SOMAIYA
VIDYAVIHAR

K J Somaiya Institute of Technology
An Autonomous Institute Permanently Affiliated to the University of Mumbai

Item No.: 3.B.1

A.C.: 21/01/2026

Autonomy Syllabus Scheme III (2023-24)

(As per NEP 2020 Guidelines)

for

Four Year Multidisciplinary

Bachelors of Technology (B.Tech.) Program

in Information Technology

with

Multiple Entry and Multiple Exit Options

Levels 4.5 - 6

(Third Year Effective from A.Y. 2025-26)

From the Principal's Desk:

To address the changing demands of the digital era, it is required to create a future-ready workforce that can navigate the complexities of an interconnected world, drive innovation, and contribute to the nation's growth. The **National Educational Policy 2020 (NEP 2020)** framed by the Government of India recommends a holistic, inclusive, and flexible approach to ensure equitable access to quality education across all levels, promote multidisciplinary research, and impart skill-based education with integration of technology. As per guidelines by the Department of Higher and Technical Education, Government of Maharashtra, the salient features of NEP 2020 aligned curriculum should include:

- Major (Core) Mandatory and Elective Courses
- Open Elective Courses
- Vocational and Skill Enhancement Courses
- Ability Enhancement Courses, Indian Knowledge System, and Value Education Courses
- Co-curricular Courses and Field Projects / Community Engagement Projects / Internship
- Multidisciplinary Minor Courses
- Option for Bachelor's Degree with Honours (based on Additional Credits)
- Option for Bachelor's Degree – Honours with Research (based on Additional Credits)
- Option for Bachelor's Degree with Double Minors (based on Additional Credits)
- Multiple Entry and Multiple Exit Options

Being an **autonomous institute** since the Academic Year 2021-22, **K. J. Somaiya Institute of Technology (KJSIT)**, has well-adapted newer approaches to reach higher levels of excellence in engineering education. Ahead of its time, the academic reforms at KJSIT have already addressed majority of these NEP 2020 aspects through its existing **Syllabus Scheme I, II, and II B** implemented under the academic autonomy. For a complete alignment with NEP 2020, the **KJSIT Autonomy Syllabus Scheme III** is introduced, to be effective from Academic Year 2023-24 across all the branches, progressively from First Year Engineering.

Specifically, the existing curriculum already comprise state-of-the-art **Major (Core) courses** in theory and practical. With an ideology that the root of innovation is 'interest', the curriculum offers wide range of Elective courses — grouped into **Major-related Electives** and **Inter-disciplinary / Open Electives**. At par with international engineering education, it follows a learner-centric approach as well as promotes MOOCs, where the students can choose to study courses concerning areas of their interests, and the same is continued in Scheme III.

Further, under the theme of "Learning by Doing", the existing curriculum includes Skill-Based Learning (SBL), Activity-Based Learning (ABL), and Technology-Based Learning (TBL) as eXposure (SAT) courses — that assure X factor in all the students of the institute. The SAT courses are practiced across the first three years of engineering, focusing on responsibilities towards society, problem-solving abilities, communication skills, ethics, leadership and teamwork, motivation for life-long learning, skills on emerging areas of technology, skills on different languages, etc. In the Syllabus Scheme III, these SAT courses are now aligned and offered as **Vocational Skill - SAT (VS - SAT) courses**, **Skill Enhancement - SAT (SE - SAT) courses**, **Ability Enhancement - SAT (AE - SAT) courses**, and **Value Education - SAT (VE - SAT) courses**.

Further, **Indian Knowledge System - SAT (IKS - SAT) course** is newly introduced in Scheme III that emphasizes on drawing insights from ancient wisdom to address modern challenges. Also, as an extension to the induction program for the First Year students, the introduced **Co-curricular - SAT (CC - SAT) course** aims to induct incumbents with the institutional practices, culture, and values, as well as encourage participation in co-curricular activities.

The component of **Project-Based Learning (PBL)** included in the Syllabus Scheme II is carried forward to Scheme III, wherein the students develop **Community Engagement / Field Projects** in Second, Third, and Last Year as Mini, Minor, and Major Projects respectively. Scheme III also retains the **Internship** component, offered with credits, to equip graduates with the industry trends, practices, and skills required at national and

global level. The duality of PBL and Internship enables student involvement in research, innovation, and entrepreneurship, which are the fulcrums of higher education.

As a new introduction in line with NEP 2020, the Syllabus Scheme III incorporates mandatory **Multidisciplinary Minor courses** in other branches of engineering. These courses promote interdisciplinary thinking and broaden the career prospects, enabling students to develop solutions to real-world problems by combining expertise from multiple domains.

Aligned with NEP 2020, the Scheme III retains the initiative taken through Scheme II / II B of offering **Honours courses** for students who are desirous of pursuing focused interest in 06 emerging areas of technology recognized by AICTE: Internet of Things, Artificial Intelligence & Machine Learning, Cyber Security, Virtual and Augmented Reality, Data Science, and Blockchain. These Honours courses correspond to high-end industry standards and offer multi-fold opportunities of specialization.

As per NEP 2020, the above curricular aspects of Four Years UG Engineering Programme shall be offered with **Multiple Entry and Multiple Exit options**, leading to the conferment of:

- **One Year UG Certificate in Technology:** Awarded after completing First Year of Engineering and acquiring additional 08 credits immediately after First Year.
- **Two Years UG Diploma in Technology:** Awarded after completing Second Year of Engineering and acquiring additional 08 credits immediately after Second Year.
- **Three Years Bachelor's Degree in Vocation (B.Voc.):** Awarded after completing Third Year of Engineering and acquiring additional 08 credits immediately after Third Year.
- **Four Years Bachelor's Degree in Technology (B.Tech.) with Multidisciplinary Minor:** Awarded after completing Fourth Year of Engineering.
- **Four Years Bachelor's Degree in Technology (B.Tech.) Honors with Multidisciplinary Minor:** Awarded after completing Fourth Year of Engineering and acquiring additional 18 credits through Honours courses in respective major discipline over Third & Fourth Year of Engineering.
- **Four Years Bachelor's Degree in Technology (B.Tech.) Honors with Research and Multidisciplinary Minor:** Awarded after completing Fourth Year of Engineering and acquiring additional 18 credits through a research project in respective major discipline during Fourth Year of Engineering.
- **Four Years Bachelor's Degree in Technology (B.Tech.) with Double Minors (Multidisciplinary & Specialization):** Awarded after completing Fourth Year of Engineering and acquiring additional 18 credits through additional courses in another Engg. / Tech. discipline during Second to Fourth Year of Engineering.

Through the implementation of Autonomy Syllabus Scheme III (as per NEP 2020 Guidelines), strategic planning, and joint efforts of all stakeholders, KJSIT is endeavouring to enhance the quality of engineering education and set a benchmark for all the autonomous institutes nationwide.

Dr. Vivek Sunnapwar
Principal and Chairman - Academic Council

Preface by Chairperson – Board of Studies (BoS) in Information Technology:

Information Technology is the backbone of modern innovation and digital transformation, driving societal advancement by revolutionizing processes, enhancing efficiency, and creating new opportunities. It enables breakthroughs in automation, data analysis, connectivity, and problem-solving, crucial for progress and development in the contemporary world. The **National Educational Policy 2020 (NEP 2020)** by Govt. of India propels us towards a holistic education system, integrating multidisciplinary research, community engagement, and skill-based learning to prepare a future-ready workforce.

To foster a generation of IT engineers capable of leveraging technology to tackle real-world challenges, advance the Sustainable Development Goals (SDGs) of the United Nations, and contribute effectively to the vision of Atmanirbhar Bharat, our curriculum for the B.Tech. Program in Information Technology has evolved from Scheme I to revised Schemes II, II B, and now to Scheme III—aligned with NEP 2020. The revision reflects reorganization and inclusion of state-of-the-art courses as well as Learning-by-Doing SAT courses, with objectives to: empower students in achieving better employability, start-ups and other avenues for higher education; holistic development as per NEP 2020; and attainment of all the program outcomes. The Scheme III introduced herewith, shall be effective for Second Year from Academic Year 2024-25, and progressively thereafter.

As per guidelines by the Department of Higher and Technical Education, Government of Maharashtra, the salient features of NEP 2020 aligned Scheme III curriculum for undergraduate engineering in Information Technology includes the following verticals:

- **Major (Core) Mandatory and Elective Courses**, which covers the cutting-edge technology courses in Information Technology, designed with consideration of current and futuristic trends in the industries. The elective courses at department-level are grouped into 04 major domains: a) Artificial Intelligence, b) Network & Security, c) Multimedia, and d) Optimization, which provides students with opportunities to have in-depth knowledge in the emerging areas concerning their own choice.
- **Open Elective Courses**, offered at institute-level provide students flexibility to explore diverse areas beyond their core curriculum, fostering interdisciplinary knowledge.
- **Vocational and Skill Enhancement Courses**, referred as Vocational Skill – SAT (VS-SAT) Courses and Skill Enhancement – SAT (SE-SAT) Courses respectively are designed to impart IT-specific vocational skills as well as enhance problem-solving skills and analytical thinking.
- **Ability Enhancement and Value Education Courses**, which cover Ability Enhancement – SAT (AE - SAT) Courses focusing on professional communication skills and learning Indian modern languages, and Value Education – SAT (VE - SAT) Courses to foster integrity, responsible decision-making, and professional conduct.
- **Community Engagement Projects and Internship**, with 5 Project-Based Learning (PBL) courses and a semester-long Internship enable students with exposure and proficiency in developing need-based or field projects to address the real-world issues of the society and/or industry.
- **Multidisciplinary Minor Courses**, which encourage students to explore diverse fields beyond their major, thus creating versatile individuals capable of contributing to multiple sectors and addressing global challenges.
- **Option for Bachelor's Degree with Honours**, promoting expertise and advanced knowledge, and enabling students to tailor their education to their interests and career aspirations.
- **Option for Bachelor's Degree – Honours with Research**, emphasizes research at UG level, thus encouraging research careers, innovation and intellectual growth.
- **Multiple Entry and Multiple Exit Options**, enables learners to earn certificates, diplomas, or degrees based on their completed credits, facilitates lifelong learning, and accommodates diverse learning needs, personal circumstances, and career goals.

The amalgamation of all these learning components in the curriculum, aligned with NEP 2020's vision of an equitable and dynamic education system, will nurture vast potential of the youths and contribute to the national development process in field of Information Technology.

The curriculum is the culmination of the efforts and meticulous work of all the members of the Board of Studies, subject-expert faculty members from other departments of the institute, external experts from academia, experienced professionals from IT companies, as well as the alumni working in IT companies across India and abroad.

We, the Board of Studies in Information Technology believe that the curriculum will meet the expectations of all the stakeholders and they shall take the advantage of the dynamic features of the curriculum—making the teaching-learning process an exalted experience for all.

Dr. Radhika Kotecha
Head – Department of Information Technology and Chairperson – BoS in Information Technology

Members of the Board of Studies (BoS) in Information Technology:

1. Dr. Radhika Kotecha (Chairperson),
   Professor and Head – Department of Information Technology
2. Dr. Hariram Chavan (Member – Internal Faculty),
   Professor – Department of Information Technology and Dean – Administration, KJSIT
3. Dr. Mansing Rathod (Member – Internal Faculty),
   Associate Professor – Department of Information Technology, KJSIT
4. Mr. Uday Rote (Member – Internal Faculty),
   Assistant Professor – Department of Information Technology and Dean – Student Welfare, KJSIT
5. Mrs. Seema Yadav (Member – Internal Faculty),
   Assistant Professor – Department of Information Technology
6. Dr. Vijaya Pinjarkar (Member – Internal Faculty),
   Assistant Professor – Department of Information Technology
7. Ms. Nasim Shah (Member – Internal Faculty),
   Assistant Professor – Department of Information Technology
8. Dr. Harsh Bhor (Member – Internal Faculty),
   Assistant Professor – Department of Information Technology
9. Dr. Reena Lokare (Member – Internal Faculty),
   Assistant Professor – Department of Information Technology
10. Mrs. Sarita Rathod (Member – Internal Faculty),
    Assistant Professor – Department of Information Technology
11. Mrs. Priyanka Deshmukh (Member – Internal Faculty),
    Assistant Professor – Department of Information Technology
12. Mrs. Trupti Patil (Member – Internal Faculty),
    Assistant Professor – Department of Information Technology
13. Dr. Lata Ragha (Member – External Faculty),
    Principal, Xavier Institute of Engineering, Mumbai
14. Dr. Manish Potey (Member – Faculty from other than Parent University)
    Professor and Dean Infrastructure, K J Somaiya School of Engineering
15. Ms. Shilpa Karekeraa (Member – Industry Expert),
    Founder and CEO, Myraa Technologies (International)
16. Mr. Sunil Jain (Member – Industry Expert),
    Director, Fractal, Mumbai

Nomenclature and Alignment of Verticals and Components

Verticals as per NEP 2020 Guidelines	Components Aligning with KJSIT Autonomy Syllabus Scheme I / II / II B	Nomenclature for KJSIT Autonomy Syllabus Scheme III Aligned with NEP 2020 Guidelines
Basic and Engineering Science Courses	Basic Science (BS) Course	Basic Science (BS) Courses
	Engineering Science (ES) Course	Engineering Science (ES) Courses
Major Courses	Professional Core (PC) Courses	Major / Professional Core (PC) Courses
	Professional Elective - Department-level (PE-DLC) Courses	Major / Professional Elective - Department-level (PE-DLC) Courses
Generic / Open Elective Courses	Open Elective - Institute-level (OE-ILC) Courses	Open Elective - Institute-level (OE-ILC) Courses
Multidisciplinary Minor Courses	-	Multidisciplinary Minor (MM) Courses
Vocational Skill Courses	Workshop I; Workshop II; SAT Courses – TBL	Vocational Skill - SAT (VS-SAT) Courses
Skill Enhancement Courses	SAT Courses – SBL (Program Specific)	Skill Enhancement - SAT (SE-SAT) Courses
Ability Enhancement Courses	Professional Communication Skills; SAT Course – SBL (Foreign and/or Indian Modern Languages)	Ability Enhancement - SAT (AE - SAT) Courses
Indian Knowledge System Courses	-	Indian Knowledge System - SAT (IKS - SAT) Courses
Value Education Courses	SAT Course – ABL (National, Global, Societal and Environmental Aspects); Business Communication & Ethics	Value Education - SAT (VE - SAT) Courses
Field Projects / Community Engagement Projects	PBL – Mini, Minor, Major	Community Engagement – Project-Based Learning (PBL)
Internship / Apprenticeship	Internship	Internship (INT)
Co-curricular Courses	Student Induction Program	Co-curricular - SAT (CC - SAT) Courses

Other Abbreviations:

- SAT – Skill/Activity/Technology-Based Learning (Exposure Courses)
- TH – Theory
- P – Practical
- TUT – Tutorial
- T1 – Test 1
- T2 – Test 2
- CA – Continuous Assessment Test (T = T1 + T2)
- ESE – End Semester Exam
- TW – Term Work
- O – Oral Exam
- P – Practical Exam
- P&O – Practical & Oral Exam

Credit Distribution Structure for Four Year Multidisciplinary B.Tech. Degree Program in Information Technology with Multiple Entry Multiple Exit Options

Level	Semester	Faculty: Science and Technology					Faculty: Any	Vocational Skills (VS) & Skill Enhancement (SE) Courses		Ability Enhancement (AE), Indian Knowledge System (IKS), Value Education (VE) Courses			Field Projects / Community Engagement (CE) Projects, Internship (INT), and Co-curricular (CC) Courses			Credits	Cumulative Credits
		Basic Science (BS) Courses	Engineering Science (ES) Courses	Major / Professional Core (PC) Courses	Major / Professional Elective - Department-level (PE-DLC) Courses	Multi-disciplinary Minor (MM) Courses	Open Elective - Institute-level (OE-ILC) Courses	VS - SAT Courses	SE - SAT Courses	AE - SAT Courses	IKS - SAT Courses	VE - SAT Courses	CE - Project-Based Learning (PBL)	INT	CC - SAT Courses		
Level 4.5	I	9	8					1				1			2	21	42
	II	9	8					1		2	1					21	
Exit Option with UG Certificate in Technology with Additional 08 Credit Bridge Course Corresponding to Skill-Based Courses / Internship / Mini Projects in Major																	
Level 5.0	III	4		15					1				1			21	85
	IV	4		11		4			1	1			1			22	
Exit Option with UG Diploma in Technology with Additional 08 Credit Bridge Course Corresponding to Skill-Based Courses / Internship / Mini Projects in Major																	
Level 5.5	V			11	4	3			1			2	1			22	130
	VI			8	4	3	3	2					3			23	
Exit Option with Bachelor's Degree in Vocation (B. Voc.) with Additional 08 Credit Bridge Course Corresponding to Skill-Based Courses / Internship / Mini Projects in Major																	
Level 6.0	VII			8	7		3						6			24	174
	VIII			8										12		20	
Total		**26**	**16**	**61**	**15**	**10**	**6**	**4**	**3**	**3**	**1**	**3**	**12**	**12**	**2**	**174**	

SEMESTER III

TEACHING SCHEME

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
ITC301	Applications of Mathematics in Engineering – I	3 – 0 – 1	04	3 – 0 – 1	04	BS
ITC302	Data Structures and Analysis	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC303	Database Management System	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC304	Computer Organization and Architecture	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC305	Software Engineering	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITL302	Data Structures Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL303	SQL Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL304	Microprocessor & Microcontroller Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITPR31	Community Engagement PBL – Mini Project I	0 – 2 – 0	02[$]	0 – 1 – 0	01	PBL
ITXS37	Skill Enhancement - SAT VII: Skill-Based Learning (Java Programming)	0 – 2* – 0	02	0 – 1 – 0	01	SE-SAT
Total		**15 – 10 – 1**	**26**	**15 – 5 – 1**	**21**	

*SAT can be conducted as TH or P or both as required.

[$]Load of learner, not the faculty.

EXAMINATION SCHEME

Course Code	Course Name	CA Marks			ESE		TW / O / P Marks				Total Marks
		T1	T2	T = T1 + T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
ITC301	Applications of Mathematics in Engineering – I	20	20	40	60	2.5	25	-	-	-	125
ITC302	Data Structures and Analysis	20	20	40	60	2.5	-	-	-	-	100
ITC303	Database Management System	20	20	40	60	2.5	-	-	-	-	100
ITC304	Computer Organization and Architecture	20	20	40	60	2.5	-	-	-	-	100
ITC305	Software Engineering	20	20	40	60	2.5	-	-	-	-	100
ITL302	Data Structures Lab	-	-	-	-	-	25	-	-	25	50
ITL303	SQL Lab	-	-	-	-	-	25	-	-	25	50
ITL304	Microprocessor & Microcontroller Lab	-	-	-	-	-	25	-	-	-	25
ITPR31	Community Engagement PBL – Mini Project I	-	-	-	-	-	25	-	-	25	50
ITXS37	Skill Enhancement - SAT VII: Skill-Based Learning (Java Programming)	-	-	-	-	-	25	-	-	-	25
Total		**100**	**100**	**200**	**300**	**-**	**150**	**-**	**-**	**75**	**725**

SEMESTER IV

TEACHING SCHEME

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
ITC401	Applications of Mathematics in Engineering – II	3 – 0 – 1	04	3 – 0 – 1	04	BS
ITC402	Computer Network and Network Design	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC403	Operating Systems	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC404	Automata Theory	3 – 0 – 0	03	3 – 0 – 0	03	PC
MMC405	Multidisciplinary Minor Course	3 – 0 – 0	03	3 – 0 – 0	03	MM
ITL402	Network Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL403	Unix Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
MML405	Multidisciplinary Minor Lab	0 – 2 – 0	02	0 – 1 – 0	01	MM
ITPR42	Community Engagement PBL – Mini Project II	0 – 2 – 0	02[$]	0 – 1 – 0	01	PBL
ITXS48	Skill Enhancement – SAT VIII: Skill-Based Learning (Python Programming)	0 – 2[*] – 0	02	0 – 1 – 0	01	SE-SAT
ITXS49	Ability Enhancement – SAT IX: Skill-Based Learning (Foreign and/or Indian Modern Languages)	0 – 2[*] – 0	02	0 – 1 – 0	01	AE-SAT
Total		**15 – 12 – 1**	**28**	**15 – 6 – 1**	**22**	

[*]SAT can be conducted as TH or P or both as required.

[$]Load of learner, not the faculty.

EXAMINATION SCHEME

Course Code	Course Name	CA Marks			ESE		TW / O / P Marks				Total Marks
		T1	T2	T = T1 + T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
ITC401	Applications of Mathematics in Engineering – II	20	20	40	60	2.5	25	-	-	-	125
ITC402	Computer Network and Network Design	20	20	40	60	2.5	-	-	-	-	100
ITC403	Operating Systems	20	20	40	60	2.5	-	-	-	-	100
ITC404	Automata Theory	20	20	40	60	2.5	-	-	-	-	100
MMC405	Multidisciplinary Minor Course	-	-	-	-	-	50	50	-	-	100
ITL402	Network Lab	-	-	-	-	-	25	-	-	25	50
ITL403	Unix Lab	-	-	-	-	-	25	-	25	-	50
MML405	Multidisciplinary Minor Lab	-	-	-	-	-	25	-	-	-	25
ITPR42	Community Engagement PBL – Mini Project II	-	-	-	-	-	25	-	-	25	50
ITXS48	Skill Enhancement – SAT VIII: Skill-Based Learning (Python Programming)	-	-	-	-	-	25	-	-	-	25
ITXS49	Ability Enhancement – SAT IX: Skill-Based Learning (Foreign and/or Indian Modern Languages)	-	-	-	-	-	25	-	-	-	25
Total		**80**	**80**	**160**	**240**	-	**225**	**50**	**25**	**50**	**750**

SEMESTER V

TEACHING SCHEME

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
ITC501	Internet Programming	3[#] – 0 – 0	03	3 – 0 – 0	03	PC
ITC502	Data Mining for Artificial Intelligence	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC503	Cyber Security	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITDLC504	Major / Professional Elective – Department-level Course – I	3 – 0 – 0	03	3 – 0 – 0	03	PE-DLC
MMC505	Multidisciplinary Minor Course	3 – 0 – 0	03	3 – 0 – 0	03	MM
ITL502	AI Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL503	Security Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITDLL504	Major / Professional Elective – Department-level Lab – I	0 – 2 – 0	02	0 – 1 – 0	01	PE-DLC
ITPR53	Community Engagement PBL – Minor Project (Internet Programming)	0 – 2 – 0	02[$]	0 – 1 – 0	01	PBL
ITXS510	Skill Enhancement – SAT X: Skill-Based Learning (Aptitude / Logic Building & Competitive Programming)	0 – 2[*] – 0	02	0 – 1 – 0	01	SE-SAT
ITXA511	Value Education – SAT XI: Activity-Based Learning (Business Communication & Ethics)	0 – 4[**] – 0	04	0 – 2 – 0	02	VE-SAT
Total		**15 – 14 – 0**	**29**	**15 – 7 – 0**	**22**	

[*]SAT can be conducted as TH or P or both as required.

[**]02 Hours class-wise and 02 Hours batch-wise.

[$]Load of learner, not the faculty.

[#]TH and P blended learning.

EXAMINATION SCHEME

Course Code	Course Name	CA Marks			ESE		TW / O / P Marks				Total Marks
		T1	T2	T = T1 + T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
ITC501	Internet Programming	20	20	40	60	2.5	-	-	-	-	100
ITC502	Data Mining for Artificial Intelligence	20	20	40	60	2.5	-	-	-	-	100
ITC503	Cyber Security	20	20	40	60	2.5	-	-	-	-	100
DLC504	Major / Professional Elective - Department-level Course – I	20	20	40	60	2.5	-	-	-	-	100
MMC505	Multidisciplinary Minor Course	-	-	-	-	-	50	50	-	-	100
ITL502	AI Lab	-	-	-	-	-	25	-	25	-	50
ITL503	Security Lab	-	-	-	-	-	25	-	-	-	25
ITDLL504	Major / Professional Elective - Department-level Lab – I	-	-	-	-	-	25	-	-	-	25
ITPR53	Community Engagement PBL – Minor Project (Internet Programming)	-	-	-	-	-	25	-	-	25	50
ITXS510	Skill Enhancement – SAT X: Skill-Based Learning (Aptitude / Logic Building & Competitive Programming)	-	-	-	-	-	25	-	-	-	25
ITXA511	Value Education – SAT XI: Activity-Based Learning (Business Communication & Ethics)	-	-	-	-	-	25	25	-	-	50
Total		**80**	**80**	**160**	**240**	**-**	**200**	**75**	**25**	**25**	**725**

Professional Electives - Department Level Elective Courses and Labs (PE-DLC – I)

Group A: Artificial Intelligence	**Group B: Project Management**	**Group C: Multimedia & User Experience**	**Group D: Interdisciplinary Technology**
Explainable Data Science (ITDLC5041)	Advanced Software Engineering and Project Management (ITDLC5042)	Computer Vision (ITDLC5043)	IoT and Smart Cities (ITDLC5044)
Data Science Lab (ITDLL5041)	DevOps Lab (ITDLL5042)	Computer Vision Lab (ITDLL5043)	IoT Lab (ITDLL5044)

SEMESTER VI
TEACHING SCHEME

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
ITC601	Web X.0	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC602	Natural Language Programming	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITDLC603	Major / Professional Elective - Department-level Course – II	3 – 0 – 0	03	3 – 0 – 0	03	PE-DLC
MMC604	Multidisciplinary Minor Course	3 – 0 – 0	03	3 – 0 – 0	03	MM
ILC605	Open Elective - Institute-level – I	3 – 0 – 0	03	3 – 0 – 0	03	OE-ILC
ITL601	Web Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL602	NLP Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITDLL603	Major / Professional Elective - Department-level Lab – II	0 – 2 – 0	02	0 – 1 – 0	01	PE-DLC
ITPR64	Community Engagement PBL – Innovation-Based Major Project A	0 – 6 – 0	06[$]	0 – 3 – 0	03	PBL
ITXT612	Vocational Skill – SAT XII: Technology-Based Learning	0 – 4[*] – 0	04	0 – 2 – 0	02	VS-SAT
Total		**15 – 16 – 0**	**31**	**15 – 8 – 0**	**23**	

[*]SAT can be conducted as TH or P or both as required.

[$]Load of learner, not the faculty.

EXAMINATION SCHEME

Course Code	Course Name	CA Marks			ESE		TW / O / P Marks				Total Marks
		T1	T2	T = T1 + T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
ITC601	Web X.0	20	20	40	60	2.5	-	-	-	-	100
ITC602	Natural Language Programming	20	20	40	60	2.5	-	-	-	-	100
ITDLC603	Major / Professional Elective - Department-level Course – II	20	20	40	60	2.5	-	-	-	-	100
MMC604	Multidisciplinary Minor Course	-	-	-	-	-	50	50	-	-	100
ILC605	Open Elective - Institute-level – I	20	20	40	60	2.5	-	-	-	-	100
ITL601	Web Lab	-	-	-	-	-	25	-	-	25	50
ITL602	NLP Lab	-	-	-	-	-	25	-	25	-	50
ITDLL604	Major / Professional Elective - Department-level Lab – II	-	-	-	-	-	25	-	-	-	25
ITPR64	Community Engagement PBL – Innovation-Based Major Project A	-	-	-	-	-	25	-	-	50	75
ITXT612	Vocational Skill – SAT XII: Technology-Based Learning	-	-	-	-	-	50	-	-	-	50
Total		**80**	**80**	**160**	**240**	**-**	**200**	**50**	**25**	**75**	**750**

Professional Electives - Department Level Elective Courses and Labs (PE-DLC – II)

Group A: Artificial Intelligence	Group B: Project Management	Group C: Multimedia & User Experience	Group D: Interdisciplinary Technology
Machine Learning and Deep Learning (ITDLC6031)	Performance Analysis of Computer Algorithms & Systems (ITDLC6032)	Geographical Information System (ITDLC6033)	Digital Agricultural and Healthcare (ITDLC6034)
Machine Learning Lab (ITDLL6031)	Algorithm Analysis Lab (ITDLL6032)	Spatial Computing Lab (ITDLL6033)	AgriTech and HealthTech Lab (ITDLL6034)

Open Elective - Institute Level Elective Course (OE-ILC – I)

Open Elective - Institute-level (OE-ILC) Courses
Product Lifecycle Management (ILC6051)
Reliability Engineering (ILC6052)
Management Information System (ILC6053)
Design of Experiments (ILC6054)
Operations Research (ILC6055)
Cyber Security and Laws (ILC6056)
Disaster Management & Mitigation Measures (ILC6057)
Energy Audit and Management (ILC6058)
Development Engineering (ILC6059)

SEMESTER VII

TEACHING SCHEME

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
ITC701	Blockchain Technology	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC702	Generative Artificial Intelligence	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITDLC703	Major / Professional Elective - Department-level Course – III	3 – 0 – 0	03	3 – 0 – 0	03	PE-DLC
ITDLC704	Major / Professional Elective - Department-level Course – IV	3 – 0 – 0	03	3 – 0 – 0	03	PE-DLC
ILC705	Open Elective - Institute-level – II	3 – 0 – 0	03	3 – 0 – 0	03	OE-ILC
ITL701	Blockchain Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL702	GenAI Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITDLL704	Major / Professional Elective - Department-level Course – IV Lab	0 – 2 – 0	02	0 – 1 – 0	01	PE-DLC
ITPR75	Community Engagement PBL - Innovation-Based Major Project B	0 – 12 – 0	12*	0 – 6 – 0	06	PBL
Total		**15 – 18 – 0**	**33**	**15 – 9 – 0**	**24**	

*Load of learner, not the faculty.

EXAMINATION SCHEME

Course Code	Course Name	CA Marks			ESE		TW / O / P Marks				Total Marks
		T1	T2	T = T1 + T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
ITC701	Blockchain Technology	20	20	40	60	2.5	-	-	-	-	100
ITC702	Generative Artificial Intelligence	20	20	40	60	2.5	-	-	-	-	100
ITDLC703	Major / Professional Elective - Department-level Course – III	20	20	40	60	2.5	-	-	-	-	100
ITDLC704	Major / Professional Elective - Department-level Course – IV	20	20	40	60	2.5	-	-	-	-	100
ILC705	Open Elective - Institute-level – II	20	20	40	60	2.5	-	-	-	-	100
ITL701	Blockchain Lab	-	-	-	-	-	25	-	-	25	50
ITL702	GenAI Lab	-	-	-	-	-	25	-	-	25	50
ITDLL704	Major / Professional Elective - Department-level Course – IV Lab	-	-	-	-	-	25	-	-	25	50
ITPR75	Community Engagement PBL - Innovation-Based Major Project B	-	-	-	-	-	50	-	-	100	150
Total		**100**	**100**	**200**	**300**	**-**	**125**	**-**	**-**	**175**	**800**

Professional Elective – Department Level Elective Courses & Labs (PE-DLC – III & PE-DLC – IV)

Group A: Artificial Intelligence	**Group B: Project Management**	**Group C: Multimedia & User Experience**	**Group D: Interdisciplinary Technology**
Reinforcement Learning (ITDLC7031)	Cyber-Secured Project Management (ITDLC7032)	Edge Computing (ITDLC7033)	Drone Technology and Space Technology (ITDLC7034)
Security in AI Systems (ITDLC7041)	Software Testing & Quality Assurance (ITDLC7042)	Augmented Reality / Virtual Reality (ITDLC7043)	Climate Technology and Finance Technology (ITDLC7044)
MLSecOps Lab (ITDLL7041)	System Testing Lab (ITDLL7042)	AR/VR Lab (ITDLL7043)	ClimateTech and FinTech Lab (ITDLL7044)

Open Elective - Institute Level Elective Course (OE-ILC – II)

Open Elective - Institute-level (OE-ILC) Courses
Project Management (ILC7051)
Finance Management (ILC7052)
Entrepreneurship Development and Management (ILC7053)
Human Resource Management (ILC7054)
Professional Ethics and CSR (ILC7055)
Research Methodology (ILC7056)
IPR and Patenting (ILC7057)
Digital Business Management (ILC7058)
Environmental Management (ILC7059)

SEMESTER VIII

TEACHING SCHEME

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
ITC801	Agentic AI	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC802	Introduction to Quantum Computing	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITL801	Agentic AI Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL802	Quantum Computing Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
INT801	Internship	0 – 24 – 0	24	0 – 12 – 0	12	INT
Total		**6 – 28 – 0**	**34**	**6 – 14 – 0**	**20**	

EXAMINATION SCHEME

Course Code	Course Name	CA Marks			ESE		TW / O / P Marks				Total Marks
		T1	T2	T = T1 + T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
ITC801	Agentic AI	20	20	40	60	2.5	-	-	-	-	100
ITC802	Introduction to Quantum Computing	20	20	40	60	2.5	-	-	-	-	100
ITL801	Agentic AI Lab	-	-	-	-	-	25	-	-	25	50
ITL802	Quantum Computing Lab	-	-	-	-	-	25	-	-	25	50
INT801	Internship	-	-	-	-	-	200	200	-	-	400
Total		**40**	**40**	**80**	**120**	-	**250**	**200**	-	**50**	**700**

SEMESTER V

TEACHING SCHEME

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
ITC501	Internet Programming	3[#] – 0 – 0	03	3 – 0 – 0	03	PC
ITC502	Data Mining for Artificial Intelligence	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC503	Cyber Security	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITDLC504	Major / Professional Elective – Department-level Course – I	3 – 0 – 0	03	3 – 0 – 0	03	PE-DLC
MMC505	Multidisciplinary Minor Course	3 – 0 – 0	03	3 – 0 – 0	03	MM
ITL501	AI Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL502	Security Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITDLL504	Major / Professional Elective – Department-level Lab – I	0 – 2 – 0	02	0 – 1 – 0	01	PE-DLC
ITPR53	Community Engagement PBL – Minor Project (Internet Programming)	0 – 2 – 0	02[$]	0 – 1 – 0	01	PBL
ITXS510	Skill Enhancement – SAT X: Skill-Based Learning (Aptitude / Logic Building & Competitive Programming)	0 – 2[*] – 0	02	0 – 1 – 0	01	SE-SAT
ITXA511	Value Education – SAT XI: Activity-Based Learning (Business Communication & Ethics)	0 – 4[**] – 0	04	0 – 2 – 0	02	VE-SAT
Total		**15 – 14 – 0**	**29**	**15 – 7 – 0**	**22**	

[*]SAT can be conducted as TH or P or both as required.

[**]02 Hours class-wise and 02 Hours batch-wise.

[$]Load of learner, not the faculty.

[#]TH and P blended learning.

EXAMINATION SCHEME

Course Code	Course Name	CA Marks			ESE		TW / O / P Marks				Total Marks
		T1	T2	T = T1 + T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
ITC501	Internet Programming	20	20	40	60	2.5	-	-	-	-	100
ITC502	Data Mining for Artificial Intelligence	20	20	40	60	2.5	-	-	-	-	100
ITC503	Cyber Security	20	20	40	60	2.5	-	-	-	-	100
DLC504	Major / Professional Elective - Department-level Course – I	20	20	40	60	2.5	-	-	-	-	100
MMC505	Multidisciplinary Minor Course	-	-	-	-	-	50	50	-	-	100
ITL501	AI Lab	-	-	-	-	-	25	-	25	-	50
ITL502	Security Lab	-	-	-	-	-	25	-	-	-	25
ITDLL504	Major / Professional Elective - Department-level Lab – I	-	-	-	-	-	25	-	-	-	25
ITPR53	Community Engagement PBL – Minor Project (Internet Programming)	-	-	-	-	-	25	-	-	25	50
ITXS510	Skill Enhancement – SAT X: Skill-Based Learning (Aptitude / Logic Building & Competitive Programming)	-	-	-	-	-	25	-	-	-	25
ITXA511	Value Education – SAT XI: Activity-Based Learning (Business Communication & Ethics)	-	-	-	-	-	25	25	-	-	50
Total		**80**	**80**	**160**	**240**	**-**	**200**	**75**	**25**	**25**	**725**

Professional Electives - Department Level Elective Courses and Labs (PE-DLC – I)

Group A: Artificial Intelligence	**Group B: Project Management**	**Group C: Multimedia & User Experience**	**Group D: Interdisciplinary Technology**
Explainable Data Science (ITDLC5041)	Advanced Software Engineering and Project Management (ITDLC5042)	Computer Vision (ITDLC5043)	IoT and Smart Cities (ITDLC5044)
Data Science Lab (ITDLL5041)	DevOps Lab (ITDLL5042)	Computer Vision Lab (ITDLL5043)	IoT Lab (ITDLL5044)

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITC501	Internet Programming	03	-	-	03

Prerequisites:	Knowledge of Basic Programming, Java Programming, Basic HTML and CSS.
Course Objectives (COBs):	1. To orient students to Web Programming fundamental. 2. To expose students to JavaScript to develop interactive web page development. 3. To expose students front end application designing using basic and advanced React. 4. To orient students to Fundamentals of Node.js. 5. To expose students to Node.js applications using express framework. 6. To gain expertise in a leading document-oriented NoSQL database, designed for speed, scalability, and developer agility using MongoDB.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Describe protocols or technologies required for various web applications. 2. Apply JavaScript to add functionality to web pages. 3. Design front-end applications using concepts React. 4. Design back-end applications using Node.js. 5. Develop web based Node.js applications using Express. 6. Apply MongoDB for frontend and backend connectivity using REST API.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction	-	02	02
1. Web Programming Fundamentals	Working of Web Browser, HTTP Protocol, HTTPS, DNS, TLS	CO1	01	04
	XML Introduction, JSON Introduction, DOM, URL, URI, REST API	CO1	03	
2. JavaScript	Introduction to ES6, Difference Between ES5 and ES6	CO2	01	07
	Variables, Condition, Loops, Functions, Events, Arrow Functions	CO2	02	
	DOM Manipulation, Classes and Inheritance	CO2	02	
	Iterators and Generators, Promise, Client-Server Communication, Fetch	CO2	02	
3. React Fundamentals and Advanced	Installation, Installing Libraries, Folder and File Structure, Components, Component Lifecycle	CO3	02	10
	State and Props., React Router and Single Page Applications, UI Design	CO3	02	
	Forms, Events, Animations	CO3	02	
	Functional Components - Refs, Use effects, Hooks, Flow architecture	CO3	02	
	Model - View-Controller Framework, Flux, Bundling the Application. Web Pack	CO3	02	
4. Node.js	Environment Setup, First App, Asynchronous Programming, Callback Concept	CO5	02	05
	Event Loops, REPL, Event Emitter	CO5	01	

	Networking Module, Buffers, Streams, File System, Web Module	CO5	02	
5. Express	Introduction, Express Router, REST API	CO5	01	04
	Generator, Authentication, Sessions	CO5	01	
	Integrating with React	CO5	02	
6. MongoDB and Building REST API using MongoDB	MongoDB: Understanding MongoDB, MongoDB Data Types, Administering User Accounts, Configuring Access Control	CO6	02	09
	Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Accessing and Manipulating MongoDB Documents from Node.js	CO6	03	
	REST API: Examining the rules of REST APIs, Evaluating API patterns, handling typical CRUD functions (create, read, update, delete)	CO6	02	
	Using Express and Mongoose to interact with MongoDB	CO6	02	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	-	01	01

Text Books:	1. V. Subramaniam, Rediscovering JavaScript, Master ES6, ES7, and ES8, Pragmatic Bookshelf. 2. A. Banks and E. Porcello, Learning React Functional Web Development with React and Redux, O'Reilly. 3. Vasan Subramanian Pro MERN Stack Full Stack Web App Development with Mongo, Express, React, and Node, Apress. 4. A. Mead, Learning Node.js Development, Packt Publishing.
Reference Books:	1. E. Brown, Web Development with Node and Express, O'Reilly. 2. V. Bojinov, RESTful Web API Design with Node.js 10, Packt Publication.
Useful Links:	1. https://reactjs.org/tutorial/tutorial.html 2. https://react-redux.js.org/introduction/quick-start 3. https://webpack.js.org/ 4. https://www.youtube.com/watch?v=-27HAh8c0YU 5. https://www.coursera.org/specializations/website-development 6. https://onlinecourses.nptel.ac.in/noc20_cs52/preview
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITC502	Data Mining for Artificial Intelligence	03	-	-	03

Prerequisites:	Database Management Systems
Course Objectives (COBs):	1. To introduce the concept of data warehouse data mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage. 2. To enable students to effectively identify sources of data and process it for data mining. 3. To make students well versed in all data mining algorithms, methods of evaluation. 4. To impart knowledge of tools used for data mining. 5. To provide knowledge on how to gather and analyze large sets of data to gain useful business understanding. 6. To impart skills that can enable students to approach business problems analytically identifying opportunities to derive business value from data.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Explain the concepts of Data Warehousing and Data Mining and their role in developing Artificial Intelligence solutions. 2. Apply data exploration and preprocessing techniques to prepare high-quality data for mining tasks. 3. Apply classification and prediction techniques, and evaluate model performance using appropriate accuracy and error measures. 4. Apply clustering and outlier detection methods to discover patterns and anomalies in data. 5. Apply frequent pattern mining techniques to extract associations, correlations, and relevant patterns from large datasets. 6. Apply data mining to design AI solutions by systematically identifying suitable techniques at each step of the KDD process, ensuring scalable implementation and incorporating ethics.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Introduction to Data Warehousing and Mining	Characteristics of Data Warehouses, Dimensional Modelling: Star and Snowflakes Schema, OLAP Operations, OLTP vs OLAP.	CO1	03	06
	KDD Process, Kind of Patterns to be Mined, Technologies Used, Data Mining Applications.		03	
2. Data Exploration and Data Pre-processing	Types of Attributes, Statistical Description of Data, Measuring Data Similarity and Dissimilarity.	CO2	02	06
	Need of Data Pre-processing, Data Cleaning, Data Integration, Data Reduction: Attribute Subset Selection, Histograms, Clustering, Sampling, Data Cube Aggregation, Data Transformation and Data	CO3	04	

	Discretization: Normalization, Binning, Histogram Analysis.			
3. Classification	Basic Concepts, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Bayesian Classification: Naïve Bayes Classifier.	CO4	04	07
	Prediction: Structure of Regression Models, Simple Linear Regression.	CO4	01	
	Accuracy and Error Measures, Precision, Recall, Holdout, Random Sampling, Cross Validation, Bootstrap.	CO5	01	
4. Clustering and Outlier Detection	Cluster Analysis: Basic Concepts; Partitioning Methods: K-Means, K-Medoids, Hierarchical Methods: Agglomerative, Divisive, Density-Based Methods: DBSCAN.	CO4, CO5	05	07
	Introduction to Outliers, Types, Challenges; Outlier Detection Methods: Supervised, Semi-Supervised, Unsupervised, Proximity-based, Clustering-based.	CO4	03	
5. Frequent Pattern Mining	Basic Concepts: Market Basket Analysis, Frequent Itemset, Closed Itemset, Association Rules, Frequent Itemset.	CO4	02	07
	Mining Methods: The Apriori Algorithm: Finding Frequent Itemset Using Candidate Generation, Generating Association Rules from Frequent Itemset, Improving the Efficiency of Apriori, Pattern Growth Approach for Mining Frequent Itemset, Mining Frequent Itemset using Vertical Data Formats.	CO4, CO5	04	
	Introduction to Advance Pattern Mining: Mining Multilevel Association Rules and Multidimensional Association Rules.	CO4	01	
6. Evolving Data Mining into Applied Artificial Intelligence	Integrating Data Mining Outputs into AI Systems, Deployment Considerations: Scalability, Model Updating, Ethical Aspects, Introduction to Big Data Analytics (BDA) for Scalable Data Mining.	CO1, CO6	02	06
	Case Studies of AI Applications: Fraud Detection with Classification and Anomaly Detection, Recommender Systems using Frequent Pattern Mining and Clustering, Sentiment Analysis and Text Mining for Natural Language Processing, Image Data Mining for Computer Vision Tasks.	CO6	04	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	-	01	01
Text Books:	1. J. Han, M. Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann. 2. P. Tan, M. Steinbach, V. Kumar, Introduction to Data Mining, Pearson. 3. P. Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, Wiley. 4. G. Shmueli, N. Patel, P. Bruce, Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner, Wiley.			

Reference Books:	1. M. Berry, G. Linoff, Data Mining Techniques, Wiley. 2. V. Pudi, R. Krishna, Data Mining, Oxford Higher Education. 3. R. Shankarmani and M. Vijayalakshmi, Big Data Analytics, Wiley Publications.
Useful Links:	1. https://nptel.ac.in/courses/106/105/106105174/ 2. https://www.coursera.org/specializations/data-warehousing/ 3. https://www.coursera.org/learn/business-intelligence-tools 4. https://www.coursera.org/learn/business-intelligence-data-analytics
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITC503	Cyber Security	03	-	-	03

Prerequisites:	Computer Networks, Operating System.
Course Objectives (COBs):	1. To introduce students to the fundamentals of cyber security. 2. To identify cyberattack stages, social engineering tactics, botnets, and cyberstalking behaviour. 3. To recognize mobile threats, wireless risks, and common cybercrime attack techniques. 4. To understand digital forensics, mobile security, and organizational security policy measures. 5. To understand network and cloud forensics, incident response, and forensic auditing. 6. To introduce AI applications in cybersecurity, including ethics and case studies.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to- 1. Understand cybersecurity concepts, threats, attacks, cybercrime, and legal frameworks. 2. Explain attack planning, cyber kill chain, social engineering, and cyberstalking. 3. Identify mobile vulnerabilities, cybercrime tools, and wireless network security threats. 4. Apply forensic techniques, analyze digital evidence, and assess mobile policies. 5. Analyze forensic models, investigate network incidents, and evaluate cloud evidence. 6. Apply AI to detect threats, manage risks, and analyze cases.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction	-	02	02
1. Introduction To Cyber Crime	Introduction to Cyber Security, Need and Challenges, CIA, Security Services, Security Mechanisms. OSI security Architecture, Threads, Attacks (including zero day and advanced persistent threats).	CO1	04	08
	Cyber Space, Cyber Crime and Information Security, Cybercriminals, The Legal Perspective, Cyber Crime and Indian ITA 2000, Categories of Cyber Crime, Cybercafe and Cybercrime.	CO1	04	
2. Cyber Offences	Attack Planning, Cyber kill chain and attack lifecycle, Social Engineering, Reconnaissance, Botnets, Attack Vector.	CO2	02	04
	Cyberstalking: Types of Stalkers, Case reported on Cyberstalking, How Stalking Works, Real-life Incident Stalking.	CO2	02	
3. Cybercrime Devices and Tools	Mobile and Wireless Devices: Proliferation of Mobile and Wireless Devices, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones.	CO3	04	09

	Tools and Methods Used in Cybercrime: Proxy Servers and Anonymizers, Password Cracking, Keyloggers and Spywares, Steganography, SQL Injection, Buffer Overflow, Attacks on Wireless Networks , DoS and DDoS Attacks, phishing and Identity Theft, Malware.	CO3	05	
4. Computer Forensics and Mobile Devices	Computer Forensics: Historical Background of Cyber forensics, Digital Forensics Science, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept.	CO4	04	07
	Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era.	CO4	03	
5. Network and Cloud Forensics	Network Forensics: Approaching a Computer Forensics Investigation, Relevance of the OSI 7 Layer Model to Computer Forensics, Incidence Response Lifecycle.	CO5	04	07
	Cloud Forensics: Cloud Services model, Need and Challenges, Cloud forensic tools, Forensics Auditing, Antiforensics.	CO5	03	
6. Trends in Forensics	Introduction to AI in Cybersecurity, AI for Malware and Phishing Detection, AI for Vulnerability and Risk Management.	CO6	02	04
	Ethical, Legal, and Practical Issues. Case Studies on AI in Cybersecurity, case study on IoT and Cybersecurity.	CO6	02	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization.	-	01	01

Text Books:	1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley. 2. Mayank Bhushan, Rajkumar, Singh, Aatif Jamshed Fundamental of Cyber Security (Principles, Theory and Practices), BPB publications. 3. Sherri Davidoff Jonathan, HAM Network Forensics, Pearson. 4. Sharron Ferrone, Ethically Hacking an Industrial Control System, BPB publications.
Reference Books:	1. Behrouz A. Ferouzan, Cryptography and Network Security, Tata Mc Graw Hill. 2. Nipun Jaswal, Mastering Network Forensics, BPB publications. 3. William Stallings, Cryptography and Network Security, Principles and Practice, Pearson Education. 4. Jaagoteens, Cyber Safety for Everyone: A comprehensive guide to online Safety, BPB publications.
Useful Links:	1. https://onlinecourses.nptel.ac.in/noc25_ee54/preview 2. https://onlinecourses.nptel.ac.in/noc23_cs127/preview
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLC5041	Explainable Data Science	03	-	-	03

Prerequisites:	Understanding of data, basic Python/R Programming.
Course Objectives (COBs):	1. Understand the foundational concepts, scope, and real-world applications of AI and Data Science. 2. Analyze how to organize, clean, and transform raw data using Excel tools and functions. 3. Learn to model data and create interactive business dashboards using Power BI. 4. Understand how to visualize multi-dimensional data using Tableau's advanced features. 5. Understand the concept and methods of making AI/ML models interpretable and transparent. 6. Understand how to present trustworthy insights and avoid misleading interpretations in data visualizations and AI outputs.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Explain key concepts and real-world use cases of AI and distinguish between machine learning and data science. 2. Examine data using Power Query, formulas, pivot tables, and charts in Excel. 3. Design dynamic dashboards with calculated KPIs, slicers, and analytical visuals in Power BI. 4. Design interactive Tableau dashboards using parameters, filters, maps, and multiple chart types. 5. Apply model-agnostic and interpretable ML techniques such as SHAP, LIME, and decision trees. 6. Identify bias and ethical issues in dashboards and explain AI decisions with respect to data privacy laws like GDPR and DPDP Act.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Introduction to Data Science and Explainability	Introduction to Data Science and Artificial Intelligence, Role of Data Science in real-world applications, Introduction to Explainable AI (XAI): Need and Scope	CO1	04	04
	Types of explainable AI models, Introduction to data storytelling and interpretability, Overview of Data Analysis tools: Excel, Power BI, Tableau	CO1	03	
2. Data Analysis using Excel	Excel fundamentals and data preparation, Data organization and lookup, Power Query for transformation and shaping	CO2	03	06
	Data summarization with Pivot Tables and basic charts, Conditional formatting for insight-driven visuals, Descriptive & Inferential Statistics in Excel, Forecasting & Predictive Modelling, Power Tools: Power Query, Power Pivot & DAX, Interactive Dashboards &	CO2	03	

	Reporting, Optimization & What-If Analysis, Advanced Formulas & Automation			
3. Dashboard Development in Power BI	Data model creation: relationships and hierarchies, DAX basics: calculated columns, measures, KPIs, Time-series analysis: rolling averages, YTD/MTD	CO3	04	06
	Forecasting visual, decomposition tree, and key influencer visual, Interactive dashboards with slicers, filters, and tooltips	CO3	03	
4. Visual Analytics using Tableau	Connecting to data and building visualizations, Working with dimensions, measures, and calculated fields, Using filters, groups, hierarchies, and parameters	CO4	04	07
	Dual-axis charts, map visualizations, Designing a multi-sheet dashboard with interactivity	CO4	03	
5. Explainable Machine Learning	Concept of interpretability, Interpretable Models, Model-Agnostic methods of interpretability	CO5	04	07
	Example Based Explanations, Integrating explainability outputs into visual tools	CO5	03	
6. Responsible Data Insights and Ethics	Designing dashboards for interpretability and trust, avoiding misleading visuals: ethical storytelling, Introduction to bias and fairness in AI	CO6	03	07
	Data privacy and compliance: overview of DPDP Act 2025 and GDPR, Real-world case studies of interpretable dashboards in healthcare, HR, finance	CO6	04	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization.	-	01	01

Text Books:	1. J. VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data. 2. C. Molnar, Interpretable Machine Learning, Creative Commons License. 3. W. Samek, G. Montavon, A. Vedaldi, L. Hansen and K. Muller, Explainable AI: Interpreting, Explaining and Visualizing Deep Learning, Springer 4. V. Dignum, Responsible Artificial Intelligence, Springer
Reference Books:	1. C. M. Bishop, Pattern Recognition and Machine Learning. 2. T. Hastie, R. Tibshirani, and J. Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction. 3. I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. 4. S. Raschka and V. Mirjalili, Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2.
Useful Links:	1. https://ps-iitd.vlabs.ac.in/ 2. https://github.com/tulip-lab/math-foundation-for-data-scientists
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 03 Hours.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLC5042	Advanced Software Engineering and Project Management	03	-	-	03

Prerequisites:	Fundamentals of Software Engineering.
Course Objectives (COBs):	1. To provide the knowledge of advanced concepts in software engineering discipline. 2. To describe software designing methods. 3. To understand IT project management. 4. To describe risk and software configuration management for quality software solutions. 5. To understand design, the architecture of software systems in various architectural styles and patterns. 6. To provide the knowledge of distributed software engineering.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Explain Agile Software Engineering. 2. Explain Software design methods. 3. Explain concepts of IT Project Management. 4. Describe risk and software configuration management. 5. Design various architectural styles and patterns of software systems. 6. Explain concepts of Distributed Software Engineering.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Software Engineering Models and Agile Development	Capability Maturity Model (CMM), V-model, Incremental Models	CO1	02	07
	Evolutionary Process Models, Agile process, Introduction, Agile Principles, Agile methodologies: Agile Methodologies: XP, FDD, DSDM, Crystal. Agility Principles, Extreme Programming (XP), Scrum, Kanban Model	CO1	05	
2. Software Design Engineering	Design Process & Quality, Design Concepts, The Design Model, Design Decisions, Views, Patterns, Application Architectures	CO2	04	07
	User Interface Design: The Golden Rules, Interface Design Steps & Analysis, Design Evaluation	CO2	03	
3. IT Project Management	Management Spectrum, 3Ps (People, Product and Process) Process and Project Metrics	CO3	01	07
	Introduction to 4 P's, W^5HH Principle, Need for Project Management, Project Life Cycle and ITPM, Project Feasibility. Project Cost Control (PERT/Cost), Resource Scheduling & Resource Levelling	CO3	03	
	RFP, PMBOK Knowledge areas, Business case, Project Planning, Project charter and Project scope, WBS.	CO3	03	

4. Risk Management & Configuration Management	Risk Identification, Risk Assessment, Risk Projection, Risk management process, RMMM	CO4	03	08
	Software Configuration Management, SCM Repositories, SCM Process	CO4	02	
	Software Quality Assurance Task and Plan, Metrics, Software Reliability, Formal Technical Review (FTR), Walkthrough, Dynamics Testing	CO4	03	
5. Designing Architectures	Design Process, Architectural Conception, Refined Experience in Action: Styles and Architectural Patterns	CO5	03	04
	Architectural Conception in Absence of Experience, Putting it all Together: Design Processes Revisited	CO5	03	
6. Introduction to Distributed Software Engineering	Motivations for Micro Services, Types of Micro Services, Small and focused Loosely coupled Micro Services	CO6	03	06
	Comparing Micro Services and Monolithic Architectures, Benefits from Micro Services, Challenges with Monolithic Architecture	CO6	03	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	-	01	01

Text Books:	1. R. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill. 2. R. Mall, Fundamentals of Software Engineering, PHI. 3. T. Jach, Marchewka, Information Technology Project Management, Wiley. 4. N. Taylor, N. Medvidovic, E. Dashofy, Software Architecture: Foundations, Theory, and Practice, Wiley. 5. L. Bass, P. Clements, R. Kazman, Software Architecture in Practice, Pearson.
Reference Books:	1. P. Jalote, An Integrated Approach to Software Engineering, Narosa Publication. 2. I. Sommerville, Software Engineering, Addison-Wesley.
Useful Links:	1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview 2. https://www.coursera.org/specializations/software-development-lifecycle 3. https://www.youtube.com/watch?v=wEr6mwquPLY 4. https://nptel.ac.in/courses/110104073
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 03 Hours.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLC5043	Computer Vision	03	-	-	03

Prerequisites:	Image Processing, Artificial Intelligence.
Course Objectives (COBs):	1. To review image processing techniques for computer vision. 2. To understand shape and region analysis. 3. To understand Hough Transform and its applications to detect lines, circles, ellipses. 4. To understand three-dimensional image analysis techniques. 5. To understand motion analysis. 6. To implement computer vision algorithms for real-world problems.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Explain and apply fundamental image processing techniques required for computer vision. 2. Analyze shapes and regions using suitable algorithms. 3. Apply Hough Transform for line, circle, and ellipse detections. 4. Describe and analyze 3D vision techniques. 5. Describe motion analysis. 6. Describe applications using computer vision techniques.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction	-	02	02
1. Image Processing Foundation	Review of Image Processing Techniques, Comparison between Image Processing and Computer Vision	CO1	02	04
	Corner and Interest Point Detection, Texture and Co-Occurrence Matrix	CO1	02	
2. Shapes and Regions	Binary Shape Analysis, Connectedness, Object Labelling and Counting, Size Filtering, Distance Functions, Skeletons and Thickening and Thinning, Hole Filling	CO2	04	08
	Deformable Shape Analysis, Boundary Tracking Procedures, Active Contours, Shape Models and Shape Recognition, Centroidal Profiles, Handling Occlusion, Boundary Length Measures, Boundary Descriptors, Fourier Descriptors, Region Descriptors	CO2	04	
3. Hough Transforms	Line Detection, Hough Transform (HT) for Line Detection, Foot-of-Normal Method, Line Localization, Line Fitting, RANSAC for Straight Line Detection, HT Based Circular Object Detection, Accurate Centre Location, Speed Problem, Ellipse Detection	CO3	04	07
	Case study: Human Iris Location, Hole Detection, Generalized Hough Transform (GHT), Spatial Matched Filtering, GHT for Ellipse Detection, Object Location, GHT for Feature Collation	CO3	03	

4. 3D Vision	Methods For 3D Vision, Projection Schemes, Shape from Shading, Photometric Stereo, Shape from Texture, Shape from Focus	CO4	04	08
	Active Range Finding, Surface Representations, Point-Based Representation, Volumetric Representations, 3D Object Recognition, 3D Reconstruction, SIFT Algorithms	CO4	04	
5. Introduction to Motion	Triangulation, Bundle Adjustment, Translational Alignment, Parametric Motion	CO5	03	06
	Spline-Based Motion, Optical Flow, Layered Motion	CO5	03	
6. Applications and Case studies	Implementation of Application Like Face Recognition, Specific Examples on Surveillance, Foreground-Background Separation	CO6	03	06
	Human Tracking and Image and Video Occlusion, Human Gait Analysis, Locating Roadway, Road Markings, Identifying Road Signs	CO6	03	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	-	01	01

Text Books:	1. D. Forsyth, J. Ponce, Computer Vision: A Modern Approach, Pearson. 2. J. Solem, Programming Computer Vision with Python: Tools and algorithms for analyzing images, O'Reilly. 3. S. Prince, Computer Vision: Models, Learning, and Inference, Ambridge University Press. 4. M. Sonka, Image Processing Computer Vision, Elsevier.
Reference Books:	1. M. Nixon and A. Aquado, Feature Extraction & Image Processing for Computer Vision, Academic Press. 2. R. Jain, R. Kasturi, B. SchunckSahni, Machine Vision, Indo American Books. 3. R. Szeliski, Computer Vision: Algorithms and Applications, Springer.
Useful Links:	1. https://nptel.ac.in/courses/106/105/106105216/# 2. https://www.coursera.org/learn/computer-vision-basics
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 03 Hours.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLC5044	IoT and Smart Cities	03	-	-	03

Prerequisites:	Computer Organization & Architecture, Microprocessor & Microcontroller, Computer Networks.
Course Objectives (COBs):	1. To explore the role of IoT in transforming traditional infrastructure into smart infrastructure. 2. To understand the architecture and programming of Arduino and Raspberry Pi platforms. 3. To explore their integration in real-time smart city applications. 4. To apply suitable short- and long-range protocols in smart city scenarios. 5. To explore cloud platforms and dashboard tools for real-time monitoring. 6. To introduce the key security and privacy challenges in IoT systems for smart cities
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Understand the fundamental concepts of IoT and the architecture of smart cities. 2. Demonstrate the ability to interface and program Arduino and Raspberry Pi for smart city use cases. 3. Implement sensor-actuator integration for automation. 4. Explain and differentiate between various IoT protocols (MQTT, CoAP, LoRa). 5. Implement data visualization tools for smart cities with cloud access control. 6. Design secure and privacy-aware IoT systems for the development and analysis of smart city applications.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Introduction to Internet of Things (IoT)	Definition, Evolution, architecture and Key Characteristics (Connectivity, Intelligence, Scale).Components of an IoT system: Sensors, Actuators, Controllers, Gateways, Concept and components of smart cities, Role of IoT in smart infrastructure	CO1	02	05
	IoT Layer Architecture, IoT Devices, Gateways, and Cloud Platforms. Edge Computing vs. Cloud Computing in IoT (brief). Machine-to-Machine (M2M) Communication	CO1	02	
	Characteristics and Architecture of Smart Cities	CO1	01	
2. IoT Hardware for Smart City System	Introduction to Arduino Development Board, Arduino Architecture and Pin Diagram, Writing Arduino Programs using Arduino IDE, Use of Arduino Libraries for Efficient Programming, Basics of Embedded C Programming for IoT Application	CO2	04	08
	Introduction to Raspberry Pi Development Board, Overview of Raspberry Pi Architecture and GPIO Pin Diagram Setting up Raspbian OS and Python Environment, Basics of Python Programming on	CO2	04	

	Raspberry Pi			
3. Sensors and Actuators in Smart City Applications	Introduction to sensors and actuators in IoT-based smart cities, Key sensors: LDR (lighting), PIR (motion), IR (parking), DHT11 (climate), Ultrasonic (waste)	CO3	04	07
	Actuators: Relays (streetlights), Motors (gates), Buzzers (alerts), LEDs (status indicators),Sensor-actuator integration for automation, Real-time applications in smart parking, street lighting, waste and irrigation systems	CO3	03	
4. IoT Communication Protocols in Smart City Applications	Classification of IoT protocols: Perception, Network, and Application layers, Short-range protocols: Bluetooth, Zigbee, Wi-Fi for smart city automation	CO4	04	08
	Long-range protocols: LoRaWAN, NB-IoT. Application layer protocols: HTTP, MQTT, CoAP in smart city data transmission	CO4	04	
5. IoT Data Management and Cloud Platforms in Smart City Applications	Introduction to IoT data flow and its role in smart city systems, Data collection, filtering, and pre-processing techniques, Data storage solutions: local vs cloud-based for smart cities	CO5	03	06
	Cloud platforms: Thing Speak, Blynk, Firebase, AWS IoT for smart city monitoring, Real-time data visualization and dashboard creation, Data security and privacy concerns in smart city cloud integration	CO5	03	
6. IoT Security, Privacy, and Applications in Smart Cities	Introduction to IoT security and privacy challenges in smart cities, Common threats: data breaches, device spoofing, DoS attacks, Security measures: encryption, authentication, secure communication, Privacy-preserving techniques in smart city data systems	CO6	03	05
	Case studies: smart waste, smart traffic, smart lighting, Real-world smart city IoT implementations and best practices. Role of AI in IoT, Digital Twins	CO6	02	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	-	01	01

Text Books:	1. Hanes, D., Salgueiro, G., Grossetete, P., Barton, R., & Henry, J. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things. Pearson Education. 2. Chaouchi, H., The Internet of Things: Connecting Objects to the Web. Wiley. 3. Margolis, M., Arduino Cookbook. O'Reilly Media. 4. Monk, S., Raspberry Pi Cookbook: Software and Hardware Problems and Solutions. O'Reilly Media.
Reference Books:	1. Bahga, A., & Madisetti, V., Internet of Things: A Hands-On Approach. Universities Press. 2. Angelakis, V., Designing, Developing, and Facilitating Smart Cities: Urban Design to IoT Solutions. Springer. 3. McEwen, A., & Cassimally, H., Designing the Internet of Things. Wiley. 4. Norris, D., Raspberry Pi: Projects for the Evil Genius. McGraw-Hill Education. 5. Tamboli, A., Build Your Own IoT Platform: Develop a Fully Flexible and Scalable Internet of Things Platform in 24 Hours. Apress

Useful Links:	1. https://nptel.ac.in/courses/106/105/106105166/ 2. https://nptel.ac.in/courses/108/108/108108179/ 3. https://www.coursera.org/specializations/iot 4. https://www.coursera.org/specializations/uiuc-iot
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITL502	AI Lab	-	01	-	01

Hardware Requirements:	PC i3 Processor or above.
Software Requirements:	WEKA, Rapid Miner, Pentaho.
Lab Prerequisite:	Object Oriented Programming Concepts, Python.
Lab Objectives (LOBs):	1. To introduce the concept of data mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage. 2. To enable students to effectively identify sources of data and process it for data mining. 3. To make students well versed in all data mining algorithms, methods, and tools. 4. To learn how to gather and analyze large sets of data to gain useful business understanding. 5. To impart skills that can enable students to approach business problems analytically by identifying opportunities to derive business value from data. 6. To identify and compare the performance of business.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Identify sources of data for mining, design a Data Warehouse schema, and perform data exploration. 2. Organize and prepare the data needed for data mining algorithms in terms of attributes and class inputs, training, validating, and testing files. 3. Implement the appropriate data mining methods like classification, clustering or association mining on large data sets using open-source tools like WEKA. 4. Implement various data mining algorithms from scratch using languages like Python / Scilab / R, etc. 5. Analyse and compare performance of some available AI packages. 6. Apply AI to solve practical problems: Analyze the problem domain, use the data collected in enterprise apply the appropriate data mining technique, interpret and visualize the results and provide decision support.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites.	-	02
1	Designing Star and Snowflake Schema.	LO1	02
2	Exploration of WEKA and implementation of the following Data Mining tasks using WEKA: a. Data Exploration b. Data Preprocessing	LO1, LO2	02
3	Implementation of Data Preprocessing using Python / Scilab: a. Data Cleaning b. Handling Missing Data c. Data Transformation, etc.	LO1, LO2	02
4	Implementation of Data Visualization and Statistical Data Analysis using Python / Scilab: a. Plotting Bar Charts, Histograms, Scatter Plots, etc. b. Implementation of Chi-square test, correlation analysis, etc.	LO1, LO2	02

5	Perform, evaluate, and compare using open-source tools like WEKA: a. Classification Algorithms b. Clustering Algorithms c. Frequent Pattern Mining Algorithms	LO3	02
6	Implement and evaluate any Classification Algorithm using Python / R / Scilab.	LO4	02
7	Implement and evaluate any Clustering Algorithm using Python / R / Scilab.	LO4	02
8	Implement and evaluate any Frequent Pattern Mining Algorithm using Python / R / Scilab.	LO4	02
9	Detailed study of AI Tools for Fraud Detection & Data Mining: H2O.ai, DataRobot, Azure ML Studio, Google Vertex AI.	LO5	02
10	KDD & Artificial Intelligence Mini Project.	LO6	04

Virtual Lab Links:	1. https://cse20-iiith.vlabs.ac.in/ 2. https://www.iiitmk.ac.in/DAVirtalLab/ 3. http://cse06-iiith.virtual-labs.ac.in/ 4. http://cse22-iiith.vlabs.ac.in/
Term Work:	• Term work should consist of a minimum of 08 experiments. • Journal must include at least 02 assignments on content of theory of the course "Data Mining for Artificial Intelligence" and "AI Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.
Practical & Oral (P&O):	P&O examination will be based on the experiment list for Total 25 Marks (Practical: 15 Marks and 10 Marks).

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITL503	Security Lab	-	01	-	01

Hardware Requirements:	PC i3 Processor or above.
Software Requirements:	KALI LINUX
Prerequisites:	Computer Network
Lab Objectives (LOBs):	1. To introduce students to the fundamentals of information gathering and network scanning using industry-standard tools. 2. To simulate and analyze various types of network attacks 3. To provide hands-on experience with mobile and wireless security assessment tools such as Drozer and Needle. 4. To explore digital forensic techniques including disk imaging, deleted file recovery, and steganalysis. 5. To enable students to perform email, memory, and browser forensics for evidence acquisition and cybercrime analysis. 6. To study and analyze anti-forensic techniques and strengthen detection capabilities against data-hiding methods.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Demonstrate information gathering and network mapping using tools. 2. Analyze DoS attacks and investigate network traffic to identify anomalies and intrusion patterns. 3. Implement mobile application security testing using tools such as Drozer (Android) and Needle (iOS). 4. Apply disk imaging and recover deleted files from damaged or formatted partitions using forensic tools. 5. Analyze digital evidence through email headers, browser cache, password hashes, and memory dumps. 6. Evaluate anti-forensics techniques and apply steganography analysis to uncover hidden data.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites	-	02
1	To implement Information Gathering Using Tool.	LO1	02
2	To implement Network Mapper using NMAP/ TCP Dump.	LO1	02
3	To simulate DoS attack using tool like Wireshark.	LO2	02
4	To simulate Wireless security tool.	LO2	02
5	To implement an Android testing setup using an emulator or a physical device.	LO3	02
6	To simulate Disk Imaging and Cloning for File Recovery from Deleted Partitions	LO4	02
7	To implement File Recovery Techniques from Deleted Partitions	LO4	02
8	To implement Memory Forensics.	LO4	02
9	To implement Email Forensics.	LO5	02

10	To simulate Password Cracking and Analysis	LO5	02
11	To implement Steganography Detection and Analysis.	LO6	02
12	To simulate Anti-Forensics Techniques and Detection.	LO6	02
Virtual Lab Links:	1. https://archive.nptel.ac.in/courses/106/105/106105217/ 2. https://www.coursera.org/learn/certified-ethical-hacking-v12-ethical-hacking-fundamentals 3. https://www.coursera.org/learn/ethical-hacking-essentials-ehe		
Term Work (TW):	• Term work should consist of a minimum of 08 experiments. • Journal must include at least 02 assignments on content of theory of the course "Cyber Security" and "Security Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.		
Practical & Oral (P&O):	P&O examination will be based on the experiment list for Total 25 Marks (Practical: 15 Marks and Oral: 10 Marks).		

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLL5041	Data Science Lab	-	01	-	01

Hardware Requirements:	PC with i3 Processor or above, 8 GB RAM
Software Requirements:	Python/R/MATLAB
Lab Prerequisite:	Hands on Python/R/MATLAB
Lab Objectives (LOBs):	1. Understand the foundational concepts, scope, and real-world applications of AI and Data Science. 2. Analyze how to organize, clean, and transform raw data using Excel tools and functions. 3. Learn to model data and create interactive business dashboards using Power BI. 4. Understand how to visualize multi-dimensional data using Tableau's advanced features. 5. Understand the concept and methods of making AI/ML models interpretable and transparent. 6. Understand how to present trustworthy insights and avoid misleading interpretations in data visualizations and AI outputs.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Use key concepts and real-world use cases of AI and distinguish between machine learning and data science. 2. Analyze data using Power Query, formulas, pivot tables, and charts in Excel. 3. Design dynamic dashboards with calculated KPIs, slicers, and analytical visuals in Power BI. 4. Design interactive Tableau dashboards using parameters, filters, maps, and multiple chart types. 5. Apply model-agnostic and interpretable ML techniques such as SHAP, LIME, and decision trees. 6. Analyze bias and ethical issues in dashboards and explain AI decisions with respect to data privacy laws like GDPR and DPDP Act.

Lab No.	Experiment Title	LOs Mapped	Hours
0.	Lab Prerequisites.	-	02
1	Exploring Real-world Applications of AI and Machine Learning.	LO1	02
2	Use Excel tools to clean, transform, analyze, and forecast sales data, and then build an interactive dashboard for management reporting.	LO2	02
3	Analyze employee data to recommend optimal workforce allocation and salary planning using Solver and What-If Analysis tools.	LO2	02
4	Design an interactive dashboard to analyze customer retention and sales trends over time, using advanced DAX and time-series calculations using PowerBI.	LO3	02
5	Develop a comprehensive financial dashboard in Power BI that tracks actual vs. budgeted expenses and revenues, monitors cost overruns, and provides actionable insights for decision-makers.	LO3	02

6	Build an interactive Tableau dashboard that helps a company analyze sales performance across global markets, visualize market penetration by region, and identify high- and low-performing areas.	LO4	02
7	Develop a Tableau dashboard to monitor and analyze student performance and learning behavior across subjects, grades, and time periods, to support academic interventions.	LO4	02
8	Use black-box models to predict credit default and apply model-agnostic interpretability techniques like SHAP (Shapley Additive Explanations) and LIME (Local Interpretable Model-agnostic Explanations) to understand individual and global predictions.	LO5	02
9	Build interpretable models (e.g., decision trees, logistic regression) and compare them with black-box models in terms of accuracy and explainability on a medical diagnosis dataset.	LO5	02
10	Develop an interactive HR analytics dashboard that adheres to ethical data visualization practices, incorporates interpretability, and respects privacy and compliance regulations such as the DPDP Act 2025 (India) and GDPR.	LO6	04

Virtual Lab Links:	1. https://ps-iitd.vlabs.ac.in/ 2. https://github.com/tulip-lab/math-foundation-for-data-scientists
Term Work:	• Term work should consist of a minimum of 08 experiments. • Journal must include at least 02 assignments on content of theory course "Explainable Data Science" and "Data Science Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). The final certification and acceptance of term work is based on satisfactory performance of laboratory work and minimum passing marks in term work evaluation.

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLL5042	DevOps Lab	-	01	-	01

Hardware Requirements:	PC with i3 Processor or above, 8 GB RAM
Software Requirements:	Ubuntu PC
Lab Prerequisite:	Understanding of project management concepts.
Lab Objectives (LOBs):	1. To understand DevOps practices, which aim to simplify the software Development Life Cycle. 2. To be aware of different Version Control tools like GIT, CVS, or Mercurial. 3. To integrate and deploy tools like Jenkins and Maven, which are used to build, test, and deploy applications in a DevOps environment. 4. To be familiar with the Selenium tool, this is used for continuous testing of applications deployed. 5. To use Docker to build, ship, and manage applications using containerization. 6. To understand the concept of Infrastructure as a code and install and configure the Ansible tool, and to understand Kubernetes architecture.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Use Version Control for developing an application. 2. Use Jenkins to build and deploy Software Applications on the production environment. 3. Apply Automated Testing. 4. Create Containerized Application. 5. Use Software Configuration, Provisioning & Monitoring Tools. 6. Design an Application using Server less Computing & Micro services.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites.	-	02
1	Create a Sample Web Page & Upload Source Code on GitHub, & Perform different Git Operations.	LO1	02
2	Create a Jenkins CI/CD pipeline with GitLab Integration Pipeline.	LO1	02
3	Create a Jenkins Pipeline for Building a Python Project.	LO2	02
4	Install & Configure Docker and build a Docker image for deploying any web/Python/Java applications.	LO2	02
5	Implementation using Ansible: a. Install & Configure Ansible. b. Install LAMP/MEAN using Ansible Playbook.	LO3	02
6	Install & Configure Container Orchestration Tools Kubernetes.	LO4	02
7	To Perform Monitoring service using Prometheus/Graphana/Loki.	LO5	02
8	Perform Automation Testing using Selenium.	LO5	02
9	Study and implementation of infrastructure as code with Terraform.	LO6	02
10	Study experiment on Cloud Computing.	LO6	04

Virtual Lab Links:	1. https://www.azuredevopslabs.com 2. https://labex.io/

Term Work:	• Term work should consist of a minimum of 08 experiments. • Journal must include at least 02 assignments on content of theory course "Advanced Software Engineering and Project Management" and "DevOps Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks and Assignments: 05 Marks). • The final certification and acceptance of term work is based on satisfactory performance of laboratory work and minimum passing marks in term work evaluation.

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLL5043	Computer Vision Lab	-	01	-	01

Hardware Requirements:	PC i3 Processor or above.
Software Requirements:	MATLAB / Open CV, Python.
Prerequisites:	Computer Graphics, Image Processing.
Lab Objectives (LOBs):	1. To review image processing techniques for computer vision. 2. To describe shape and region analysis. 3. To explain Hough Transform and its applications to Edge linking lines, circles, ellipses. 4. To describe three-dimensional image analysis techniques. 5. To describe motion analysis. 6. To implement computer vision algorithms for real-world problems.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Implement fundamental image processing techniques required for computer vision. 2. Analyze shapes and regions using suitable algorithms. 3. Apply Hough Transform for edge linking of line, circle and ellipse detections. 4. Apply and analyze 3D vision techniques. 5. Implement motion analysis. 6. Develop applications using computer vision techniques, Team work and communication skills.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites	-	02
1	Implementation of Image Processing fundamentals: Corner and Interest Point Detection	LO1	02
2	Implementation and Processing of Shapes and Regions: a. Skeletons and Thickening and Thinning b. Boundary Detection Procedures.	LO2	02
3	Implementation of Line Detection through Hough Transforms or edge linking to Hough Transforms.	LO3	02
4	Implementation of RANSAC algorithm.	LO3	02
5	Implementation of 3D Vision Methods and conversion of 2D into 3D vision.	LO4	02
6	Implementation of applying texture to 3D image or vision.	LO4	02
7	Implementation of SIFT algorithm.	LO4	02
8	Implementation to measure distance between two Human in motion.	LO5	02
9	Implementation of spline-based motion algorithm.	LO5	02
10	Implementation of face recognition.	LO6	04
11	Development of a Computer Vision-based E-commerce Application for Product Detection and Recommendation.	LO6	04
12	Application Development: a. Surveillance b. Road Markings c. Object Location d. Hole Detection	LO6	04

Virtual Lab Links:	https://cse19-iiith.vlabs.ac.in/
Term Work (TW):	• Term work should consist of a minimum of 08 experiments. • Journal must include at least 02 assignments on content of theory of the course "Computer Vision" and "Computer Vision lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLL5044	IoT Lab	-	01	-	01

Hardware Requirements:	PC with i3 Processor or above, Arduino Board, Raspberry Pi Board, Sensors, Actuators.
Software Requirements:	Arduino IDE, Raspbian Operating System, ThingSpeak.
Lab Prerequisites:	Embedded C and Python Programming.
Lab Objectives (LOBs):	1. To explore the role of IoT in transforming traditional infrastructure into smart infrastructure. 2. To understand the architecture and programming of Arduino and Raspberry Pi platforms. 3. To explore their integration in real-time smart city applications. 4. To apply suitable short- and long-range protocols in smart city scenarios. 5. To explore cloud platforms and dashboard tools for real-time monitoring. 6. To introduce the key security and privacy challenges in IoT systems for smart cities
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Apply the fundamental concepts of IoT and the architecture of smart cities. 2. Demonstrate the ability to interface and program Arduino and Raspberry Pi for smart city use cases. 3. Implement sensor-actuator integration for automation. 4. Use various IoT protocols (MQTT, CoAP, LoRa). 5. Implement data visualization tools for smart cities with cloud access control. 6. Design secure and privacy-aware IoT systems for the development and analysis of smart city applications.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites.	-	02
1	Implementation of LED Fade In and Fade Out Using Control of LED via IoT.	LO1, LO2	02
2	Design of an Automatic Traffic Light Control System Using IoT Component.	LO2, LO3	02
3	Design and Implementation of an IoT-Based Temperature, Humidity, and Gas Detection System.	LO2, LO3	02
4	Designing and Testing LED Control via ESP8266 NodeMCU Web Server in Station Mode.	LO2, LO3, LO4	02
5	Implementation of Pi Camera Interfacing and Image Capture Using Raspberry Pi.	LO2, LO3, LO5	02
6	Design the blinking of an LED interfacing with Raspberry Pi.	LO1, LO2, LO3	02
7	Implement a mini project which will be related to Smart City Use Cases with Arduino and Raspberry pi. (List is attached for reference)	LO1-LO6	06

	• Smart Street Lighting System Using LDR and Motion Sensor (Arduino) • Smart Traffic Density-Based Signal Control (Arduino + Ultrasonic Sensors) • Environmental Monitoring System for Air Quality and Temperature (Raspberry Pi) • Smart Water Level Monitoring and Alert System (Arduino) • IoT-Based Smart Waste Bin Monitoring System (NodeMCU/Arduino + Raspberry Pi) • Smart Surveillance System with Image Capture and Email Alert (Raspberry Pi + Pi Camera) • Smart Door Lock System with RFID and Raspberry Pi • Real-Time Bus/Vehicle Tracking System (GPS + Raspberry Pi) • Home Automation System Using Arduino and Blynk App • Smart Parking System with Slot Detection and Cloud Update (Arduino + Ultrasonic Sensor + NodeMCU)		

Virtual Lab Links:	1. https://learniot.kjsieit.in/ 2. https://www.arduino.cc/ 3. https://www.iot4smes.eu/en/raspberrypi_simulator.aspx 4. https://www.labcenter.com/visualdesigner/raspberry-pi/
Term Work (TW):	• Term work should consist of a minimum of 05 experiments (From 1 to 6) and one mini project. • Journal must include at least 02 assignments on content of theory of course "IoT and Smart Cities" and "IoT Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 10, Mini project:10 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.
Practical & Oral (P&O):	P&O examination will be based on the experiment list for Total 25 Marks (Practical: 15 Marks and Oral: 10 Marks).

PBL Course Code	PBL Course Name	Credits			
		TH	P	TUT	Total
ITPR53	Community Engagement PBL – Minor Project (Internet Programming)	-	01	-	01

Hardware Requirements:	PC with i3 Processor or above, IoT Components.
Software Requirements:	JDK 8 or above, Node.js, React, MongoDB, Express.
Prerequisites:	Web Programming.
PBL Objectives (PROBs):	1. To create awareness among the students of the characteristics of several domain areas where IT can be effectively used. 2. To practice the process of identifying the needs and converting it into a problem statement. 3. To apply engineering knowledge and modern tools/technologies for deriving solutions to the real-world problems. 4. To inculcate the process of self-learning and research. 5. To be acquainted with solving the problem in a group. 6. To improve communication, management and report-writing skills of the students.
PBL Outcomes (PROs):	Upon completion of the course, the learners will be able to: 1. Identify societal / research needs, formulate problem statements, review research literature, and analyses complex engineering problems. 2. Design suitable solutions for the problems including scope, objectives, timeline, system flow, user interface, algorithms, etc. 3. Gather, analyse, and interpret data — and apply knowledge of engineering fundamentals, modern tools / technologies for development of solutions. 4. Analyze sustainability and scalability of the developed solution and its impact in terms of environmental, societal, safety, legal, cultural, health, etc. aspects. 5. Apply ethical principles, excel in written and oral communication, and engage in independent and life-long learning. 6. Interact efficiently and effectively as an individual with the team members or leader for timely and professional management of projects.
Guidelines for Project-Based Learning (PBL):	1. Students have to form a team of minimum 02 and maximum 04 members, based on their area of interest and size of project. Interdisciplinary (inter-branch) teams are encouraged. 2. Students should develop a Web Application using a suitable Internet Technology. 3. Students should carry out a survey and identify needs, which shall be converted into problem statement for Minor Project in consultation with Faculty Guide, Internal committee of faculties, and the Head of Department. 4. Projects on societal contribution (healthcare, agriculture, etc.) are preferred. Students should try to take up need-based live projects so as to get exposure to communication with beneficiaries and skills for understanding client requirements. 5. Based on the idea presentation as well as discussion on feasibility, novelty, and contribution of the idea, a project definition will be finalized. 6. Students shall submit their implementation plan in the form of Gantt / PERT / CPM chart, which will cover weekly activity of the Mini project. 7. A log book is to be prepared by each group, wherein the group can record weekly work progress and the Faculty Guide can verify and record notes / comments. 8. Students in a group shall understand the problem effectively, propose multiple solutions, and select the best possible solution in consultation with their guide.

	9. Students shall convert the best solution into a working model using various components of their domain areas and demonstrate. 10. The solution is to be validated with proper justification and report to be compiled in standard format of the Department. 11. With the focus on self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Minor Projects, if the problem statement is huge and significant, a same problem statement can be worked upon for 02 semesters, i.e., same Minor Project in Semesters V and VI. Projects with a very large scope can also be taken forward to higher semesters, in consultation with the Head of the Department. 12. Students are encouraged to participate in Technical Paper Presentation competitions. 13. The students' group shall complete a project in all aspects including: Identification of need / problem, proposed final solution, Procurement of components / systems / data, Building prototype and testing. 14. Three reviews will be conducted for continuous assessment: one shall be for finalization of the problem and proposed solution, second shall be for evaluation of work progress, and third shall be for evaluation of implementation and testing of solutions. 15. Minor Project shall be assessed based on following parameters: • Attainment of Course Outcomes. • Technical efficiency and quality of developed solution. • Innovativeness in solutions. • Impact on environment. • Cost effectiveness. • Sustainability analysis. • Societal impact. • Effective use of standard engineering norms. • Contribution of an individual as member or leader. • Clarity in written and oral communication. 16. Students are encouraged to publish a paper based on the work in Conferences / Student competitions.
Useful Learning Links:	1. https://www.coursera.org/projects/build-a-full-website-using-wordpress 2. https://www.coursera.org/specializations/website-development 3. https://www.coursera.org/specializations/full-stack-react 4. https://www.coursera.org/specializations/web-design 5. https://www.udemy.com/course/ux-web-design-master-course-strategy-design-development/ 6. https://onlinecourses.swayam2.ac.in/cec21_lb01/preview
Term Work (TW):	• Term Work shall be granted based individual's contribution in group activity, their understanding and response to questions. • Term Work evaluation shall be for Total 25 Marks — based on the following evaluation: o Presentation in Review 1 o Presentation in Review 2 o Presentation in Review 3 o Project Report and Log Book
Practical & Oral (P&O):	P&O examination will be of Total 25 Marks and shall be based on the Project Demonstration, Presentation, and Report.

Exposure Course Code	Exposure Course Name	Credits			
		TH	P	TUT	Total
ITXS510	Skill Enhancement – SAT X: Skill Based Learning (Aptitude/Logic Building & Competitive Programming)	-	01	-	01

Hardware Requirements:	PC with i3 Processor or above.
Software Requirements:	Turbo C, JDK, Python, MySQL.
Skill Prerequisites:	Knowledge of Elementary Mathematics (HSC level), Knowledge of Basic English Grammar (SSC level), Knowledge of Basic Programming Languages.
Skill Objectives (SOBs):	1. To create the basic awareness about how to prepare for recruitment process. 2. To introduce the students to computational skills required to appear for recruitment tests. 3. To introduce the students to programming skills required to appear for recruitment tests/ project /coding competitions.
Skill Outcomes (SOs):	Upon completion of the course, the learners will be able to: 1. Solve problems that require Quantitative Ability. 2. Solve problems that Logical, Verbal and Non-Verbal Reasoning Skills. 3. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability. 4. Solve basic problems of Competitive Programming. 5. Solve advanced problems for Competitive Programming including Data Structures, Code Optimization, etc. 6. Solve campus placements papers covering Competitive Programming and Competitive Programming competition problem statements.

Module No. and Name	Subtopics	SOs Mapped	Hours / Subtopic	Total Hours / Module
1. Basics of Quantitative Abilities	Problems on Number System, HCF and LCM, Algebra, Profit & Loss, Average & Allegation / Mixture	SO1, SO3	02	04
	Problems on Ratio and Proportion, Percentage, Time and Work, Geometry Mensuration	SO1, SO3	02	
2. Arithmetic Quantitative Abilities	Problems on Ages, Permutation and Combination, Probability, Time and Distance	SO1, SO3	02	04
	Problems on Simple and Compound Interest, Boats & Stream, Pipes & Cisterns, Height & Distance	SO1, SO3	02	
3. Logical, Verbal and Non-Verbal Reasoning	Analytical, Puzzles, Blood relationship, Data Interpretation, Data sufficiency, Logical Deductions, Logical Sequence of Words	SO2, SO3	02	04
	Logical Venn Diagrams, Statement and Arguments, Statement and Assumptions, Statement and Conclusions	SO2, SO3	02	

4. Programming Techniques	Introduction to Competitive Programming, Programming Contests, Platforms for Competitive Programming Practice, Language Features	SO4, SO6	02	04
	Different approaches to solve programming problems	SO4, SO6	02	
5. Data Structures, Analysis and Optimization	Code Optimization, Programming Questions with Time Complexity	SO5, SO6	03	06
	Dynamic Programming Problems, Sorting, Searching	SO5, SO6	03	
6. Advanced Data Structures and Mathematical Problems	Intermediate Algorithms: String Manipulation, Bit Manipulation, Intermediate Data Structures: Trees, Set, Map, Heap, Graph	SO5, SO6	03	06
	Greedy Algorithms, Game Theory, Tries, Segment Trees, Suffix Tree, Suffix Array, Graph Colouring	SO5, SO6	03	
Text Books:	1. A. Sharma, How to Prepare for Quantitative Aptitude for CAT, McGraw Hill. 2. R. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand. 3. R. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand. 4. A. Laaksonen, Guide to Competitive Programming Learning and Improving Algorithms through Contests, Springer.			
Reference Books:	1. S. Skiena, The Algorithm Design Manual, Springer. 2. T. Cormen, Introduction to Algorithms, PHI. 3. S. Halim, F. Halim, S. Effendy, Competitive Programming 4 - Book 1: The Lower Bound of Programming Contests in the 2020s.			
Useful Learning Links:	1. https://onlinecourses.nptel.ac.in/noc21_cs99/preview 2. https://unacademy.com/a/i-p-c-beginner-track 3. https://www.coursera.org/learn/competitive-programming-core-skills 4. https://www.coursera.org/learn/computational-thinking-problem-solving 5. https://www.faceprep.in/c/competitive-programming/ 6. https://www.geeksforgeeks.org/competitive-programming-a-complete-guide/ 7. https://www.hackerrank.com/ 8. https://www.codechef.com/ 9. https://codeforces.com/ 10. https://www.codingninjas.com/codestudio 11. https://practice.geeksforgeeks.org/ 12. https://leetcode.com/problemset/all/			
Term Work (TW):	Term Work evaluation shall be for Total 25 Marks (Quiz / Mini-challenge: 10 Marks and Active Participation: 15 Marks) • Quiz / Mini-challenge: Evaluation shall be conducted for every module. The average of all quizzes / mini-challenges shall be considered for assigning the marks. • Active Participation: Marks will be awarded based on students' participation in SBL sessions; presenting/showcasing learned skills through Events / Competitions / Trainings / Internships, etc.; Submission of Report / Progress of problem solving on various platforms; Achievements / Recognitions, etc.			

Lab Code	Lab Name	Credits			
		TH	P	TUT	Total
ITXA511	Value Addition – SAT XI : Activity-Based Learning (Business Communication & Ethics)	-	02	-	02

Hardware Requirements:	PC i3 Processor or above.
Software Requirements:	Language Laboratory Software: ODLL (Oréll Digital Language Lab).
Prerequisites:	Fundamental knowledge of Professional Communication Skills as acquired in Semester II.
Lab Rationale:	This curriculum is designed to build up a professional and ethical approach, effective oral and written communication with enhanced soft skills. Through practical sessions, it augments student's interactive competence and confidence to respond appropriately and creatively to the implied challenges of the global Industrial and Corporate requirements. It further inculcates the social responsibility of engineers as technical citizens.
Lab Objectives (LOBs):	1. To discern and develop an effective style of writing important technical/business documents. 2. To investigate possible resources and plan a successful job campaign. 3. To comprehend the dynamics of professional communication in the form of group discussions, meetings, etc. required for career enhancement. 4. To develop creative and impactful presentation skills. 5. To analyze personal traits, interests, values, aptitudes and skills. 6. To understand the importance of integrity and develop a personal code of ethics.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Plan and prepare effective business/technical documents which will in turn provide a solid foundation for their future managerial roles. 2. Strategize their personal and professional skills to build a professional image and meet the demands of the industry. 3. Emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations. 4. Deliver persuasive and professional presentations. 5. Develop creative thinking and interpersonal skills required for effective professional communication. 6. Apply codes of ethical conduct, personal integrity and norms of organizational behaviour.

Module No. and Name	Subtopics	LOs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Lab Outline	Prerequisite Concepts and Course Introduction.	-	01	01
1. Advanced Technical Writing: Project / Problem	Classification of Reports: Classification on the basis of Subject Matter (Technology, Accounting, Finance, Marketing, etc.), Time Interval (Periodic, One-time, Special), Function (Informational, Analytical, etc.), Physical Factors (Memorandum, Letter, Short & Long)	LO1, LO6	01	06

Based Learning	Parts of a Long Formal Report: Prefatory Parts (Front Matter), Report Proper (Main Body), Appended Parts (Back Matter)	LO1, LO6	01	
	Language and Style of Reports: Tense, Person & Voice of Reports, Numbering Style of Chapters, Sections, Figures, Tables and Equations, Proofreading Through Plagiarism Checkers	LO1, LO6	01	
	Definition, Purpose & Types of Proposals: Solicited (in conformance with RFP) & Unsolicited Proposals, Types (Short and Long proposals)	LO1, LO6	01	
	Parts of a Proposal: Elements, Scope and Limitations, Conclusion	LO1, LO6	01	
	Technical Paper Writing: Parts of a Technical Paper (Abstract, Introduction, Research Methods, Findings and Analysis, Discussion, Limitations, Future Scope and References), Language and Formatting, Referencing in IEEE Format	LO1, LO6	01	
2. Employment Skills	Cover Letter & Resume: Parts and Content of a Cover Letter, Difference between Bio-data, Resume & CV, Essential Parts of a Resume, Types of Resumes (Chronological, Functional & Combination)	LO2, LO4	01	06
	Verbal Aptitude Test: Modelled on CAT, GRE, GMAT exams	LO2, LO4	01	
	Group Discussions: Purpose of a GD, Parameters of Evaluating a GD	LO2, LO4	01	
	Types of GDs (Normal, Case-based & Role Plays)	LO2, LO4	01	
	GD Etiquettes	LO2, LO4	01	
	Personal Interviews: Planning and Preparation, Types of Questions, Types of Interviews (Structured, Stress, Behavioural, Problem Solving & Case-based), Modes of Interviews: Face-to-face (One-to one and Panel) Telephonic, Virtual	LO2, LO4	01	
3. Business Meetings	Conducting Business Meetings: Types of Meetings, Meeting Etiquettes	LO3, LO6	01	02
	Documentation: Notice, Agenda, Minutes	LO3, LO6	01	
4. Technical / Business Presentations	Effective Presentation Strategies: Defining Purpose, Analyzing Audience, Location and Event Gathering, Selecting & Arranging Material	LO4, LO2	01	02
	Structuring a Presentation, Making Effective Slides, Types of Presentations Aids, Closing a Presentation.	LO4, LO2	01	
5. Interpersonal Skills	Emotional Intelligence	LO5, LO6	01	08
	Motivation	LO5, LO6	01	

	Assertiveness	LO5, LO6	01	
	Time Management	LO5, LO6	02	
	Stress Management	LO5, LO6	02	
	Start-up Skills: Financial Literacy, Risk Assessment, Data Analysis (E.g. Consumer Behaviour, Market Trends, etc.)	LO5, LO6	01	
6. Corporate Ethics	Intellectual Property Rights: Copyrights, Trademarks, Patents	LO6	01	02
	Case Studies: Cases related to Business / Corporate Ethics	LO5, LO6	01	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	-	01	01

Activity No.	**Activity Title**	**Lab Hours / Activity**
1	Test of English as Foreign Language (TOEFL)	02
2	Group Discussion (Practice Session) – I	02
3	Group Discussion (Practice Session) – II	02
4	Final Group Discussion – I	02
5	Final Group Discussion – II	02
6	English Aptitude Test	02
7	Resume Writing	02
8	Mock Interview	02
9	Role Play Techniques for Interpersonal Skills	02
10	Project Report Presentation – I	02
11	Project Report Presentation – II	02
12	Technical Proposal	02
13	Corporate Ethics/Role Play/Case Studies	02
14	Business Meetings: Case Studies/Role Play	02

Text Books:	1. S. Kumar & P. Lata, Communication Skills Workbook, Oxford University Press. 2. C. Bovée, and J. Thill, Business Communication Today. Upper Saddle River, Pearson.
Reference Books:	1. V. Arms, Humanities for the Engineering Curriculum: With selected chapters from Olsen/Huckin: Technical Writing and Professional Communication, McGraw Hill. 2. J. Butterfield, Verbal Communication: Soft Skills for a Digital Workplace, Cengage Learning. 3. L. Masters, H. Wallace, and L. Harwood, Personal Development for Life and Work, Cengage Learning. 4. S. Robbins, T. Judge, and T. Campbell, Organizational Behaviour, Pearson. 5. M. Raman, S. Sharma, Technical Communication, Principles and Practice. Oxford University Press. 6. A. Ram, Place Mentor - Tests of Aptitude for Placement Readiness. Oxford University Press.

Useful Learning Links:	1. Interview techniques (How to answer tell me about yourself) - https://www.youtube.com/watch?v=m5kR7TPAkSw 2. The 4 types of team members you can hire - https://www.youtube.com/watch?v=5bYYFfpbSqc 3. Every Meeting Ever - https://www.youtube.com/watch?v=K7agjXFFQJU 4. TOEFL listening skill - https://www.youtube.com/watch?v=jSUh0Civuv4 5. MBA interview - https://www.youtube.com/watch?v=cwW9QBNuwCw 6. How to write a successful CV - https://www.youtube.com/watch?v=U0JAfqEak2c
Term Work (TW):	• Term work shall consist of a minimum of 08 assignments. • Term work evaluation shall be for Total 25 Marks based on Assignments (15 Marks) and Book Report (10 Marks). • The final certification and acceptance of term work will be based on attendance, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.
Oral (O):	Oral examination will be based on a Group Discussion (GD) and the Project/Book Report Presentation for Total 25 Marks (GD: 10 Marks and Presentation: 15 Marks).
Guidelines:	• The main body of the project/book report should contain a minimum 25 pages (excluding front and back matter). • The group size for the final report presentation should not be less than 05 students or exceed 07 students. • There will be an end–semester presentation based on the book report.

SEMESTER VI - B.TECH. (INFORMATION TECHNOLOGY)

TEACHING SCHEME

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		Course Category
		TH – P – TUT	Total	TH – P – TUT	Total	
ITC601	Web X.0	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITC602	Natural Language Programming	3 – 0 – 0	03	3 – 0 – 0	03	PC
ITDLC603	Major / Professional Elective – Department Level Course – II	3 – 0 – 0	03	3 – 0 – 0	03	PE-DLC
MMC604	Multidisciplinary Minor Course	3 – 0 – 0	03	3 – 0 – 0	03	MM
ILC605	Open Elective – Institute Level - I	3 – 0 – 0	03	3 – 0 – 0	03	OE-ILC
ITL601	Web Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITL602	NLP Lab	0 – 2 – 0	02	0 – 1 – 0	01	PC
ITDLL603	Major / Professional Elective – Department- Level Lab - II	0 – 2 – 0	02	0 – 1 – 0	01	PE-DLC
ITPR64	Community Engagement PBL – Innovation-Based Major Project A	0 – 6 – 0	06[$]	0 – 3 – 0	03	PBL
ITXT612	Vocational Skill – SAT XII: Technology-Based Learning	0 – 4[*] – 0	04	0 – 2 – 0	02	VS-SAT
Total		**15 – 16 – 0**	**31**	**15 – 8 – 0**	**23**	

[*]SAT can be conducted as TH or P or both as required.

[$]Load of learner, not the faculty.

EXAMINATION SCHEME

Course Code	Course Name	CA Marks			ESE		TW/O/P Marks				Total Marks
		T1	T2	T = T1 + T2	Marks	Duration (in Hrs)	TW	O	P	P&O	
ITC601	Web X.0	20	20	40	60	2.5	-	-	-	-	100
ITC602	Natural Language Programming	20	20	40	60	2.5	-	-	-	-	100
ITDLC603	Major / Professional Elective – Department Level Course – II	20	20	40	60	2.5	-	-	-	-	100
MMC604	Multidisciplinary Minor Course	-	-	-	-	-	50	50	-	-	100
ILC605	Open Elective – Institute Level - I	20	20	40	60	2.5	50	50	-	-	100
ITL601	Web Lab	-	-	-	-		25	-	-	25	50
ITL602	NLP Lab	-	-	-	-		25	-	25	-	50
ITDLL603	Major / Professional Elective – Department- Level Lab - II	-	-	-	-		25	-	-	-	50
ITPR64	Community Engagement PBL – Innovation-Based Major Project A	-	-	-	-		25	-	-	-	25
ITXT612	Vocational Skill – SAT XII: Technology-Based Learning	-	-	-	-		25	-	-	50	75
Total		**80**	**80**	**160**	**240**		**200**	**50**	**25**	**75**	**750**

Abbreviations: TH – Theory, P – Practical, TUT – Tutorial, PC – Professional Core Course, PE-DLC – Professional Elective - Department Level Elective Course, PBL – Project-Based Learning, SAT – Skill/Activity/Technology-Based Learning (Exposure Course), CA – Continuous Assessment, T1 – Test 1, T2 – Test 2, ESE – End Semester Exam, TW – Term Work, O – Oral Exam, P – Practical Exam, P&O – Practical & Oral Exam.

Professional Electives - Department Level Elective Courses and Labs (PE-DLC – II)

Group A: Artificial Intelligence	**Group B: Project & Management**	**Group C: Multimedia & User Experience**	**Group D: Interdisciplinary Technology**
Machine Learning and Deep Learning (ITDLC6031)	Performance Analysis of Computer Algorithms & Systems (ITDLC6032)	Geographical Information System (ITDLC6033)	Digital Agricultural and Healthcare (ITDLC6034)
Machine Learning Lab (ITDLL6031)	Algorithm Analysis Lab (ITDLL6032)	Spatial Computing Lab (ITDLL6033)	AgriTech and HealthTech Lab (ITDLL6034)

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITC601	Web X.0	03	-	-	03

Prerequisites:	Java Programming, Python Programming, Javascript, HTML, and CSS.
Course Objectives (COBs):	1. To understand evolution from Web 2.0 to Web 3.0, analytics, and semantic web. 2. To learn TypeScript fundamentals and understand how to use it in web application. 3. To develop dynamic frontends using Angular and understand its architecture. 4. To implement server-side logic using Flask framework. 5. To gain knowledge of Rich Internet Application Technologies. 6. To apply secure coding practices and understand web vulnerabilities.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Describe the basic concepts related to web analytics and semantic web. 2. Develop type-safe, maintainable code using TypeScript. 3. Create responsive single-page application using Angular. 4. Design web applications and backend services with Flask. 5. Describe and integrate AJAX and open-source frameworks for rich internet applications. 6. Identify and mitigate web vulnerabilities.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Web Analytics and Semantic Web	Web Analytics 2.0: Introduction, Components, Clickstream Analysis, Choosing optimal web analytics tools	CO1	03	05
	Web3.0 and Semantic Web: Characteristics, Semantic Stack, RDF, SPARQL, Ontology, N-Triples, and Turtle syntax, Introduction to GA4 and server-side tracking	CO1	02	
2. TypeScript for Scalable Web Applications	TypeScript Overview and Architecture, Environment Setup, Types, Variables, Operators	CO2	01	06
	Decision-making structures, Loops, Functions, Classes and Objects	CO2	02	
	Modules and Namespaces, TypeScript in modern frameworks	CO2	03	
3. Frontend Development with Angular	Angular vs AngularJS, Project Setup, Components: Lifecycle, Encapsulation, Interaction, Styling	CO3	02	09
	Templates: Interpolation, Binding Techniques (Event, Property, Two-way)	CO3	02	
	Directives: Attribute vs Structural, Routing & Navigation, Forms: Reactive Forms, Validation.	CO3	02	
	Testing: ng test, Debugging techniques	CO3	01	
	Angular Material & PWA integration basics	CO3	02	
4. Flask for Backend	Flask Environment Setup, App Routing, URL Building, Flask HTTP Methods	CO4	03	05

Development	Flask Request Object, Cookie Handling, File Uploading	CO4	02	
5. Rich Internet Applications & Frameworks	AJAX: Concepts, Working	CO5	02	06
	Building RIAs with AJAX Techniques: HTML5, CSS3, DOM, XML HTTP Requests, JavaScript, and Server-side integration with PHP	CO5	03	
	Introduction to CMS and Frameworks: Django, Drupal, Joomla	CO5	01	
6. Web Security and Secure Coding	Importance of Web Security, Common Attacks: XSS, CSRF, SQLi, Clickjacking, MITM, DoS, Code Injection	CO6	02	08
	Authentication vs Authorization, Secure practices: OAuth2, JWT, 2FA	CO6	02	
	CORS, CSP, Input Sanitization, Secure local/session storage	CO6	02	
	Secure API Practices, Security Headers, Security testing with Postman, Burp Suite, OWASP ZAP	CO6	02	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	-	01	01

Text Books:	1. B. Cherny, Programming TypeScript- Making Your Javascript Application Scale, O'Reilly Media Inc. 2. S. Holmes, C. Harber, Getting MEAN with Mongo, Express, Angular, and Node, Manning Publications. 3. M. Grinberg, "Flask Web Development: Developing Web Applications with Python", O'Reilly. 4. Andrew Hoffman, Web Application Security, O'Reilly Media Inc. 5. J. Hebeler, M. Fisher, R. Blace, A. Perez-Lopez, Semantic Web Programming, Wiley Publishing, Inc.
Reference Books:	1. Y. Fain and A. Moiseev, TypeScript Quickly, Manning Publications. 2. B. Dayley, B. Dayley, C. Dayley, Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications, 2nd Edition, Addison-Wesley Professional. 3. A. Bretz and C. Ihrig, Full Stack JavaScript Development with MEAN, SitePoint Pty. Ltd.Dr. D. Shah, Advanced Internet Programming, StarEdu Solutions.
Useful Links:	1. https://onlinecourses.swayam2.ac.in/cec21_lb01/preview 2. https://www.coursera.org/lecture/single-page-web-apps-with-angularjs 3. https://www.coursera.org/learn/microsoft-web-development-with-python
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITC602	Natural Language Programming	03	-	-	03

Prerequisites:	Fundamentals of Mathematics with basic knowledge of Probabilities, Theory of Computer Science and Python for programming assignment.
Course Objectives (COBs):	1. To introduce the basics of natural language processing and its real-world applications. 2. To understand word formation and apply rule-based methods for morphological analysis. 3. To learn sentence structure using grammar rules and parsing techniques. 4. To understand meaning representation and interpretation of words in language. 5. To study conversation structure, reference resolution, and basic dialogue system design. 6. To explore practical applications such as sentiment analysis, text classification, and information retrieval.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Apply basic text processing methods: tokenization, stemming, and lemmatization. 2. Use rule-based methods to analyze word forms and structures. 3. Design and use grammar rules to parse simple sentences. 4. Apply methods to find and compare meanings of words in text. 5. Create simple dialogue systems and resolve references in text. 6. Develop NLP tools like sentiment analyzers, classifiers, and search models.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Introduction to NLP and Text Processing	What is Natural Language Processing (NLP)? History of NLP, Generic NLP System, Levels of NLP, Knowledge in Language Processing, Ambiguity in Natural Language, Stages in NLP, Challenges of NLP, Processing Indian Languages, Applications of NLP	CO1	03	05
	Basic Text Processing: Tokenization, Stop word Removal, Stemming and Lemmatization, Regular Expressions and Tokenization, Introduction to NLP Tools: NLTK, SpaCy	CO1	02	
2. Word Level Analysis	Morphological analysis: Inflection, derivation, Finite State Automata for morphology, Morphological parsing Language Models: N-grams, Spelling Error Detection and Correction, Smoothing Techniques	CO2	03	06
	Perplexity Text Classification: Bag-of-Words, TF-IDF, Naive Bayes, Evaluation Metrics: Precision, Recall, F1-Score, Confusion Matrix	CO2	03	
3. Syntax Analysis and Parsing	Parts of Speech (POS) Tagging: Penn Treebank and Universal POS tags, Rule-based vs. stochastic tagging (e.g., HMM), Conditional Random Field (CRF) Noun Phrase Chunking and Shallow Parsing: BIO tagging scheme, Chunk patterns and evaluation	CO3	03	07

	Context-Free Grammars (CFGs): Grammar rules and derivations, Ambiguity in parsing, Top-down and Bottom-up Parsing: Recursive descent, shift-reduce parsing, Backtracking issues	CO3	02	
	CYK Algorithm: Parsing with dynamic programming, Conversion to CNF and Chart Parsing, Dependency Parsing: Directed acyclic graphs, Transition-based and graph-based approaches	CO3	02	
4. Semantics Analysis	Lexical Semantics: Synonymy, antonymy, hyponymy, polysemy, WordNet, VerbNet, FrameNet, Word Sense Disambiguation (WSD): Knowledge-based, supervised, unsupervised methods, Sense inventory and context features	CO4	03	07
	Compositional Semantics: First-order predicate logic, Lambda calculus and quantifiers, Semantic Role Labelling (SRL): PropBank roles, Frame identification and argument labelling	CO4	02	
	Vector Semantics and Distributional Hypothesis: Co-occurrence matrices, Similarity metrics (cosine, Jaccard) Word Embeddings: Word2Vec: CBOW and Skip-Gram, GloVe and context-based models.	CO4	02	
5. Discourse and Pragmatics	Discourse Coherence and Cohesion: Discourse relations, Anaphora and ellipsis resolution, Hobbs algorithm, machine learning-based resolution, Pronoun resolution challenges in Indian languages	CO5	03	07
	Rhetorical Structure Theory (RST): EDU segmentation, Discourse trees and relations, Dialogue Acts and Structure: Speech act theory-assertive, directives, Dialogue corpora and annotation, Intent	CO5	02	
	Detection and Dialogue Management-Rule-based vs. ML-based intent classifiers, Slot filling, context tracking Evaluation of Dialogue Systems: BLEU, METEOR, user satisfaction, Human-in-the-loop evaluation	CO5	02	
6. NLP Applications and Case Studies	Implementation of Applications like Machine Translation, Information Retrieval, Question Answers System. Categorization, Summarization, Sentiment Analysis, Named Entity Recognition	CO6	03	07
	Recent Researches in Natural Language Processing. , Understanding and Fine-Tuning Pre-trained Language Models.	CO6	02	
	Introduction to Ethical and Societal Implications of LLMs, Introduction to Agentic AI to create smart language agents.	CO6	02	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization.	-	01	01

Text Books:	1. Daniel Jurafsky. James H. Martin, Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition with Language Models 2. T. Siddiqui and U. Tiwari, Natural Language Processing and Information Retrieval, Oxford University Press
Reference Books:	1. S. Bird, E. Klein, Natural Language Processing with Python, O Reilly 2. D. Bikel and I. Zitouni, Multilingual Natural Language Processing Applications, Pearson
Useful Links:	1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview 2. https://archive.nptel.ac.in/courses/106/106/106106211/ 3. https://www.nltk.org/book/ 4. https://web.stanford.edu/class/cs224n/
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLC6031	Machine Learning and Deep Learning	03	-	-	03

Prerequisites:	Fundamentals of Neural Networks and Fundamentals of Mathematics.
Course Objectives (COBs):	1. To understand the fundamentals concepts of Machine Learning. 2. To understand the functioning of Neural Networks. 3. To understand need and apply concepts of Ensemble Learning. 4. To design Convolutional Neural Network for real-life application. 5. To design Recurrent Neural Network for real-life applications. 6. To understand advanced concepts in Deep Learning.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Explain the Machine Learning components and challenges. 2. Apply Ensemble methods for performance enhancement of Machine Learning algorithms and analyze their performance. 3. Explain the concepts of Neural Networks, its algorithms, applications, and limitations. 4. Apply Convolutional Neural Networks for real-world applications. 5. Apply Recurrent Neural Networks for real-world applications. 6. Apply advanced techniques in Deep Learning.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction.	-	02	02
1. Machine Learning Fundamentals	Introduction to Machine Learning (ML): Applications, Data, Types.	CO1	01	07
	Designing a Machine Learning Model: Project Setup, Data Pipeline, Modeling, Serving.	CO1	03	
	Probability Theory: Random Variables, Distributions, Maximum Likelihood Estimation, Bias and Variance.	CO1	02	
	Overfitting and Underfitting, Challenges Motivating Deep Learning.	CO1	01	
2. Ensemble Learning	Introduction of Ensemble Methods, Need and Usefulness in Enhancing ML Algorithms, Bagging, Boosting.	CO2	03	06
	Random Forest, Incremental Learning.	CO2	02	
	Performance Evaluation Metrics of ML Algorithms.	CO2	01	
3. Basic Neural Networks	Biological Neuron, Introduction to Neural Networks, Basic Architecture, Types of Neural Networks.	CO3	01	06
	Activation Functions, Single Layer Perceptron and Multilayer Perceptron, Multilayer Feed Forward Network (FFN).	CO3	02	
	Backpropagation Algorithm, Variations in Standard Backpropagation, Vanishing Gradient Problem, Exploding Gradient Problem.	CO3	03	

4. Convolutional Neural Networks	Introduction to Convolutional Neural Networks (CNN), Components, ReLU Layer, Training a Convolutional Network.	CO4	02	07
	Case Studies of Convolutional Architectures: AlexNet, GoogLeNet, ResNet, The Effects of Depth, Pre-trained Models.	CO4	03	
	Applications of CNN.	CO4	02	
5. Recurrent Neural Networks	Introduction to Recurrent Neural Networks (RNN), Architecture, RNN versus CNN, RNN versus FNN.	CO5	02	07
	Training Recurrent Networks and Challenges Thereof, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRUs).	CO5	03	
	Applications of Recurrent Neural Networks.	CO5	02	
6. Advanced Topics in Deep Learning	Attention Mechanisms, Autoencoders, Generative Adversarial Networks (GANs), Training a GAN, Comparison with Variational Autoencoders (VAE).	CO6	03	06
	Using GANs for Generating Image Data, Conditional GANs, Evaluating Generative Models.	CO6	03	
ii. Course Conclusion	Recap of Modules, Outcome, Applications and Summarization.	-	01	01

Text Books:	1. S. Rose, L. Kumar, D Renuka, Deep Learning using Python, Wiley. 2. I. Goodfellow, Y. Bengio and A. Courville, Deep Learning, MIT Press. 3. T. Mitchell, Machine Learning, McGraw Hill.
Reference Books:	1. C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer. 2. J. Han, M. Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann. 3. M. Nielsen, Neural Networks and Deep Learning, Determination Press.
Useful Links:	1. http://neuralnetworksanddeeplearning.com/ 2. https://www.coursera.org/specializations/deep-learning 3. https://onlinecourses.nptel.ac.in/noc20_cs62/preview 4. https://onlinecourses.nptel.ac.in/noc22_cs29/preview
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLC6032	Performance Analysis of Computer Algorithms & Systems	03	-	-	03

Prerequisites:	
Course Objectives (COBs):	1. Understand how to analyze and evaluate algorithm efficiency and performance. 2. Understand and apply amortized analysis techniques to evaluate the average performance of dynamic data structures over a sequence of operations. 3. Understand key concepts such as performance metrics, technology trends, dependability, and cost-performance trade-offs to develop the ability to quantitatively evaluate and compare computer system designs. 4. Evaluate system performance metrics and understand how computer architecture affects performance. 5. Learn to conduct experimental analysis and apply concepts to real-world systems and algorithms. 6. Understand the architectural principles, performance considerations, and design trade-offs of Warehouse-Scale Computers and Edge Computing systems, and analyze their evolution through real-world case studies.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Analyze and compare algorithms' time and space complexity to determine their efficiency. 2. Apply amortized analysis techniques such as aggregate, accounting, and potential methods to evaluate the average-case performance of dynamic data structures. 3. Evaluate computer system designs using key quantitative principles, including performance metrics, cost, dependability, and technology trends. 4. Evaluate system performance using benchmarks, performance models, and architectural insights to identify bottlenecks and optimize systems. 5. Design and execute performance experiments using profiling tools and interpret performance data for real-world algorithms and systems. 6. Analyze and compare the architecture, design, and performance trade-offs between Warehouse-Scale Computers and Edge Computing systems through case studies.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction	-	02	02
1. Fundamentals of Algorithm Performance Analysis	Introduction to Algorithm Analysis, Growth of functions: Big-O, Omega, and Theta notations, Best-case, average-case, worst-case complexity, Time and space complexity	CO1	03	06
	Recurrence relations (e.g., Master's Theorem), Practical measurement vs theoretical analysis, trade-off between time and space complexity	CO1	03	
2. Amortized Analysis	Introduction to Aggregate analysis, Methods of amortized analysis: Aggregate analysis, the accounting method, and the potential method, key applications of amortized analysis: Dynamic tables	CO2	03	06

	Disjoint Set Union Data Structure, Fibonacci Heaps, Distinguishing Amortized Analysis, Practical Implications and Considerations	CO2	03	
3. Fundamentals of Quantitative Design and Analysis	Introduction, Classes of Computers, Defining Computer Architecture, Trends in Technology, Trends in Cost, Dependability	CO3	03	05
	Measuring and Reporting Performance, Quantitative Principles of Computer Design, Fallacies and Pitfalls	CO3	02	
4. Performance Evaluation of Systems	Performance metrics: throughput, latency, speedup, scalability, Benchmarking tools and techniques, Performance modelling: deterministic vs probabilistic models	CO4	03	06
	Bottleneck analysis and system tuning, CPU, memory, I/O performance evaluation, Amdahl's Law and Gustafson's Law	CO4	03	
5. Experimental Techniques and Case Studies	Designing performance experiments, Profiling tools (e.g., gprof, perf, valgrind), Visualization of performance data (e.g., charts, heatmaps)	CO5	04	08
	Case studies: Sorting algorithms, Graph traversal, Parallel programs	CO5	02	
	Algorithm vs system performance trade-off, Performance optimization strategies	CO5	02	
6. Warehouse-Scale Computers to Edge Architectures	Introduction to Warehouse-Scale Computing (WSC), Architecture of Warehouse-Scale Computers, Performance and Cost Metrics	CO6	04	08
	Introduction to Edge Computing, Architecture and Design of Edge Systems	CO6	02	
	WSC to Edge: Evolution and Comparison, Case Studies	CO6	02	
ii. Course Conclusion	Recap of Modules, Outcomes, Applications and Summarization	-	01	01

Text Books:	1. Thomas H. Cormen et al. – Introduction to Algorithms, MIT Press 2. John L. Hennessy & David A. Patterson – Computer Architecture: A Quantitative Approach
Reference Books:	1. Raj Jain – The Art of Computer Systems Performance Analysis 2. Robert Sedgewick & Kevin Wayne – Algorithms 3. Anany Levitin – Introduction to the Design and Analysis of Algorithms
Useful Links:	1. https://www.coursera.org/specializations/boulder-data-structures-algorithms 2. https://www.coursera.org/learn/analysis-of-algorithms 3. https://onlinecourses.nptel.ac.in/noc25_cs150/preview
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLC6033	Geographical Information System	03	-	-	03

Prerequisites:	Image Processing, Computer Vision.
Course Objectives (COBs):	1. To prepare the students in identifying, analyzing and solving geospatial problems. 2. To train the students in developing practical and executable solutions to the challenges of growing field of Remote Sensing and GIS. 3. To impart the students with strong base of knowledge that makes them suitable both for industries as well as for teaching and research. 4. To inculcate the students with the sensitivity towards ethics, public policies and their responsibilities towards the society. 5. To develop a basic understanding about Geo-Spatial techniques and its applications. 6. Usage of diverse remote sensing data for extracting needed geo-spatial information.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Explain Geo-Spatial techniques and its applications. 2. Describe various GIS techniques within spatial analytical framework and handle huge spatial and non-spatial database. 3. Explain Satellite Hard copy FCC images and Survey of India Topo sheets. 4. Discuss various radiometric and spatial enhancement techniques and create land cover map using different clustering techniques using DIP methods. 5. Describe various GIS techniques within spatial analytical framework and handle huge spatial and non-spatial database. 6. Explain integrated geospatial techniques and apply them in solving real world problems.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction	-	02	02
1. Fundamental of Remote Sensing	Definition: Components of Remote Sensing, Active and Passive Remote Sensing, Electro Magnetic Spectrum, Interaction of EMR with the Earth's Surface	CO1	03	09
	Interactions with the Atmosphere Energy Sources and Radiation. Active and Passive Remote Sensing	CO1	03	
	Energy Interaction with the Earth Surface Features. Data Acquisition and Recording. Remote Sensing Data Products	CO1	03	
2. Image Interpretation and Digital Image Processing	Introduction to Digital Image and Imaging Sensors: Data Formats of Digital Image	CO2	03	06
	Display of Digital Image: Image Processing Systems, Strategies, Keys, Equipment, Fundamentals of Image Classification and Analysis	CO2	03	
3. Geographic Information System	Introduction to GIS: Definitions of GIS and Related Terminology, Components of GIS	CO3	03	06
	GIS Data: Georeferenced Data, introduction to Data Input and Output in GIS, Fundamentals of Data Quality	CO3	03	

	and Management			
4. Spatial Data Analysis	Characteristics of Map Coordinate Systems: Introduction to Map projections- Geo-referencing Frameworks and Reference	CO4	03	09
	Coordinate Systems. GIS analysis functions, Retrieval Reclassification, Buffering and Neighbourhood	CO4	03	
	Overlaying: Data Output, Fundamentals of GIS Analysis Functions	CO4	03	
5. GIS Software Exploration	GIS and Image Interpretation Software, Salient features, Capabilities and Limitations	CO5	03	06
	Data management in public domain GIS software, Attribute Data Management	CO5	03	
6. Case Studies	Application of Remote Sensing GIS: Case studies, GIS and Remote Sensing	CO6	03	03
ii. Course Conclusion	Recap of Modules, Outcome, Applications, and Summarization	-	01	01
Text Books:	1. Lillies and T.M. and Kiefer R.W., Remote Sensing and image Interpretation, John Wiley and Sons, New York, 2004. 2. Burrrough P.A and McDonnel R.A., Principles of Geographic Information Systems, Oxford university press, 1998. 3. A.M. Chandra and S.K. Ghosh, Remote Sensing and Geographical Information System, Narosa Publishing House, New Delhi, 2006.			
Reference Books:	1. B. Bhatta, Remote Sensing and GIS, Oxford University Press. 2. S. Aronoff, Geographical Information Systems, WDL. 3. N. Agrawal, Essentials of GPS, BS Publications.			
Useful Links:	1. https://www.coursera.org/learn/remote-sensing 2. https://www.coursera.org/specializations/gis-mapping-spatial-analysis 3. https://www.classcentral.com/course/swayam-remote-sensing-and-gis-14272			
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.			
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.			

Course Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLC6034	Digital Agricultural and Healthcare	03	-	-	03

Prerequisites:	Understanding of Data analysis.
Course Objectives (COBs):	1. To introduce foundational concepts in Agritech and digital agriculture, including global trends and policy initiative. 2. To explore key Agritech technologies like IoT, AI, drones, and precision farming for smart agricultural practices. 3. To promote innovation and entrepreneurial thinking through exposure to Agritech startups and business models. 4. To develop competency in health data analysis and visualization using real-world medical datasets. 5. To familiarize students with medical sensor integration and the architecture of smart healthcare devices. 6. To equip students with the ability to apply AI/ML techniques in healthcare analytics and decision support systems.
Course Outcomes (COs):	Upon completion of the course, the learners will be able to: 1. Explain key concepts in Agritech and digital agriculture, and recall emerging trends and global initiatives in agricultural digitization. 2. Explain the working principles of core Agritech technologies such as IoT, drones, and precision tools in modern farming systems. 3. Apply data analytics and visualization tools (e.g., Python, Excel, Tableau) to real-world healthcare datasets to derive insights. 4. Analyze the structure and function of medical devices and sensors, and examine their integration within digital health systems. 5. Evaluate the potential of Agritech startups by assessing case studies, business models, and technology adoption in rural and urban ecosystems. 6. Design and develop machine learning solutions for healthcare prediction, diagnosis, or decision support systems based on medical data inputs.

Module No. and Name	Subtopics	COs Mapped	Hours / Subtopic	Total Hours / Module
i. Prerequisites and Course Outline	Prerequisite Concepts and Course Introduction	-	02	02
1.Introduction to Agritech & Digital Agriculture	Agricultural Technology, Overview of modern agriculture challenges and opportunities, Precision agriculture: concepts and benefits, Digital farming ecosystems	CO1	03	06
	Role of data in agriculture (big data, IoT, cloud computing), Government policies and global trends in Agritech, Case studies: Agritech success stories (India & Global)	CO1	03	
2. Core Agritech Technologies	Remote sensing and drone technology in agriculture, IoT and smart farming systems, Soil and crop health monitoring systems, Automated irrigation and water management technologies	CO2	03	06

	AI/ML in yield prediction and pest control, Supply chain optimization using blockchain, Agri robotics and automation, Climate-smart agriculture & sustainability	CO2	03	
3. Agritech Startups, Innovation & Entrepreneurship	Agritech business models and value chains, Role of incubators, accelerators, and venture capital in Agritech, Key Agritech startups and innovations (India and global landscape)	CO3	03	08
	Digital marketplaces & platforms for farmers, Policy frameworks, subsidies, and regulatory issues, Ethical issues and data privacy in Agritech	CO3	03	
	Future trends: Vertical farming, Biotech, and Synthetic Agriculture	CO3	02	
4. Health Data Analytics and Visualization:	Introduction to health data and its lifecycle, Data sources and acquisition, Challenges in health data, Data pre-processing and cleaning	CO4	03	06
	Health data analytics methods, Data visualization for health insights, Ethical and Legal Considerations in Health Data Analytics	CO4	03	
5. Medical Devices and Sensor Integration:	Fundamentals of Medical Devices and Sensor Technology, Role of IoT in Healthcare, Wearable, Implantable, and Remote Monitoring Devices	CO5	03	06
	Engineering Design Principles for Health and Agricultural Sensors, Medical Device Integration and Interoperability, Case Studies and Emerging Trends	CO5	03	
6. Machine Learning and AI in Healthcare	Foundations of Machine Learning and Artificial Intelligence, Applications of Machine Learning and AI in Healthcare	CO6	03	07
	Applications of Machine Learning and AI in Health Informatics and case studies	CO6	02	
	Explainability and Ethics in Medical and Agricultural AI, Challenges and Future Directions and case studies	CO6	02	
ii. Course Conclusion	Recap of Modules, Outcome, Applications, and Summarization	-	01	01
Text Books:	1. M. M. Shah, Techies Who Talked to Plants: The Agritech Pioneers of India. New Delhi, India: Bloomsbury India, 2024. 2. S. Sahgal, Agribusiness and Technology: Revolutionizing the Future of Farming. New Delhi, India: SAGE Publications, 2022. 3. V. D. C. Baskar, K. S. Kumaravel, S. Jain, and A. Kumar, Agri Startup: A Sustainopreneurship Approach. New Delhi, India: Satish Serial Publishing House, 2023.			
Reference Books:	1. P. Patra, R. Devi, and G. Sikka, Eds., Smart Agriculture: Ancient Wisdom and Modern Technology. Jaipur, India: Rawat Publications, 2023. 2. Y. K. Alagh, The Future of Indian Agriculture. New Delhi, India: National Book Trust, 2020. 3. Healthcare Data Analytics" by Chandan K. Reddy and Charu C. Aggarwal (Chapman & Hall/CRC) 4. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic.			

	5. "Medical Instrumentation: Application and Design" by John G. Webster (Wiley) 6. Bioinstrumentation" by John G. Webster (Wiley) 7. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron (O'Reilly Media)
Useful Links:	1. https://www.coursera.org/articles/what-is-health-informatics 2. https://www.coursera.org/learn/supply-chain-of-agriculture
Continuous Assessment (CA):	• Continuous Assessment shall be conducted for Total 40 Marks, including 02 Tests of 20 marks each. • Duration of each Test will be 1 Hour and addition of scores in both the tests will be considered for passing.
End Semester Examination (ESE):	• End Semester Exam shall be conducted for Total 60 Marks. • Duration of End Semester Exam shall be 02 Hours and 30 Minutes.

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITL601	Web Lab	-	01	-	01

Hardware Requirements:	PC with configuration: Intel Core i3/i5/i7, 4 GB RAM
Software Requirements:	Angular IDE, Visual Studio Code, Notepad++, Python Editors, MySQL, XAMPP, JDK
Lab Prerequisites:	HTML/HTML5, CSS/CSS3, JavaScript, Python
Lab Objectives (LOBs):	1. Open-Source Tools for Web Analytics and Semantic Web. 2. Programming in TypeScript for designing Web Applications. 3. Angular Framework for Single Page Web Applications. 4. AJAX for Rich Internet Applications. 5. Flask Framework for building web applications. 6. To apply secure coding practices and understand web vulnerabilities.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Apply open-source tools for web analytics and semantic web apps development and deployment. 2. Apply the basic concepts of TypeScript for designing web applications. 3. Implement Single Page Applications using Angular Framework. 4. Develop Rich Internet Applications using AJAX. 5. Design web applications using Flask. 6. Apply secure coding and identify web vulnerabilities.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites.	-	02
1	Study Any 2 tools in each 1. Study web analytics using open-source tools like Matomo, Open Web Analytics, AWStats, Countly, and Plausible. 2. Study Semantic Web Open-Source Tools like Apache TinkerPop, RDFLib, Apache Jena, Protégé, and Sesame.	LO1	04
2	Perform Any 2 from the following: 1. Functions example using TypeScript. 2. Inheritance and Access Modifiers example using TypeScript. 3. Building a Simple Website with TypeScript.	LO2	04
3	Perform Any 2 from the following: 1. Create a simple HTML web page Project using Angular Framework and apply components. 2. Events and Validations in Angular. (Create functions and add events, adding HTML validators, using $valid property of Angular, etc.). 3. Create an application for like Students Record Management using Angular.	LO3	04
4	Perform Any 2 from the following: 1. Write a JavaScript program for a AJAX. 2. Write a program to use AJAX for user validation using and to show the result on the same page below the submit button. 3. Design and develop small web application using AJAX, HTML and JSP.	LO4	06

5	Perform Any 3 from the following: 1. Design Feedback Form using Flask. 2. Design Weather App using Flask. 3. Design Portfolio Website using Flask. 4. Create a complete Machine learning web application using React and Flask.	LO5	06
6	Perform Any 1 from the following: 1. Demonstrate XSS or SQL Injection on a test app and apply sanitization to fix it. 2. Implement Clickjacking with form input data prefilled from a URL parameter.	LO6	06

Virtual Lab Links:	https://html-iitd.vlabs.ac.in/
Term Work (TW):	• Term work should consist of a minimum of 8-10 experiments • Journal must include at least 02 assignments on content of theory of the course "WEB X.0" and "Web Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.
Practical & Oral (P&O):	Practical examination will be based on the experiment list for Total 25 Marks.

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITL602	NLP Lab	-	01	-	01

Hardware Requirements:	PC with i3 Processor or above.
Software Requirements:	Python 3.6 or higher, Jupyter Notebook, Python IDEs.
Lab Prerequisites:	Python Programming Language.
Lab Objectives (LOBs):	1. To understand and implement fundamental text preprocessing and tokenization. 2. To explore language modeling techniques and smoothing strategies. 3. To perform morphological analysis using stemming and lemmatization. 4. To understand syntactic analysis using tagging and parsing techniques. 5. To apply semantic analysis and document similarity techniques. 6. To develop end-to-end NLP applications using machine learning and deep learning.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Apply tokenization and regular expressions to preprocess and clean raw text. 2. Design unigram and bigram models and evaluate with smoothing techniques. 3. Implement morphological transformations of input text. 4. Develop POS taggers, CFG parsers, and dependency parsers for sentence structure analysis. 5. Use WordNet, TF-IDF, and cosine similarity to extract semantics and document distances. 6. Design text classifiers and fine-tune BERT models for NLP tasks using HuggingFace.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites.	-	02
1	Implement basic text preprocessing operations including tokenization using regular expressions.	LO1	02
2	Develop an N-gram language model (unigram, bigram) for a given corpus and evaluate using smoothing techniques.	LO1	02
3	Perform stemming and lemmatization on raw text using NLTK or spacy.	LO2	02
4	Implement rule-based and statistical POS tagging using HMMs and evaluate tagging accuracy.	LO2	02
5	Write a program for constituency parsing using a given context-free grammar.	LO3	02
6	Implement a dependency parser using transition-based parsing.	LO3	02
7	Use WordNet to explore word senses, synonyms, and relationships between words.	LO4	02
8	Calculate cosine similarity between documents using TF-IDF vector representation.	LO4	02
9	Build a text classifier using Naive Bayes for sentiment analysis on a dataset.	LO5	02
10	Extract named entities from text using spacy or NLTK.	LO5	02
11	Implement word embedding using Word2Vec and visualize them using PCA.	LO6	02
12	Fine-tune a pre-trained BERT model for a text classification task using HuggingFace Transformers.	LO6	02

Virtual Lab Links:	https://nlp-iiith.vlabs.ac.in/Introduction.html?domain=ComputerScience
Term Work (TW):	• Term work should consist of a minimum of 8-10 experiments

	• Journal must include at least 02 assignments on content of theory of the course "Natural Language Processing" and "NLP Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.
Practical (P):	Practical examination will be based on the experiment list for Total 25 Marks. (Practical: 15 Marks and Oral 10 Marks).

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLL6031	Machine Learning Lab	-	01	-	01

Hardware Requirements:	PC with Configuration: Intel i3 core or above, 8 GB RAM or above, 500 GB HDD.
Software Requirements:	Linux / Windows Operating System.
Prerequisites:	Fundamentals of Neural Networks and Fundamentals of Mathematics.
Lab Objectives (LOBs):	1. To identify and analyze various data distributions. 2. To understand need and apply concepts of Ensemble Learning. 3. To understand the functioning of Neural Networks. 4. To design Convolutional Neural Network for real-life application. 5. To design Recurrent Neural Network for real-life applications. 6. To understand advanced concepts in Deep Learning.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Apply Machine Learning concepts for evaluating data distribution. 2. Apply Ensemble and incremental learning methods for performance enhancement of Machine Learning algorithms. 3. Apply basic Neural Networks for real-world applications. 4. Apply Convolutional Neural Networks for real-world applications. 5. Apply Recurrent Neural Networks for real-world applications. 6. Apply advanced techniques in Deep Learning.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites.	-	02
1	Apply Goodness of Fit tests to analyse the data distribution.	LO1	04
2	Implement Ensemble Learning in a distributed environment and compare the performance with corresponding centralized model.	LO2	02
3	Implement Incremental Learning for suitable application and compare its performance with traditional algorithms.	LO2	02
4	Implement Neural Networks for a real-world classification problem and analyze its performance.	LO3	02
5	Implement Neural Networks for a real-world prediction problem and analyze its performance.	LO3	02
6	Implement Convolutional Neural Networks for suitable application using any of the following architectures: a. AlexNet b. GoogLeNet c. ResNet	LO4	04
7	Implement Recurrent Neural Networks for suitable application using Long Short-Term Memory (LSTM).	LO5	02
8	Implement Recurrent Neural Networks for suitable application using Gated Recurrent Units (GRUs).	LO5	04
9	Implement Advanced Deep Learning algorithms for Image Data.	LO6	04

Virtual Lab Links:	1. https://vlab.spit.ac.in/ai/#/home 2. http://www.iitk.ac.in/idea/aidar.html 3. http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php
Term Work (TW):	1. Term work should consist of a minimum of 08 experiments. 2. Journal must include at least 02 assignments on content of theory course "Machine Learning and Deep Learning" and "Machine Learning Lab". 3. Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks and Assignments: 05 Marks). 4. The final certification and acceptance of term work is based on satisfactory performance of laboratory work and minimum passing marks in term work evaluation.
Practical & Oral (P&O):	P&O examination will be based on the experiment list for Total 25 Marks (Practical: 15 Marks and Oral 10 Marks).

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLL6032	Algorithm Analysis Lab	-	01	-	01

Hardware Requirements:	PC with i3 Processor or above.
Software Requirements:	C/Python/Java
Lab Prerequisites:	Data structure and algorithms fundamentals.
Lab Objectives (LOBs):	1. Understand how to analyze and evaluate algorithm efficiency and performance. 2. Understand and apply amortized analysis techniques to evaluate the average performance of dynamic data structures over a sequence of operations. 3. Understand key concepts such as performance metrics, technology trends, dependability, and cost-performance trade-offs to develop the ability to quantitatively evaluate and compare computer system designs. 4. Evaluate system performance metrics and understand how computer architecture affects performance. 5. Learn to conduct experimental analysis and apply concepts to real-world systems and algorithms. 6. Understand the architectural principles, performance considerations, and design trade-offs of Warehouse-Scale Computers and Edge Computing systems, and analyze their evolution through real-world case studies.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Analyze and compare algorithms' time and space complexity to determine their efficiency. 2. Apply amortized analysis techniques such as aggregate, accounting, and potential methods to evaluate the average-case performance of dynamic data structures. 3. Evaluate computer system designs using key quantitative principles, including performance metrics, cost, dependability, and technology trends. 4. Evaluate system performance using benchmarks, performance models, and architectural insights to identify bottlenecks and optimize systems. 5. Design and execute performance experiments using profiling tools and interpret performance data for real-world algorithms and systems. 6. Analyze and compare the architecture, design, and performance trade-offs between Warehouse-Scale Computers and Edge Computing systems through case studies.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites.	-	02
1	Implement and compare sorting algorithms (Bubble, Merge, Quick).	LO1	02
2	Implement a stack with a multipop operation.	LO1	02
3	Simulate a dynamic array resizing using amortized analysis.	LO2	02
4	Implement recursive algorithms (e.g., Merge Sort, Binary Search).	LO2	02
5	Use cProfile, line_profiler, and matplotlib to profile CPU usage.	LO3	02
6	Simulate speedup for parallelizable portions of code.	LO3	02
7	Monitor CPU, memory, and I/O usage of a running program.	LO4	02
8	Compare naive matrix multiplication vs block matrix multiplication.	LO5	02

9	Use multiprocessing or concurrent futures to parallelize tasks.	LO5	02
10	Simulate data processing on edge (local) vs central (cloud-like) system.	LO6	02

Virtual Lab Links:	1. https://ds2-iiith.vlabs.ac.in/exp/dijkstra-algorithm/index.html 2. https://virtutal-daa-lab.netlify.app/ 3. https://cse01-iiith.vlabs.ac.in/exp/sorting/
Term Work (TW):	• Term work should consist of a minimum of 8-10 experiments • Journal must include at least 02 assignments on content of theory of the course "Performance Analysis of Computer Algorithms & Systems" and "Algorithm Analysis Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.
Practical (P):	Practical examination will be based on the experiment list for Total 25 Marks.

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLL6033	Spatial Computing Lab	-	01	-	01

Hardware Requirements:	PC i3 Processor or above.
Software Requirements:	MATLAB / Open CV, Python.
Prerequisites:	None
Lab Objectives (LOBs):	1. To prepare the students in identifying, analyzing and solving geospatial problems. 2. To train the students in developing practical and executable solutions to the challenges of growing field of Remote Sensing and GIS. 3. To impart the students with strong base of knowledge that makes them suitable both for industries as well as for teaching and research. 4. To inculcate the students with the sensitivity towards ethics, public policies and their responsibilities towards the society. 5. To develop a basic understanding about Geo-Spatial techniques and its applications. 6. Usage of diverse remote sensing data for extracting needed geo-spatial information.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Apply various GIS techniques within spatial analytical framework and handle huge spatial and non-spatial database. 2. Interpret Satellite Hard copy FCC images and Survey of India Topo sheets. 3. Apply field spectroscopy techniques to collect and analyze spectral signatures of various land cover features 4. Execute various radiometric and spatial enhancement techniques. 5. Create land cover map using different clustering techniques using DIP methods. 6. Implement integrated geospatial techniques and apply them in solving real world problems.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites.	-	02
1	To understand Remote Sensing Data and Visual Interpretation.	LO1	02
2	i) To import / Export of Satellite Data and Digital Interpretation using Standard FCC. ii) To implement Topology Creation and Correction of Topological Errors in Vector Layers.	LO2	02
3	To study the principles, methodology, and applications of field spectra collection and in-situ calibration using a handheld spectro-radiometer.	LO3	02
4	To implement Radiometric and Atmospheric Correction using Python-based Libraries (e.g., Rasterio, Py6S).	LO4	02
5	To implement Geo-referencing and Geocoding Using Ground Control Points (GCPs) and Google Earth Engine.	LO5	02
6	i) To create Geo-Database Raster/Vector Layer Management, Metadata Handling in QGIS. ii) To implement Spatial and Attribute Data Linking.	LO5	02

7	To implement Land Use/Land Cover Classification using Supervised and Unsupervised Clustering (K-means, SVM).	LO5, LO6	02
8	To perform vector overlay analysis in QGIS using the Clip, Difference, Intersect, Union, and Symmetrical Difference tools	LO1-LO6	02
9	To create and design a thematic map in QGIS using vector/raster data, map symbology, labeling, and layout elements (title, legend, scale bar, north arrow, and coordinate grid)	LO1-LO6	02
10	To implement change Detection Analysis Using Multi-temporal Satellite Imagery.	LO6	02
11	To implement Object-Based Image Analysis (OBIA) for Urban Feature Extraction.	LO6	02
Virtual Lab Links:	1. https://www.coursera.org/learn/remote-sensing. 2. https://www.coursera.org/specializations/gis-mapping-spatial-analysis 3. https://www.classcentral.com/course/swayam-remote-sensing-and-gis-14272		
Term Work (TW):	• Term work should consist of a minimum of 8-10 experiments • Journal must include at least 02 assignments on content of theory of the course "Geographical Information System" and "Spatial Computing Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.		

Lab Code	Course Name	Credits			
		TH	P	TUT	Total
ITDLL6034	AgriTech and HealthTech Lab	-	01	-	01

Hardware Requirements:	PC i3 Processor or above.
Software Requirements:	MATLAB / Python.
Prerequisites:	None
Lab Objectives (LOBs):	1. To introduce foundational concepts in Agritech and digital agriculture, including global trends and policy initiatives. 2. To explore key Agritech technologies like IoT, AI, drones, and precision farming for smart agricultural practices. 3. To promote innovation and entrepreneurial thinking through exposure to Agritech startups and business models. 4. To develop competency in health data analysis and visualization using real-world medical datasets. 5. To familiarize students with medical sensor integration and the architecture of smart healthcare devices. 6. To equip students with the ability to apply AI/ML techniques in healthcare analytics and decision support systems.
Lab Outcomes (LOs):	Upon completion of the course, the learners will be able to: 1. Define key concepts in Agritech and digital agriculture, and recall emerging trends and global initiatives in agricultural digitization. Remembering 2. Explain the working principles of core Agritech technologies such as IoT, drones, and precision tools in modern farming systems. Understanding 3. Apply data analytics and visualization tools (e.g., Python, Excel, Tableau) to real-world healthcare datasets to derive insights. Applying 4. Analyze the structure and function of medical devices and sensors, and examine their integration within digital health systems. Analyzing 5. Evaluate the potential of Agritech startups by assessing case studies, business models, and technology adoption in rural and urban ecosystems. Evaluating 6. Design and develop machine learning solutions for healthcare prediction, diagnosis, or decision support systems based on medical data inputs.

Lab No.	Experiment Title	LOs Mapped	Hours
0	Lab Prerequisites (Image Processing, Computer Vision)	-	02
1	Present India's "Dhenu 1.0" AI assistant and AI weather station project working model.	LO1	02
2	Cloud Computing & Big Data Analytics tools used in agriculture with working model.	LO2	02
3	Climate Data Monitoring and Alerting System for Microclimate Management	LO2	02
4	Sustainability Analysis and Input Optimization Using Smart Farming Data tools	LO3	02
5	Real-Time Pest Detection Using Deep Learning Models	LO4	02

6	Exploring the Health Data Lifecycle: Understand different types of health data and walk through the lifecycle.	LO5	02
7	Acquiring Health Data from Various Sources: Learn how to source health datasets and import them into analysis tools.	LO5	02
8	Fundamentals of Medical Devices and Sensor Technology	LO5	02
9	Wearable, Implantable & Remote Monitoring Device: Simulate or build wearable sensor systems.	LO6	02
10	Analyze real-world examples of medical device innovation and trends: Short Study	LO6	02
Virtual Lab Links:	1. https://agriculturevlab.eu/ 2. https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering		
Term Work (TW):	• Term work should consist of a minimum of 8 experiments. • Journal must include at least 2 assignments on content of theory of the course "Digital Agricultural and Healthcare" and "Agri Tech and Health Tech Lab". • Term work evaluation shall be for Total 25 Marks (Experiments: 20 Marks, Assignments: 05 Marks). • The final certification and acceptance of term work will be based on attendance in Theory and Lab sessions, satisfactory performance of laboratory work, and minimum passing marks in term work evaluation.		
Practical & Oral (P&O):	P&O examination will be based on the experiment list for Total 25 Marks (Practical: 15 Marks and Oral: 10 Marks).		

PBL Course Code	PBL Course Name	Credits			
		TH	P	TUT	Total
ITPR64	Community Engagement PBL – Innovation-Based Minor Project A	-	01	-	01
Hardware Requirements:	PC with i3 Processor or above.				
Software Requirements:	Python, MySQL, Node.js, React				
Prerequisites:	Java Programming, Python Programming, Web Programming.				
PBL Objectives (PROBs):	1. To create awareness among the students of the characteristics of several domain areas where IT can be effectively used. 2. To practice the process of identifying the needs and converting it into a problem statement. 3. To apply engineering knowledge and modern tools/technologies for deriving solutions to the real-world problems. 4. To inculcate the process of self-learning and research. 5. To be acquainted with solving the problem in a group. 6. To improve communication, management and report-writing skills of the students.				
PBL Outcomes (PROs):	Upon completion of the course, the learners will be able to: 1. Identify societal / research needs, formulate problem statements, review research literature, and analyse complex engineering problems. 2. Design suitable solutions for the problems including scope, objectives, timeline, system flow, user interface, algorithms, etc. 3. Gather, analyse, and interpret data — and apply knowledge of engineering fundamentals, modern tools / technologies for development of solutions. 4. Analyze sustainability and scalability of the developed solution and its impact in terms of environmental, societal, safety, legal, cultural, health, etc. aspects. 5. Apply ethical principles, excel in written and oral communication, and engage in independent and life-long learning. 6. Interact efficiently and effectively as an individual with the team members or leader for timely and professional management of projects.				
Guidelines for Project-Based Learning (PBL):	1. Students have to form a team of minimum 02 and maximum 04 members, based on their area of interest and size of project. Interdisciplinary (inter-branch) teams are encouraged. 2. Students should develop an Artificial Intelligence-based Web Application. 3. Students should carry out a survey and identify needs, which shall be converted into problem statement for Minor Project in consultation with Faculty Guide, Internal committee of faculties, and the Head of Department. 4. Projects on societal contribution (healthcare, agriculture, etc.) are preferred. Students should try to take up need-based live projects so as to get exposure to communication with beneficiaries and skills for understanding client requirements. 5. Based on the idea presentation as well as discussion on feasibility, novelty, and contribution of the idea, a project definition will be finalized. 6. Students shall submit their implementation plan in the form of Gantt / PERT / CPM chart, which will cover weekly activity of the Mini project. 7. A log book is to be prepared by each group, wherein the group can record weekly work progress and the Faculty Guide can verify and record notes / comments. 8. Faculty Guide may give inputs to students during Mini Project activity; however, focus shall be on self-learning.				

	9. Students in a group shall understand the problem effectively, propose multiple solutions, and select the best possible solution in consultation with their guide. 10. Students shall convert the best solution into a working model using various components of their domain areas and demonstrate. 11. The solution is to be validated with proper justification and report to be compiled in standard format of the Department. 12. With the focus on self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Minor Projects, if the problem statement is huge and significant, a same problem statement can be worked upon for 02 semesters, i.e., same Minor Project in Semesters V and VI. Projects with a very large scope can also be taken forward to higher semesters, in consultation with the Head of the Department. 13. Students are encouraged to participate in Technical Paper Presentation competitions. 14. The students' group shall complete a project in all aspects including: Identification of need / problem, proposed final solution, Procurement of components / systems / data, building prototype and testing. 15. Three reviews will be conducted for continuous assessment: one shall be for finalization of the problem and proposed solution, second shall be for evaluation of work progress, and third shall be for evaluation of implementation and testing of solutions. 16. Minor Project shall be assessed based on following parameters: • Attainment of Course Outcomes. • Technical efficiency and quality of developed solution. • Innovativeness in solutions. • Impact on environment. • Cost effectiveness. • Sustainability analysis. • Societal impact. • Effective use of standard engineering norms. • Contribution of an individual as member or leader. • Clarity in written and oral communication. 17. Students are encouraged to publish a paper based on the work in Conferences / Student competitions.
Useful Learning Links:	1. https://www.udemy.com/course/artificial-intelligence-projects-with-python-handson-2-in-1/ 2. https://www.codechef.com/problems/DSPCXI11
Term Work (TW):	• Term Work shall be granted based individual's contribution in group activity, their understanding and response to questions. • Term Work evaluation shall be for Total 25 Marks — based on the following evaluation: ○ Presentation in Review 1 ○ Presentation in Review 2 ○ Presentation in Review 3 ○ Project Report and Log Book
Practical & Oral (P&O):	P&O examination will be of Total 25 Marks and shall be based on the Project Demonstration, Presentation, and Report.

Exposure Course Code	Exposure Course Name	Credits			
		TH	P	TUT	Total
ITXT612	Vocational Skill - SAT – XII: Technology-Based Learning	-	01	-	01
Prerequisites:	Basic Engineering and Technology courses.				
TBL Objectives (TOBs):	1. To acquire competency in emerging areas of technology. 2. To create a mind set for life-long learning required to persist technological shifts and be abreast with the market trends. 3. To facilitate learning at self-paced schedules. 4. To boost time management ability and self-discipline. 5. To provide opportunities of strengthening digital footprints by showcasing the additional proficiency acquired as well as improve connectivity and networking. 6. To enhance employment and entrepreneurial opportunities requiring specialization.				
TBL Outcomes (TOs):	Upon completion of the course, the learners will be able to: 1. Explain concepts of the emerging technology learned through the pursued course. 2. Describe social, ethical, and legal issues surrounding the learned technology. 3. Demonstrate professionalism and skills of digital age learning and working. 4. Demonstrate knowledge in entrance exams for higher technical education, placement interviews, and other avenues. 5. Analyze real-world case studies in society/industry for applicability of sustainable technological solutions. 6. Apply the acquired knowledge in developing technology-based solutions to real-world problems or other projects at hand.				
Guidelines for Technology-Based Learning (TBL):	1. Learners should enrol for an online course based on their area of interest concerning emerging areas of technology in consultation with Faculty Supervisor nominated by the Head of Department. 2. The course duration should be of minimum 08 weeks. 3. Students should watch all the videos of the course to learn the course in-depth and entirety. 4. Students should solve weekly assignments that are to be submitted online within the prescribed deadline. 5. Students should register and appear for the course certification exam on scheduled date and time. 6. Students should submit the certificate of course completion to the Faculty Supervisor. 7. Faculty Supervisor shall monitor students' participation and progress at every stage — from course enrolment to certification.				
Useful Learning Links:	1. https://swayam.gov.in 2. https://www.nptel.ac.in 3. https://www.coursera.org				
Term Work (TW):	Term Work evaluation shall be for Total 25 Marks based on progress and completion of the course.				