Of Medical Things	PC	3	0	0	3	4	40	60	100
6.	**21CS8201**	Sem 8: Iot Cloud and Data Analytics	PC	3	0	0	3	4	40	60	100

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in BLOCK CHAIN TECHNOLOGY

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	**21CS5205**	Sem 5: Public Key Infrastructure and Trust Management	PC	3	0	0	3	3	40	60	100

2.	21CS6205	Sem 6: Introduction to block chain	PC	3	0	0	3	3	40	60	100
3.	21CS6206	Sem 6: Cryptocurrency	PC	3	0	0	3	3	40	60	100
4.	21CS7205	Sem 7: Smart Contracts and Solidity	PC	3	0	0	3	3	40	60	100
5.	21CS7206	Sem 7: Block chain and distributed ledger technology	PC	3	0	0	3	3	40	60	100
6.	21CS8202	Sem 8: Bitcoin Essentials and Use-Cases	PC	3	0	0	3	3	40	60	100

B.E (Hons) COMPUTER SCIENCE AND ENGINEERING with Specialization in FULL STACK DEVELOPMENT

S.No.	Course Code	Course Title	Category	Periods per Week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	21CS5206	Sem 5: Web Technology	PC	3	0	0	3	3	40	60	100
2.	21CS6207	Sem 6: Front End Development with REACT and TYPESCRIPT	PC	3	0	0	3	3	40	60	100
3.	21CS6258	Sem 6: Back End Development with NodeJS	PC	3	0	0	3	3	40	60	100
4.	21CS7207	Sem 7: Nosql Databases with Mongo DB	PC	3	0	0	3	3	40	60	100
5.	21CS7208	Sem 7: DevOps	PC	3	0	0	3	3	40	60	100
6.	21CS8203	Sem 8: Web Application Security	PC	3	0	0	3	3	40	60	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

Chairman

Chairman BoS **Dean Academics** **Principal**

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Programme	Course Code	Course Name	L	T	P	C
B.E	21CS7201	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

Course Objective

1. To Know about the fundamentals of networks security, security architecture, threats and vulnerabilities
2. Use the different cryptographic operations of symmetric cryptographic algorithms
3. Apply the different cryptographic operations of public key cryptography
4. Identify the various Authentication schemes to simulate different applications.
5. Understand various Security practices and System security standards

Unit	Description	Instructional Hours
I	**INTRODUCTION** Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography-Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.	9
II	**SYMMETRIC KEY CRYPTOGRAPHY** MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid"s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.	9
III	**PUBLIC KEY CRYPTOGRAPHY** MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.	9
IV	**MESSAGE AUTHENTICATION AND INTEGRITY** Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509	9
V	**SECURITY PRACTICE AND SYSTEM SECURITY** Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.	9
	Total Instructional Hours	**45**

Course Outcome

- CO1: Explain the fundamentals of networks security, security architecture, threats and vulnerabilities
- CO2: classify the symmetric encryption techniques.
- CO3: Illustrate various Public key cryptographic techniques.
- CO4: Discuss on the various Authentication schemes.
- CO5: Understand various Security practices and System security standards

TEXT BOOKS:

T1: William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall of India/Pearson Education, New Delhi, 2010

T2: Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill Publishing Company, New Delhi, 2007.

REFERENCE BOOKS:

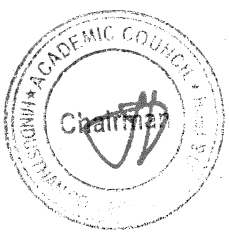
R1: Behrouz Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill Publishing Company , New Delhi, 2010

R2: Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

R3: Kaufman, Perlman and Speciner, "Network Security: Private Communication in a public world", Prentice Hall of India/ Pearson Education, New Delhi, 2004.

R4: C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd

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	Course Code	Name of the Course	L	T	P	C
B.E	21CS7202	CLOUD COMPUTING	3	0	0	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 - Cloud Stack - 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 ENABLIBNG TECHNOLOGIES** Data center Technology – Virtualization Technology – Web Technology – Multitenant Technology – service technology – case study in AWS.	8
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.	10
	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

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 Architecture‖, 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	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.E	21CS7251	MACHINE LEARNING TECHNIQUES	2	0	2	3

Course Objective

1. To introduce the basic concepts and techniques of Machine Learning.
2. To have a thorough understanding of the Supervised and Unsupervised learning techniques
3. To study the various probability based learning techniques
4. To understand graphical models of machine learning algorithms
5. To improve classification efficiency.

Unit	Description	Instructional Hours
I	**FOUNDATIONS OF LEARNING** Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation-generalization tradeoff – bias and variance – learning curve. *Illustrative Programs: Implement and demonstratethe FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.*	7+2
II	**LINEAR MODELS** Linear classification – univariate linear regression – multivariate linear regression – regularized regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures – support vector machines – soft margin SVM – going beyond linearity – generalization and overfitting – regularization – validation. *Illustrative Programs: Create a training dataset using SVM, implement decision boundary using SVM*	7+2
III	**DISTANCE-BASED MODELS** Nearest neighbor models – K-means – clustering around medoids – silhouttes – hierarchical clustering – k-d trees – locality sensitive hashing– non-parametric regression – ensemble learning – bagging and random forests – boosting – meta learning. *Illustrative Programs: Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.*	7+2
IV	**TREE AND RULE MODELS** Decision trees – learning decision trees – ranking and probability estimation trees – regression trees – clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining – first-order rule learning. *Illustrative Programs: 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 toclassify a new sample.*	7+2
V	**REINFORCEMENT LEARNING** Markov Chain Monte Carlo Methods – Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal difference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control. *Illustrative Programs: Metropolis–Hastings Algorithm by using Markov Chain Monte Carlo Methods, HMM Baum–Welch (Forward–Backward) Algorithm*	7+2
	Total Instructional Hours	**45**

Course Outcome	CO1:	Explain theory underlying machine learning .
	CO2:	Construct algorithms to learn linear and non-linear models
	CO3:	Implement data clustering algorithms.
	CO4:	Construct algorithms to learn tree and rule-based models.
	CO5:	Apply reinforcement learning techniques for real life problems.

TEXT BOOKS:

T1: Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, —Learning from Data‖, AML Book Publishers, 2012.

T2: P. Flach, —Machine Learning: The art and science of algorithms that make sense of data‖, Cambridge University Press, 2012.

REFERENCE BOOKS:

R1: K. P. Murphy, —Machine Learning: A probabilistic perspective‖, MIT Press, 2012.

R2: M. Mohri, A. Rostamizadeh, and A. Talwalkar, —Foundations of Machine Learning‖, MIT Press, 2012.

R3: C. M. Bishop, —Pattern Recognition and Machine Learning‖, Springer, 2007.

R4: D. Barber, —Bayesian Reasoning and Machine Learning‖, Cambridge University Press, 2012.

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	2	2	2	2	1	1	-	-	-	-	-	2	3	3

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS7001	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	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.E	21CS7002	SECURITY LABORATORY	0	0	3	1.5

Course Objective

1. To develop code for classical Encryption Techniques to solve the problems.
2. To build cryptosystems by applying symmetric and public key encryption algorithms.
3. To construct code for authentication algorithms.
4. To develop a signature scheme using Digital signature standard.
5. To demonstrate the network security system using open source tools.

S. No.	Description of the Experiments
1.	Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts: a. Caesar Cipher b. Playfair Cipher c. Hill Cipher d. Vigenere Cipher e. Rail fence – row & Column f. Transformation Transformation Implement the following algorithms
2.	a. DES b. RSA Algorithm c. Diffiee-Hellman d. MD5 e. SHA-1.
3.	Perform an experiment how to use DumpSec.
4.	Generate password hashes with openSSL.
5.	Setup a honey pot and monitor the honeypot on network (KF Sensor)
6.	Installation of rootkits and study about the variety of options
7.	Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler)
8.	Demonstrate intrusion detection system (ids) using any tool (snort or any other open source software)

Total hours 45

Course Outcome

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

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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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS7306	AI ANALYST	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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PROFESSIONAL ELECTIVE -3

Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS7301	MULTICORE ARCHITECTURE AND PROGRAMMING	3	0	0	3

Course Objective

1. To Describe the need for multi-core processors, and their architecture.
2. To understand the challenges in parallel and multi-threaded programming.
3. To learn about the various parallel programming paradigms such as OpenMP and MPI.
4. To develop multi-core programs and design parallel solutions.
5. To compare and contrast serial and parallel programming.

Unit	Description	Instructional Hours
I	**MULTI-CORE PROCESSORS** Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.	9
II	**PARALLEL PROGRAM CHALLENGES** Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutex, locks, semaphores, barriers) – deadlocks and live locks – communication between threads (condition variables, signals, message queues and pipes).	9
III	**SHARED MEMORY PROGRAMMING WITH Open MP** Open MP Execution Model – Memory Model – Open MP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.	9
IV	**DISTRIBUTED MEMORY PROGRAMMING WITH MPI** MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived data types – Performance evaluation.	9
V	**PARALLEL PROGRAM DEVELOPMENT:** Case studies – n-Body solvers – Tree Search – Open MP and MPI implementations and comparison.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Describe multi-core architectures and identify their characteristics and challenges.
CO2: Identify the issues in programming Parallel Processors.
CO3: Write programs using Open MP and MPI.
CO4: Design parallel programming solutions to common problems.
CO5: Compare and contrast programming for serial processors and programming for parallel processors.

TEXT BOOKS:

T1: Peter S. Pacheco, —An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2011.
T2: Darryl Gove, —Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011.

REFERENCE BOOKS:

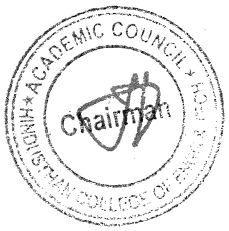
R1: Michael J Quinn, —Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003.

R2: Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.

R3: Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

R4: Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 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	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



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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS7302	CYBER FORENSICS	3	0	0	3

Course Objective

1. To Learn basics of Computer Forensics
2. Be familiar with forensics tools
3. Learn to analyze and validate forensics data
4. To gain the Knowledge about the Ethical Hacking
5. To Understand the concepts of Ethical hacking in web applications

Unit	Description	Instructional Hours
I	**INTRODUCTION TO COMPUTER FORENSICS** An overview of Digital Forensics-Preparing for digital forensics-preparing a Digital Forensics Investigation. Data Acquisition: Understanding Storage Formats for Digital Evidence-Validating Data Acquisitions-Performing RAID Data Acquisition-Using Network Acquisition Tools-Using other Forensics Acquisition Tools.	9
II	**EVIDENCE COLLECTION AND FORENSICS TOOLS** Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	9
III	**ANALYSIS AND VALIDATION** Validating Forensics Data – Data Hiding Techniques – Performing Live Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics	9
IV	**ETHICAL HACKING** Introduction to Ethical Hacking – Foot printing – Scanning Networks – Enumeration – System Hacking – Malware Threats :Trojan and Backdoors – Sniffing	9
V	**ETHICAL HACKING IN WEB** Social Engineering – Denial of Service – Session Hijacking – Hacking Web servers – Hacking Web Applications –Web based Password Cracking Techniques– SQL Injection – Hacking Wireless Networks – Hacking Mobile Platforms.	9
	Total Instructional Hours	45

Course Outcome

CO1: Explain the basics of computer forensics
CO2: Use a number of different computer forensic tools to a given scenario
CO3: Apply and validate forensics data
CO4: Understand about Ethical hacking
CO5: Implement real-world hacking techniques in Ethical hacking.

TEXT BOOKS:

T1: Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
T2: CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.

REFERENCE BOOKS:

R1: John R.Vacca, —Computer Forensics, Cengage Learning, 2005
R2: MarjieT.Britz, —Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
R3: AnkitFadia — Ethical Hacking Second Edition, Macmillan India Ltd, 2006
R4: Kenneth C.Brancik —Insider Computer Fraud Auerbach Publications Taylor & Francis Group–2008.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E	21CS7303	WIRELESS SENSOR NETWORKS	3	0	0	3

Course Objective

1. To Familiarize the students with the fundamentals of wireless communication technology and modulation techniques.
2. To learn the concepts of Adhoc networks and design issues of sensor networks.
3. To Study the architecture and protocols of wireless sensor networks
4. To understand the design issues and to learn the concepts of routing protocols
5. To Discuss the various challenges in providing Qos and to learn about energy management.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.	9
II	**AD HOC NETWORKS – INTRODUCTION** Introduction to Adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering	9
III	**WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS** Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.	9
IV	**WSN ROUTING PROTOCOLS** Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.	9
V	**QOS AND ENERGY MANAGEMENT** QoS: Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, Need for energy management, classification, battery, transmission power, and system power management schemes. Case study: Energy Efficient Environmental monitoring.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Explain the concepts and applications of various wireless communication techniques.
CO2: Analyze the design issues of ad hoc and sensor networks.
CO3: Learn architecture of various wireless sensor networks and MAC protocols
CO4: To analyze the design issues and concepts of routing protocols.
CO5: Evaluate the QoS related performance measurements of WIRE LESS sensor networks and real time case studies.

TEXT BOOKS:

T1: C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.

T2: Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002

REFERENCE BOOKS:

R1: Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications",World Scientific Publishing Company, 2006.

R2: Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005.

R3: Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.

R4: Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

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.E	21CS7304	C# and .NET AND PROGRAMMING	3	0	0	3

Course Objective

1.To understand the basics of C# and .NET.
2.To implement the C# language constructs and OOP.
3.To implement advanced programming in C#.
4.Fundamental window programming.
5.Build web based applications using c#.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO C#** Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.	9
II	**OBJECT ORIENTED ASPECTS OF C#** Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.	9
III	**APPLICATION DEVELOPMENT ON .NET** Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box(Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.	9
IV	**WEB BASED APPLICATION DEVELOPMENT ON .NET** Programming web application with web forms, ASP.NET introduction, working with XML and .NET,Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.	9
V	**CLR AND .NET FRAMEWORK** Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: To learn the basics of .net Frame work and C# language.
CO2: To learn C# elements and OOPS concepts.
CO3: To learn interface and inheritance concepts in C# language.
CO4: To learn fundamentals of window application programming and create a window application.
CO5: To develop web applications and learn advanced features of C#.

TEXT BOOKS:

T1: Stanley B.Lippman , "C# Primer : A practical approach", Pearson Education,1991.

T2: David.S.Platt, Introducing Microsoft . Net , Microsoft Press, 3rd, Edition, 2003.

REFERENCE BOOKS:

R1: Ben Albahari, Pter Drayton, Brad Merrill, "C# Essentials", Oreilly& Associates, 2001.
R2: E.Balagurusamy, Programming in C # Tata McGraw Hill, 2002.
R3: Conard.J., et.al., Introducting .Net, wrox Press, 2000.
R4: Eric Gunnerson , "A Programmers Introduction to C# ",A Press, 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	Course Code	Name of the Course	L	T	P	C
B.E	21CS7305	SOFTWARE TESTING	3	0	0	3

Course Objective

1. To learn the criteria for test cases.
2. To learn the design of test cases.
3. To understand test management and test automation techniques.
4. To apply test metrics and measurements.
5. To document test plans and test cases designed.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Tester"s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies.	9
II	**TEST CASE DESIGN** Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State-based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.	9
III	**LEVELS OF TESTING** The need for Levers of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.	9
IV	**TEST MANAGEMENT** People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group - Capability Maturity Model (CMM) – Project Maturity Model (PMM).	9
V	**TEST AUTOMATION** Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics. **Tools: Selenium, TestingWhiz, Sahi, Tosca Test suite and Katalon Studio.**	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Prepare test planning based on the document.
CO2: Design test cases suitable for a software development for different domains.
CO3: Use automatic testing tools.
CO4: Develop and validate a test plan.
CO5: Document test plans and test cases designed.

TEXT BOOKS:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.

2. Ron Patton, " Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007.

REFERENCES:

1.Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.

2. Edward Kit," Software Testing in the Real World – Improving the Process", Pearson Education, 1995.

3. Boris Beizer," Software Testing Techniques" – 2nd Edition, Van Nostrand Reinhold, New York, 1990.

4. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson 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	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.E	21CS7401	FOUNDATION SKILLS IN INFORMATION TECHNOLOGY(NASSCOM)	3	0	0	3

Course Objective

1. To introduce the basics of C programming language
2. To Learn about the concepts of structure and unions
3. To be exposed about sorting, searching, hashing algorithms
4. To Learn various testing and maintenance measures
5. To outline the principles for Software Project Management

Unit	Description	Instructional Hours
I	**BASIC PROGRAMMING CONCEPTS IN C LANGUAGE** Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays.	9
II	**FUNCTIONS, POINTERS, STRUCTURES AND UNIONS** Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.	9
III	**SORTING, SEARCHING, HASHING TECHNIQUES** Sorting algorithms: Insertion sort – Selection sort – Shell sort – Bubble sort – Quick sort – Merge sort – Radix sort – Searching: Linear search –Binary Search Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing	9
IV	**SOFTWARE TESTING AND ITS TYPES** Software testing fundamentals-Internal and external views of Testing-white box testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing -alpha and beta testing -Acceptance testing – Performance testing– Usability and Accessibility testing – Compatibility testing – Test cases-Testing the documentation	9
V	**STAFFING IN SOFTWARE PROJECTS** Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the basics of C programming language
CO2: Apply the concepts of structures and unions
CO3: Apply the sorting, searching, hashing algorithms.
CO4: Understand the various testing and maintenance.
CO5: Understand the Project Management principles while developing software.

TEXT BOOKS:

T1: Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson Education, 1988.
T2: Roger S. Pressman, "Software Engineering – A Practitioner"s Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.

REFERENCE BOOKS:

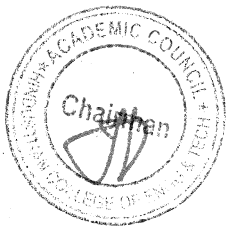
R1: Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.

R2: Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.

R3: Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.

R4: Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.

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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MINOR DEGREE IN CSE

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS5601	DATA STRUCTURES AND DESIGN	3	0	0	3

Course Objective

1. Understand the fundamental concepts of linear data structures
2. Learn the concept of various linear data structures like Linked list
3. Studythe concept of stack and queue.
4. Summarize the various non-linear data structures like binary tree, binary search tree, AVL, splay tree and red black tree.
5. Implement graph algorithms for solving real world problems

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OF DATA STRUCTURES** Introduction – Need for data structures – Types of data structures – Algorithm: Characteristics – Analysis of complexity – time complexity, space complexity, order of growth – Linear List: Array representation and its operations.	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

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

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HONOURS WITH SPECIALIZATION

(IOT)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS5204	FUNDAMENTALS OF INTERNET OF THINGS	3	0	0	3

Course Objective

1. To introduce the terminology, technology and its applications
2. To study about the concept of M2M(machine to machine)with necessary protocols.
3. To understand the Python Scripting Language which is used in many IoT devices
4. To know about the Raspberry Pi platform, that is widely used in IoT applications
5. To implement of web-based services on IoT devices.

Unit	Description	Instructional Hours
I	**BASICS OF IOT** Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks	9
II	**IOT NETWORK ARCHITECTURE AND DESIGN** Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino	9
III	**DEVELOPING INTERNET OF THINGS** Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.	9
IV	**IMPLEMENTATION** Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN),SDN for IoT, Data Handling and Analytics	9
V	**CASE STUDIES** Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring	9
	Total Instructional Hours	**45**

Course Outcome

- CO1: Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- CO2: Compare and contrast the deployment of smart objects and the technologies to connect them to network
- CO3: Appraise the role of IoT protocols for efficient network communication..
- CO4: Elaborate the need for Data Analytics and Security in IoT.
- CO5: Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry

TEXT BOOKS:

1. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)

2. "Make sensors": Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media, 2014.

3. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti

REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"

2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

3. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013

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

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HONOURS WITH SPECIALIZATION

(BLOCK CHAIN TECHNOLOGY)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS5205	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, Virtu al 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	3	2	2	2	3	-	-	-	-	2	2	3	3
CO2	3	2	2	3	1	2	-	-	-	-	3	1	3	2
CO3	3	3	1	1	3	3	-	-	-	-	2	3	3	3
CO4	2	2	2	2	3	2	-	-	-	-	1	2	2	2
CO5	3	1	1	2	3	1	-	-	-	-	3	2	3	1

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HONOURS WITH SPECIALIZATION

(DATA SCIENCE)

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS5206	DATA WAREHOUSING 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**

Course Outcome

CO1: To demonstrate the basics of designing a Data warehouse system and perform business analysis with OLAP tools
CO2: To discuss about various data preprocessing techniques.
CO3: To explain various techniques applied for mining frequent patterns.
CO4: To summarize the working of various classification algorithms.
CO5: To 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:

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.

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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	2	3	3	1	-	-	-	-	-	-	2	2	3
CO3	2	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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MINOR DEGREE IN FINTECH AND BLOCK CHAIN

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22CS5602	FINANCIAL MANAGEMENT	3	0	0	3

Course Objective

1. To acquire the knowledge of the decision areas in finance.
2. To learn the various sources of Finance
3. To describe about capital budgeting and cost of capital
4. To discuss on how to construct a robust capital structure and dividend policy
5. To develop an understanding of tools on Working Capital Management.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO FINANCIAL MANGEMENT** Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts	9
II	**SOURCES OF FINANCE** Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc	9
III	**INVESTMENT DECISIONS:** Investment Decisions: capital budgeting – Need and Importance – Techniques of Capital Budgeting –- Payback -ARR – NPV – IRR – Profitability Index. Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.	9
IV	**FINANCING AND DIVIDEND DECISION** Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure . Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy	9
V	**WORKING CAPITAL DECISION** Working Capital Management: Working Capital Management - concepts - importance - Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies	9
	Total Instructional Hours	**45**

Course Outcome		
	CO1:	Acquire the knowledge of the decision areas in finance.
	CO2:	learn the various sources of Finance
	CO3:	describe about capital budgeting and cost of capital
	CO4:	construct a robust capital structure and dividend policy

	CO5:	develop an understanding of tools on Working Capital Management.

TEXT BOOKS:

1.M.Y. Khan and P.K.Jain Financial management, Text, Tata McGraw Hill

2.M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd

REFERENCE BOOK:

1 James C. Vanhorne –Fundamentals of Financial Management– PHI Learning,.

2. Prasanna Chandra, Financial Management,

3. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

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Minor Degree in Entrepreneurship

Programme	Course Code	Name of the course	L	T	P	C
BE/B.Tech	**22BA5601**	**Foundations of Entrepreneurship**	**3**	**0**	**0**	**3**

Course Objective	CO1: To enable students gain insights on entrepreneurship. CO2: To make students understand the sources of product & business ideas. CO3: To provide knowledge on business opportunity identification. CO4: To enable students to develop business plan CO5: To enable students to prepare feasibility reports and understand trends in entrepreneurship.

Unit	Description	Instructional Hours
I	**Introduction to Entrepreneurship:** Entrepreneurial growth in India; sources of entrepreneurship in India. Entrepreneurship process; entrepreneurial mindset: concept and impact; Entrepreneurial growth strategies. Characteristics of an Entrepreneur – Qualities of an Entrepreneur. Entrepreneurial success and failure - reasons and remedies.	9
II	**Product Development:** Introduction and Meaning of a Product – Sources of Business or Product Ideas – Criteria for Selecting a Product – Barriers to the successful development of New Products – Why do new products fail. Technology - Considerations in selecting technology.	9
III	**Business Opportunity Identification:** Need and Importance - Steps in identification of Business Opportunity. Techniques of market Survey – Market Research Procedure.	9
IV	**Business Plan Development**: Business modelling: concept, types and functions; Innovation and Entrepreneurship: concept and challenges. The business plan as an entrepreneurial tool, Elements of business planning, Objectives, Market analysis, development of Product/idea, Marketing, Finance, Organization and management, Ownership, Critical risk contingencies of the proposal, Scheduling and milestones.	9
V	**Feasibility Report & trends:** Contents of a feasibility report – Considerations while preparing a feasibility report – Proforma of a feasibility report. Technical, Financial, Marketing, Personnel, and management feasibility reports. Trends in entrepreneurship: Rural, Social and women entrepreneurship.	9
	Total Instructional Hours	**45**

Course Outcome	CO1: Understand the basics of entrepreneurship and its process.
	CO2: Understand the concept of product development and the role of technology.
	CO3: Able to understand and identify business opportunity
	CO4: Able to develop business plan / business model
	CO5: Able to prepare feasibility reports and understand the trends in entrepreneurship.

TEXT BOOKS:

T1- S.Anil Kumar, S.C.Poornima, Mini KAbraham, K.Jayashree "Entrepreneurship Development",New Age International Publishers.

T2- Jasmer singh Sain, Entrepreneurship and small Business" Deep and Deep publication

T3- Shankar Raj, "Entrepreneurship Theory and Practice" Vijay Nicole Imprints Pvt ltd.

T4- Khanka, S.S, "Entrepreneurship Development", S. Chand & company

T5- Vasant Desai, "Fundamentals of Entrepreneurship "Himalaya Publishing House.

REFERENCE BOOKS:
R1- Khanna, S. S., Entrepreneurial Development, S. Chand, New Delhi.
R2- Hisrich D. Robert, Michael P. Peters, Dean A. Sheperd, Entrepreneurship, McGraw-Hill,6 ed.
R3- Zimmerer W. Thomas,Norman M.Scarborough, Essentials of Entrepreneurship and Small Business Management, PHI,4 ed.
R4- Holt H. David, Entrepreneurship: New Venture Creation, Prentice- Hall of India, New Delhi, Latest edition.
R5- Kuratko, F. Donald, Richard M. Hodgetts, Entrepreneurship: Theory, Process, Practice, Thomson, 7ed.
R6- Desai, Vasant, Dynamics of Entrepreneurship: New Venture Creation, Prentice-Hall of India, New Delhi, Latest edition.
R7- Patel, V. G., The Seven Business Crises and How to Beat Them, Tata McGraw-Hill, New Delhi, 1995.
R8- Roberts, Edward B.(ed.), Innovation: Driving Product, Process, and Market Change, San Francisco: Jossey Bass, 2002.

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Minor Degree In Environment And Sustainability

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	22CE5601	SUSTAINABLE INFRASTRUCTURE DEVELOPMENT	3	0	0	3

Course Objective

1. To gain knowledge on concepts and socio-economic policies of sustainable development.
2. To examine the strategies for implementing sustainable development programmes.
3. To learn the various sustainability and performance indicators, their assessment techniques and constraints
4. To explore the different approaches for resource management for a sustainable urban planning.
5. To understand the principles of urban planning and built-in environment.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SUSTAINABLE DEVELOPMENT** Definitions and principles of Sustainable Development - History and emergence of the concept of Sustainable Development - Environment and Development linkages- Globalization and environment – Millennium Development Goals: Status (global and Indian) Impacts on approach to development policy and practice in India, future directions.	9
II	**ENVIRONMENTAL SUSTAINABILITY** Land, Water and Food production - Moving towards sustainability: Energy powering Sustainable Development - Financing the environment and Sustainable Development.	9
III	**SUSTAINABILITY INDICATORS** Sustainability indicators – Hurdles to Sustainability-Operational Guidelines-Interconnected prerequisites for sustainable development - Science and Technology for sustainable development – Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development.	9
IV	**URBAN PLANNING AND ENVIRONMENT** Environment and Resources, Sustainability Assessment, Future Scenarios, Form of Urban Region, Managing the change, Integrated Planning, Sustainable Development.	9
V	**THE BUILT-IN ENVIRONMENT** Urban Form, Land Use, Compact Development, Principles of street design- complete streets, Transport Integrated Urban land use Planning, Guidelines for Environmentally Sound Transportation.	9
	Total Instructional Hours	**45**

Course Outcome

The students will be able to:
CO1: Describe the concepts and socio-economic policies of sustainable development.
CO2: Recognize and identify the strategies for implementing sustainable development programmes.
CO3: Comprehend the various sustainability and performance indicators, their assessment techniques and constraints
CO4: Identify the different approaches for resource management for a sustainable urban planning
CO5: Illustrate the principles of urban planning and built-in environment.

REFERENCE BOOKS:

R1. Gilg A W and Yarwood R," Rural Change and Sustainability-Agriculture, the Environment and Communities", CABI Edited by S J Essex, September 2005.
R2. Ganesha Somayaji and Sakarama Somayaji, "Environmental Concerns and Sustainable development: Some perspectives from India", Editors: publisher TERI Press, ISBN 8179932249.
R3. James H. Weaver, Michael T. Rock, Kenneth Kustere, "Achieving Broad-Based Sustainable Development: Governance, Environment, and Growth with Equity", Kumarian Press, West Hartford, CT. Publication Year,1997.
R4. Kirkby. J, O'Keefe P. and Timberlake, "Sustainable development" Earth Scan Publication, London,1996.
R5. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher: Belhaven Press,ISBN:1852930039.
R6. Munier N, "Introduction to Sustainability", Springer2005

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

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B.E (Hons) CSE

(BLOCK CHAIN TECHNOLOGY)

Programme	Course code	Name of the course	L	T	P	C
B.E	21CS7206	**Smart Contracts and Solidity**	3	0	0	3

Course Objective

The student should be able

1. Understand Blockchain platform
2. Basics of smart contracts, decentralized apps, and decentralized anonymous organizations (DAOs)
3. To understand and Create new crypto-currency (token/coin).

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.

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.E	21CS7207	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.

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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B.E (Hons) CSE

(FULL STACK DEVELOPMENT)

Programme	Course code	Name of the course	L	T	P	C
B.E	21CS7208	**No Sql Databases with Mongo DB**	3	0	0	3

Course Objective

The student should be able

1. To Discuss what type of NoSQL database to implement based on business requirements (key-value, document, full text, graph, etc.).
2. To Apply NoSQL data modeling from application specific queries.
3. To Use Atomic Aggregates and denormalization as data modeling techniques to optimize query processing.
4. To Distinguish various NOSQL database stores
5. To Apply Indexing Techniques of NoSQL

Unit	Description	Instructional Hours
I	**Introduction to NoSQL** Definition And Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store, Car Make And Model Database, Working With Language Bindings	9
II	**Interacting with NoSQL** If NoSql Then What, Language Bindings For NoSQL Data Stores, Performing Crud Operations, Creating Records, Accessing Data, Updating And Deleting Data.	9
III	**NoSQL Storage Architecture** Working With Column-Oriented Databases, Hbase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value Stores In Memcached And Redis, Eventually Consistent Non-Relational Databases	9
IV	**NoSQL Stores** Similarities Between Sql And Mongodb Query Features, Accessing Data From Column- Oriented Databases Like Hbase, Querying Redis Data Stores, Changing Document Databases,Schema Evolution In Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.	9
V	**Indexing and Ordering Data Sets** Essential Concepts Behind A Database Index, Indexing And Ordering In Mongodb, Creating and Using Indexes In Mongodb, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.	9
	Total Instructional Hours	45

Course Outcome

CO1	Discuss what type of NoSQL database to implement based on business requirements (key-value, document, full text, graph, etc.)
CO2	Apply NoSQL data modeling from application specific queries
CO3	Use Atomic Aggregates and denormalization as data modeling techniques to optimize query processing
CO4	Distinguish various NOSQL database stores
CO5	Apply Indexing Techniques of NoSQL.

TEXT BOOK:

T1 Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6

T2 Pramod Sadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional, 2012..

REFERENCES:

R1 Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.

R2 Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013

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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B.E 21CS7209 DEVOPS 3 0 0 3

COURSE OBJECTIVES:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT I INTRODUCTION TO DEVOPS 9

DevOps -Definition - Practices -DevOps life cycle process - need for DevOps -Barriers - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build,

test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven

create and build Artificats, Dependency management, Installation of Gradle, Understand build using

Gradle

UNIT III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a

Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin,

Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring

Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible

modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build

a sample code, Modify azure-pipelines.yaml file -Case study: MLOPS: Definition-Developing Models- Real world examples

COURSE OUTCOMES:

CO1: Understand different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.

CO3: Ability to Perform Automated Continuous Deployment

CO4: Ability to do configuration management using Ansible

CO5: Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXT BOOKS

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.138

2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020

2. by Mitesh Soni

3. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.

4. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.

5. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

6. https://www.jenkins.io/user-handbook.pdf

7. https://maven.apache.org/guides/getting-started/

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PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	0	0	0	0	3	0	0	0	1	3
CO2	3	1	1	2	0	3	0	0	2	0	0	2	1	1
CO3	3	1	1	2	0	3	0	0	2	0	0	2	2	3
CO4	3	1	1	2	0	3	0	0	0	0	0	2	2	3
CO5	3	1	1	1	0	0	0	0	0	0	0	3	2	3
Avg	**3**	**1**	**1**	**2**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**2**	**2**	**3**

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MINOR DEGREE

CSE

Programme	Course code	Name of the course	L	T	P	C
B.E	21CS7601	**Introduction to Machine Learning**	3	0	0	3

COURSE OBJECTIVES:

1.To understand the basic concepts of machine learning.

2.To understand and build supervised learning models.

3.To understand and build unsupervised learning models.

4.To learn about Neural Networks

5.To evaluate the algorithms based on corresponding metrics identified

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING 9

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT IV NEURAL NETWORKS 9

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test

COURSE OUTCOMES:

CO1: Explain the basic concepts of machine learning.

CO2 : Construct supervised learning models.

CO3 : Construct unsupervised learning algorithms.

CO4: Experiment about Neural networks concepts

CO5: Evaluate and compare different models

TEXTBOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERENCES

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.

3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.

4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016

5. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing 3rd Edition, 2019.

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

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Programme	Course code	Name of the course	L	T	P	C
B.E	21CS7602	INTRODUCTION TO CYBER SECURITY	3	0	0	3

COURSE OBJECTIVES:

1.To learn cybercrime and cyber law.

2.To understand the cyber-attacks and tools for mitigating them.

3.To understand information gathering.

4.To learn how to detect a cyber-attack.

5.To learn how to prevent a cyber-attack

UNIT – I : INTRODUCTION 9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for CyberCrime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment

UNIT – II : ATTACKS AND COUNTERMEASURES 9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT – III : RECONNAISSANCE 9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – PortScanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches.

UNIT – IV : INTRUSION DETECTION 9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed orHybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort

UNIT – V : INTRUSION PREVENTION 9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations –Intrusion Prevention Systems – Example Unified Threat

Management Products

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Explain the basics of cyber security, cybercrime and cyber law

CO2: Classify various types of attacks and learn the tools to launch the attacks

CO3: Apply various tools to perform information gathering

CO4: Apply intrusion techniques to detect intrusion

CO5: Apply intrusion prevention techniques to prevent intrusion

TEXT BOOKS:

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of CyberSecurity", Notion Press, 2021. (Unit-1 &2)

2. William Stallings, Lawrie Brown, "Computer Security Principles and Practice",Third Edition, Pearson Education, 2015. (Unit-4 & 5)

REFERENCE BOOKS:

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: EthicalHacking and Penetration Testing Made easy", Elsevier, 2011. (Unit-3)

2. David Kim, Michael G. Solomon, "Fundamentals of Information SystemsSecurity", Jones & Bartlett Learning Publishers, 2013.

3. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes,Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.

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	-	1	-	-	-	-	-	2	3	3
CO2	3	3	2	1	-	2	-	-	-	-	-	2	3	3
CO3	3	3	1	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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