NPR
College of Engineering and Technology
(AN AUTONOMOUS INSTITUTION)
NBA Accredited (B.E. - CSE, ECE, EEE & Mechanical Engg.) | Accredited by NAAC with 'A' Grade
Recognized by UGC under 2 (f) | ISO 9001:2015 Certified | Approved by All India Council for Technical Education, New Delhi
Affiliated to Anna University, Chennai
Natham, Dindigul (Dist.) - 624 401, Tamil Nadu.

B.E. COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

REGULATIONS - 2023
CHOICE BASED CREDIT SYSTEM (CBCS)
CURRICULUM AND SYLLABUS

NPR COLLEGE OF ENGG. & TECHNOLOGY NATHAM

Chairperson-Board of Studies,
Department of Computer Science and Engineering,
NPR College of Engineering & Technology
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Natham, Dindigul 624401.

I - Department Vision

- To produce globally competent Artificial Intelligence and Machine Learning professionals equipped to drive innovation in an increasingly digitized and intelligent society.

II - Department Mission

- To establish a conducive academic environment for Artificial Intelligence and Machine Learning by imparting quality education and industry- relevant training
- To inspire students to apply AI and ML technologies in developing impactful solutions for real-word social problems
- To encourage students to pursue higher education and engage in research across emerging domains of Artificial Intelligence and Machine Learning
- To instill professional ethics and discipline in students while shaping them into industry-ready AI and ML professionals dedicated to societal growth

III - Program Name: Computer Science and Engineering (Artificial Intelligence and Machine Learning)

IV - Program Educational Objectives

Graduates of Computer Science and Engineering (Artificial Intelligence and Machine Learning) Program will be able to:

- **PEO 1:** Develop proficiency in applying advanced AI and ML techniques to address industry-specific challenges in a globalized digital economy.
- **PEO 2:** Foster innovation and entrepreneurship among graduates to create impactful AI-driven solutions for complex societal issues.
- **PEO 3:** Equip graduates with the skills to adapt and lead in rapidly evolving AI and ML technologies, ensuring lifelong learning and professional growth.
- **PEO 4:** Instill a strong ethical foundation in graduates to responsibly deploy AI and ML solutions, promoting inclusivity and sustainability in digital transformation efforts.

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V - Program Outcomes

Engineering Graduates will be able to:

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

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VI - Program Specific Outcomes

Graduates of the Computer Science and Engineering (Artificial Intelligence and Machine Learning) will have:

- **PSO1**: The skills necessary to use AI, ML, DL, and RL to create leading-edge, services, and technology.
- **PSO2**: The knowledge of Utilizing statistical techniques and computational tools to overcome challenges in interdisciplinary fields.

VII - Mapping of PEOs, POs, and PSO - Tabular Format

POs PEOs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
PEO1	✓	✓	✓	✓	-	✓	-	-	-	✓	✓	✓	✓	✓
PEO2	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓
PEO3	✓	✓	✓	✓	-	✓	-	-	✓	✓	✓	✓	✓	✓
PEO4	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	✓	✓	✓

VIII - Program Scope

- Computer Science is a very vast discipline. The course trains the students of the basics and different aspects of computer engineering. It includes foundations of computer systems, computer architecture & organization, networking, the theory of computation, database systems, electronics, operating systems, programming and website designing, e-commerce & multimedia applications, principles of programming languages, software engineering, hardware engineering, etc.
- Students also have an option of appearing for GATE exam whose scorecard is evaluated by various government organizations for recruitment. Computer engineers can also get numerous jobs in the private firms and top companies like TCS, Wipro, Microsoft, Google, Infosys, Accenture, HCL, Facebook, Cognizant, Adobe, Oracle, Sun Microsystems, Flipkart, IBM, etc.

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IX - Program Specific Criteria

Core Technical Knowledge: The curriculum should cover fundamental areas of CSE including algorithms, data structures, programming languages, computer organization and architecture, operating systems, databases, software engineering principles, computer networks and theory of computation.

Mathematics and Science Foundation: The program should provide a strong foundation in mathematics, including calculus, discrete mathematics and linear algebra, as well as relevant scientific principles that underpin computer science, information technology, such as logic and probability theory.

Breadth of Computer Science and Engineering: The curriculum should offer a broad range of elective courses that allow students to explore various areas of computer science such as artificial intelligence, machine learning, data science, computer graphics, human-computer interaction, cyber security and software development.

Laboratory and Project Experience: The Program should provide hands-on-laboratory experiences to reinforce theoretical concepts and develop practical skills. Project based courses or capstone projects that require students to apply their knowledge and skills to solve real- world Problems are also essential.

Professional skills and ethics: CSE Program should emphasize the development of professional skills, including communication, teamwork, Problem-solving, critical thinking and ethical considerations. Students should understand the ethical and social implications of computing and prepared to adhere to professional standards.

Continuous Improvement and Assessment: CSE Program should have mechanisms in place for continuous improvement and assessment of student learning outcomes. This involves regular evolution of the curriculum, feedback from industry professionals, alumni and students, and incorporation of emerging trends and technologies.

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X – Curriculum I Semester to VIII Semester

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	23IP100	Induction Programme	-	-	-	-	-	0
THEORY								
2	23HS101	Professional English-I	HSMC	3	0	0	3	3
3	23MA101	Matrices and calculus	BSC	3	1	0	4	4
4	23PH101	Engineering Physics	BSC	3	0	0	3	3
5	23CY101	Engineering Chemistry	BSC	3	0	0	3	3
6	23GE101	Problem Solving and C Programming	ESC	3	0	2	5	4
7	23GE103	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
8	23BS111	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
9	23GE112	English Laboratory - I	EEC	0	0	2	2	1
			TOTAL	**16**	**1**	**8**	**25**	**21**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23HS201	Professional English - II	HSMC	2	0	0	2	2
2	23MA901	Probability and Statistics	BSC	3	1	0	4	4
3	23PH203	Physics for Information Science	BSC	3	0	0	3	3
4	23BE201	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
5	23GE901	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
6	23CS201	Python Programming	PCC	3	0	0	3	3
7	23GE201	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	1	1
8		NCC Credit Course Level 1#		2	0	0	2	2#
PRACTICALS								
9	23GE211	Engineering Practices Laboratory	ESC	0	0	3	3	1.5
10	23CS211	Python Programming Laboratory	PCC	0	0	3	3	1.5
11	23GE212	English Laboratory - II	EEC	0	0	2	2	1
			TOTAL	**17**	**1**	**8**	**26**	**22**

NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

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SEMESTER III

SL.NO	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23MA302	Discrete Mathematics	BSC	3	1	0	4	4
2	23CS901	Digital Principles and Computer Organization	ESC	3	0	2	5	4
3	23CS301	Data Structures and Algorithms	PCC	3	0	2	5	4
4	23CS302	Foundations of Data Science	PCC	3	0	0	3	3
5	23CS303	Object Oriented Programming using Java	PCC	3	0	0	3	3
PRACTICALS								
6	23CS311	Data Science Laboratory	PCC	0	0	3	3	1.5
7	23CS312	Object Oriented Programming using Java Laboratory	PCC	0	0	3	3	1.5
8	23CSAO1	Value added courses - I[$]	EEC	0	0	2	2	1[$]
			TOTAL	**15**	**1**	**10**	**26**	**21**

[$] Value added courses – I is offered for all the students. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

SEMESTER IV

SL. NO	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23AL401	Artificial Intelligence	PCC	3	0	0	3	3
2	23AL402	Machine Learning	PCC	3	0	0	3	3
3	23AL403	Database System Design and Management	PCC	3	0	0	3	3
4	23CS403	Object Oriented Software Engineering	PCC	3	0	2	5	4
5	23CS404	Operating Systems	PCC	3	0	0	3	3
6	23CS405	Theory of Computation	PCC	3	0	0	3	3
7		NCC Credit Course Level 2[#]	-	3	0	0	3	3[#]
PRACTICALS								
8	23AL411	Artificial Intelligence and Machine Learning Laboratory	PCC	0	0	3	3	1.5
9	23AL412	Database System Design and Management Laboratory	PCC	0	0	3	3	1.5
10	23CSAO2	Value added courses – II[$]	EEC	0	0	2	2	1[$]
TOTAL				**18**	**0**	**10**	**28**	**22**

[#] NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

[$] Value added courses – II is offered for all the students. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

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SEMESTER V

SL. NO	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23AL501	Natural Language Processing	PCC	3	0	2	5	4
2	23AL502	Deep Learning for Vision	PCC	3	0	2	5	4
3	23CS902	Distributed Computing	PCC	3	0	0	3	3
4		Open Elective – I~	OEC	3	0	0	3	3~
5		Professional Elective I	PEC	2	0	2	4	3
6		Professional Elective II	PEC	2	0	2	4	3
7		Mandatory Course*	MC	3	0	0	3	0*
PRACTICALS								
8	23AL511	Summer internship I	EEC	0	0	0	0	2
TOTAL				**19**	**0**	**8**	**27**	**22**

~ Open Elective - I shall be chosen from the list of open electives offered by other Programmes.

* Mandatory Course are Non-credit Courses (Student shall select one course from the list given under Mandatory Courses)

SEMESTER VI

SL. NO	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23CS601	Cryptography and Cyber Security	PCC	3	0	0	3	3
2	23AL601	Cognitive Science	PCC	3	0	2	5	4
3	23CS903	Embedded Systems and IoT	PCC	3	0	2	5	4
4		Open Elective – II~	OEC	3	0	0	3	3~
5		Professional Elective III	PEC	2	0	2	4	3
6		Professional Elective IV	PEC	2	0	2	4	3
PRACTICALS								
7	23AL611	Mini Project	EEC	0	0	4	4	2
TOTAL				**16**	**0**	**12**	**28**	**22**

~ Open Elective - II shall be chosen from the list of open electives offered by other Programmes.

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SEMESTER VII

SL. NO	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	23AL701	Ethics and AI	HSMC	2	0	0	2	2
2		Elective - Management &	HSMC	3	0	0	3	3&
3	23AL702	Text and Speech Analysis	PCC	3	0	2	5	4
4		Open Elective – III~	OEC	3	0	0	3	3~
5		Professional Elective V	PEC	2	0	2	4	3
6		Professional Elective VI	PEC	2	0	2	4	3
PRACTICALS								
7	23AL711	Summer internship II	EEC	0	0	0	0	2
8	23CS712	Research Paper Writing and Publication	EEC	0	0	2	2	1
TOTAL				**15**	**0**	**8**	**23**	**21**

& Elective - Management shall be chosen from the Elective Management courses.

~ Open Elective - III shall be chosen from the list of open electives offered by other Programmes.

SEMESTER VIII

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICAL								
1	23AL811	Project Work	EEC	0	0	20	20	10
TOTAL				0	0	20	20	10

TOTAL CREDITS: 161

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XI - Elective - Management

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23GE701	Principles of Management	HSMC	3	0	0	3	3
2.	23GE702	Total Quality Management	HSMC	3	0	0	3	3
3.	23GE703	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4.	23GE704	Human Resource Management	HSMC	3	0	0	3	3
5.	23GE705	Knowledge Management	HSMC	3	0	0	3	3
6.	23GE706	Industrial Management	HSMC	3	0	0	3	3

XII - Mandatory Courses

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23MC901	English for Communication (Swayam)	MC	3	0	0	3	0
2.	23MC902	Introduction to Women and Gender Studies	MC	3	0	0	3	0
3.	23MC903	Disaster Risk Reduction and Management	MC	3	0	0	3	0
4.	23MC904	History of Science and Technology in India	MC	3	0	0	3	0
5.	23MC905	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
6.	23MC906	Well Being with Traditional Practices- Yoga, Ayurveda and Siddha	MC	3	0	0	3	0
7.	23MC907	State, Nation Building and Politics in India	MC	3	0	0	3	0
8.	23MC908	Industrial Safety	MC	3	0	0	3	0
9.	23MC909	Indian Constitution	MC	3	0	0	3	0
10.	23MC910	Elements of Literature	MC	3	0	0	3	0

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XIII - Professional Elective Courses

Professional Elective Courses: Verticals

Vertical I Data Science	Vertical II Full Stack Development	Vertical III Cloud Computing and Data Center Technologies	Vertical IV Cyber Security and Data Privacy	Vertical V Creative Media	Vertical VI Emerging Technologies	Vertical VII Prompt Engineering
Exploratory Data Analysis	Web Technologies	Cloud Computing Fundamentals	Ethical Hacking	Augmented Reality/Virtual Reality	Augmented Reality/Virtual Reality	Prompt Engineering Fundamentals
Recommender Systems	App Development	Virtualization	Digital and Mobile Forensics	Multimedia and Animation	Robotic Process Automation	Prompt Engineering for ChatGPT
Neural Networks and Deep Learning	Cloud Services Management	Cloud Services Management	Social Network Security	Video Creation and Editing	Neural Networks and Deep Learning	AI Applications and Prompt Engineering
Text and Speech Analysis	UI and UX Design	Data Warehousing	Modern Cryptography	UI and UX Design	Cyber security	Prompt Engineering for Web Developers
Business Analytics	Software Testing and Automation	Storage Technologies	Engineering Secure Software Systems	Digital marketing	Quantum Computing	Prompt Injection Vulnerabilities
Image and Video Analytics	Web Application Security	Software Defined Networks	Crypto currency and Block chain Technologies	Visual Effects	Crypto currency and Block chain Technologies	Open AI Prompt Engineering Best Practices
Computer Vision	DevOps	Stream Processing	Network Security	Game Development	Game Development	Prompt Engineering for Research
Optimization Techniques	Principles of Programming Languages	Security and Privacy in Cloud	Security and Privacy in Cloud	Multimedia Data Compression and Storage	3D Printing and Design	Deeping Learning.AI - Prompt Engineering for Developers

Registration of Professional Elective Courses from verticals:

Professional Elective Courses will be registered in Semesters V, VI and VII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled one Semester and another one course in another semester. The registration of courses for B.E. / B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2023, Clause 18.

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: DATA SCIENCE

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23PAD02	Exploratory Data Analysis	PEC	2	0	2	4	3
2.	23PAD06	Recommender Systems	PEC	2	0	2	4	3
3.	23PAD05	Neural Networks and Deep Learning	PEC	2	0	2	4	3
4.	23PAD07	Text and Speech Analysis	PEC	2	0	2	4	3
5.	23PAD01	Business Analytics	PEC	2	0	2	4	3
6.	23PAD04	Image and Video Analytics	PEC	2	0	2	4	3
7.	23AD902	Computer Vision	PEC	2	0	2	4	3
8.	23PAD10	Optimization Techniques	PEC	2	0	2	4	3

VERTICAL 2: FULL STACK DEVELOPMENT

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23PIT01	Web Technologies	PEC	2	0	2	4	3
2.	23PIT02	App Development	PEC	2	0	2	4	3
3.	23PIT03	Cloud Services Management	PEC	2	0	2	4	3
4.	23PIT04	UI and UX Design	PEC	2	0	2	4	3
5.	23PIT05	Software Testing and Automation	PEC	2	0	2	4	3
6.	23PIT06	Web Application Security	PEC	2	0	2	4	3
7.	23PIT07	DevOps	PEC	2	0	2	4	3
8.	23PIT08	Principles of Programming Languages	PEC	3	0	0	3	3

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VERTICAL 3: CLOUD COMPUTING AND DATA CENTER TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23PAL02	Cloud Computing Fundamentals	PEC	2	0	2	4	3
2.	23PCS01	Virtualization	PEC	2	0	2	4	3
3.	23PIT03	Cloud Services Management	PEC	2	0	2	4	3
4.	23PCS02	Data Warehousing	PEC	2	0	2	4	3
5.	23PCS03	Storage Technologies	PEC	3	0	0	3	3
6.	23PCS04	Software Defined Networks	PEC	2	0	2	4	3
7.	23PCS05	Stream Processing	PEC	2	0	2	4	3
8.	23PCS06	Security and Privacy in Cloud	PEC	2	0	2	4	3

VERTICAL 4: CYBER SECURITY AND DATA PRIVACY

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23PCS07	Ethical Hacking	PEC	2	0	2	4	3
2.	23PCS08	Digital and Mobile Forensics	PEC	2	0	2	4	3
3.	23PCS09	Social Network Security	PEC	2	0	2	4	3
4.	23PCS10	Modern Cryptography	PEC	2	0	2	4	3
5.	23PCS11	Engineering Secure Software Systems	PEC	2	0	2	4	3
6.	23PCS12	Crypto currency and Block chain Technologies	PEC	2	0	2	4	3
7.	23PCS13	Network Security	PEC	2	0	2	4	3
8.	23PCS06	Security and Privacy in Cloud	PEC	2	0	2	4	3

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VERTICAL 5: CREATIVE MEDIA

S. NO.	COURSECODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23PCS14	Augmented Reality/Virtual Reality	PEC	2	0	2	4	3
2.	23PCS15	Multimedia and Animation	PEC	2	0	2	4	3
3.	23PCS16	Video Creation and Editing	PEC	2	0	2	4	3
4.	23PIT04	UI and UX Design	PEC	2	0	2	4	3
5.	23PCS17	Digital marketing	PEC	2	0	2	4	3
6.	23PCS18	Visual Effects	PEC	2	0	2	4	3
7.	23PCS19	Game Development	PEC	2	0	2	4	3
8.	23PCS20	Multimedia Data Compression and Storage	PEC	2	0	2	4	3

VERTICAL 6: EMERGING TECHNOLOGIES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23PCS14	Augmented Reality/Virtual Reality	PEC	2	0	2	4	3
2.	23CS906	Robotic Process Automation	PEC	2	0	2	4	3
3.	23PAD05	Neural Networks and Deep Learning	PEC	2	0	2	4	3
4.	23PCS21	Cyber security	PEC	2	0	2	4	3
5.	23PCS22	Quantum Computing	PEC	2	0	2	4	3
6.	23PCS12	Crypto currency and Block chain Technologies	PEC	2	0	2	4	3
7.	23PCS19	Game Development	PEC	2	0	2	4	3
8.	23PCS23	3D Printing and Design	PEC	2	0	2	4	3

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Vertical 7: Prompt Engineering

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	23PAL01	AI Applications and Prompt Engineering	PEC	2	0	2	4	3
2.	23PAL03	Deeping Learning.AI - Prompt Engineering for Developers	PEC	2	0	2	4	3
3.	23PAL04	Open AI Prompt Engineering Best Practices	PEC	2	0	2	4	3
4.	23PAL05	Prompt Engineering Fundamentals	PEC	2	0	2	4	3
5.	23PAL06	Prompt Injection Vulnerabilities	PEC	2	0	2	4	3
6.	23PAL07	Prompt Engineering for Web Developers	PEC	2	0	2	4	3
7.	23PAL08	Prompt Engineering for Research	PEC	2	0	2	4	3
8.	23PAL09	Prompt Engineering for ChatGPT	PEC	2	0	2	4	3

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XIV - Open Electives

S. No.	Course Code	Course Title	Category	Periods Per Week			Contact Periods	Credits
				L	T	P		
1.	23OCE01	Cartography & GIS	OEC	3	0	0	3	3
2.	23OCE02	Environment, Health & Safety	OEC	3	0	0	3	3
3.	23OCE03	Environment Impact Assessment	OEC	3	0	0	3	3
4.	23OCE04	Industrial waste water management	OEC	3	0	0	3	3
5.	23OCE05	Remote sensing concepts	OEC	3	0	0	3	3
6.	23OEC01	Antenna Fundamentals	OEC	3	0	0	3	3
7.	23OEC02	Consumer Electronics	OEC	3	0	0	3	3
8.	23OEC03	Display Devices Fundamentals	OEC	3	0	0	3	3
9.	23OCE04	Embedded and Real time Systems	OEC	3	0	0	3	3
10.	23OEC05	Fundamentals of Image Processing	OEC	3	0	0	3	3
11.	23OEC06	Fundamentals of Nano Electronics	OEC	3	0	0	3	3
12.	23OEC07	Internet of Things	OEC	3	0	0	3	3
13.	23OEC08	Sensors and Actuators	OEC	3	0	0	3	3
14.	23OEC09	Wearable Devices and its Applications	OEC	3	0	0	3	3
15.	23OEC10	Wireless Sensor Networks	OEC	3	0	0	3	3
16.	23OEE01	AI with Mat lab	OEC	3	0	0	3	3
17.	23OEE02	Applied Soft Computing	OEC	3	0	0	3	3
18.	23OEE03	Electric Vehicle Technology	OEC	3	0	0	3	3
S. No.	Course Code	Course Title	Category	Periods Per Week			Contact Periods	Credits
				L	T	P		
19.	23OEE04	Electrical Safety	OEC	3	0	0	3	3
20.	23OEE05	E-waste Management	OEC	3	0	0	3	3
21.	23OEE06	Industrial Automation	OEC	3	0	0	3	3
22.	23OEE07	Power Plant Instrumentation	OEC	3	0	0	3	3
23.	23OEE08	Principles of Robotics	OEC	3	0	0	3	3
24.	23OEE09	Sensors and Transducers	OEC	3	0	0	3	3
25.	23OEE10	Solar and Wind Energy Resources	OEC	3	0	0	3	3
26.	23OME01	Energy Conservation and Management	OEC	3	0	0	3	3
27.	23OME02	Energy Technology	OEC	3	0	0	3	3
28.	23OME03	Engineering Graphics Design	OEC	3	0	0	3	3
29.	23OME04	Foundation of Robotics	OEC	3	0	0	3	3
30.	23OME05	Industrial Design & Rapid Prototyping Techniques	OEC	3	0	0	3	3
31.	23OME06	Introduction to Industrial Automation Systems	OEC	3	0	0	3	3
32.	23OME07	Introduction to non- destructive testing	OEC	3	0	0	3	3
33.	23OME08	Mechatronics	OEC	3	0	0	3	3

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34.	23OME09	Nanomaterials and applications	OEC	3	0	0	3	3
35.	23OME10	Nano Technology	OEC	3	0	0	3	3
36.	23OME11	Operations Management	OEC	3	0	0	3	3
37.	23OME12	Production Planning and Control	OEC	3	0	0	3	3
38.	23OME13	Quality Engineering	OEC	3	0	0	3	3
39.	23OME14	Sustainable Manufacturing	OEC	3	0	0	3	3
40.	23OMA01	Algebra and Number Theory	OEC	3	0	0	3	3
41.	23OMA02	Graph Theory	OEC	3	0	0	3	3
42.	23OMA03	Linear Algebra	OEC	3	0	0	3	3
43.	23OMA04	Operations Research	OEC	3	0	0	3	3
44.	23OMA05	Queuing and Reliability Modelling	OEC	3	0	0	3	3
45.	23OMA06	Resource Management Techniques	OEC	3	0	0	3	3
46.	23OHS01	English for Competitive Examinations	OEC	3	0	0	3	3
47.	23OHS02	Project Report Writing	OEC	3	0	0	3	3

XV - Value added courses

S.No	Course Title	Category	Contact Periods	Credits
1	Git, GitHub, Mern Stack	EEC	2	1
2	R-Programming and Power-BI	EEC	2	1
3	Docker (Multi-Container Based Application)	EEC	2	1
4	Jenkins	EEC	2	1
5	MongoDB	EEC	2	1

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XV – Summary of Curriculum Components with Credits

COURSE COMPONENTS	CREDITS PER SEMESTER								TOTAL CREDITS	NO. OF SUBJECTS	CREDIT WEIGHTAGE
	I	II	III	IV	V	VI	VII	VIII			
HSMC	4	3					5		12	6	10.71%
BSC	12	9	4						25	8	14.28%
ESC	4	4.5	4						12.5	4	7.14%
PCC		4.5	13	22	11	11	4		65.5	22	39.28%
PEC					6	6	6		18	6	10.71%
OEC					3	3	3		9~	3	5.35%
EEC	1	1			2	2	3	10	21	7	12.5%
MC	-	-	-	-	0	-	-	-	0*	1	-
TOTAL	**21**	**22**	**21**	**22**	**22**	**22**	**21**	**10**	**161**	**56**	**100%**

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SEMESTER I

I – Course Name: 23HS101 PROFESSIONAL ENGLISH - I

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B.E./B.TECH. – COMMON TO ALL BRANCHES	I	HSMC	3	0	0	3

II - Course Objectives

1.	To improve the communicative competence of learners.
2.	To learn to use basic grammatic structures in suitable contexts.
3.	To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text.
4.	To help learners use language effectively in professional contexts.
5.	To develop learners' ability to read and write complex texts, summaries, articles, blogs,definitions, essays and user manuals.

III - Course Content

Preamble: This course is designed to impart required levels of Communication Skills in Reading and Writing and Proficiency in English language in writing necessary for different professional contexts.		
Unit – I	**INTRODUCTION TO EFFECTIVE COMMUNICATION**	**9 Periods**
Fundamentals of Communication- effective communication- seven C's of effective communication **Reading** - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. **Writing** - Writing emails / letters. **Grammar** – Simple Tenses (Present / Past /Future); Question types: Wh/ Yes or No/- Question Tags. **Vocabulary** – Synonyms (word -meaning-sentence making); (One word substitution; Abbreviations & Acronyms (as used in technical contexts) – Silent letters		
Unit – II	**NARRATION AND SUMMATION**	**9 Periods**
Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel& technical Kogs. **Writing** - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) **Grammar** –Progressive tenses (Present / Past /Future); Subject-Verb Agreement; Prepositions. **Vocabulary** - Wordforms (prefixes& suffixes); Phrasal verbs.		
Unit – III	**DESCRIPTION OF A PROCESS / PRODUCT**	**9 Periods**
Reading – Reading advertisements, gadget reviews; user manuals. **Writing** - Writing definitions; instructions; and Product /Process description. **Grammar** - Imperatives; Adjectives; Degrees of comparison; Perfect Tenses (Present / Past /Future); **Vocabulary** - Compound Nouns, Homonyms; and Homophones.		
Unit – IV	**CLASSIFICATION AND RECOMMENDATIONS**	**9 Periods**

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Reading – Newspaper articles; Journal reports –and Non-Verbal Communication (tables, pie charts etc,) Note-making. **Writing** –Writing recommendations; Transferring information from non-verbal (chart, graph etc, to verbal mode), Transcoding, **Grammar** – Perfect continuous tenses (Present / Past /Future); Articles; Pronouns - Possessive & Relative pronouns. **Vocabulary** - Collocations; Fixed / Semi fixed expressions – Idioms and Phrases		
Unit – V	**EXPRESSION**	**9 Periods**
Reading – Reading editorials; and Opinion blogs; **Writing** – Essay Writing (Descriptive or narrative). **Grammar**– Punctuation; Simple, Compound & Complex Sentences. **Vocabulary** - Cause & Effect Expressions – Content vs Functionwords – British & American vocabulary (spelling and word changes)		

Text Books:	[1] English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2023 edition)
	[2] English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN.Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
Reference Books:	[1] Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw-Hill India, 2017.
	[2] A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
	[3] English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw HillEducation, ISBN : 0070264244.
	[4] Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
	[5] Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.
MOOC/Web Platforms:	https://onlinecourses.nptel.ac.in/noc23_hs115/preview

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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Use appropriate words in a professional context and communicate in a professional context.	Apply (K3)
CO2	Gain understanding of basic grammatic structures and use them in right context.	Understand (K2)
CO3	Read and infer the denotative and connotative meanings of technical texts and use technical words in describing products with appropriate definitions.	Apply (K3)
CO4	Write definitions, descriptions, narrations and essays on various topics.	Create (K6)
CO5	Express their opinions effectively in both oral and written medium of communication.	Create (K6)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-2	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-3	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-4	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-5	-	-	-	-	-	-	-	-	3	3	-	2	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I – Course Name: 23MA101 MATRICES AND CALCULUS

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B.E./B.TECH. COMMON TO ALL BRANCHES	I	BSC	3	1	0	4

II - Course Objectives

1.	To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2.	To familiarize the student with functions of several variables. This is needed in many branches of engineering.
3.	To familiarize the students with integral calculus and various techniques of integration.
4.	To Make the students understand the concepts of vector calculus and applications.
5.	To acquaint the student with mathematical tools needed in evaluating ordinary differential equations and their applications.

III - Course Content

Preamble:
This course introduces basic concepts and techniques of multivariable calculus, matrices, and ordinary differential equations and highlights their applications in various field of engineering such as Design Engineering, Electric Circuit Theory, Cryptography, Resistor conversion, Robotics etc

Unit – I	**MATRICES**	**12 Periods**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley – Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms

Unit – II	**FUNCTIONS OF SEVERAL VARIABLES**	**12 Periods**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

Unit – III	**INTEGRAL CALCULUS AND MULTIPLE INTEGRALS**	**12 Periods**

Definite integrals – Properties – Problems- Double and Triple integrals – Cartesian, polar coordinates – change of order of integration – Applications: Area between curves, Volume of integrals.

Unit – IV	**VECTOR CALCULUS**	**12 Periods**

Gradients - Divergence - Curl – Directional derivative - Irrotational and Solenoidal vector fields– Vector Integration (Line integral, Surface integral, Volume integral, Simple Problems only) – Green's theorem in plane, Gauss divergence theorem and Stoke's Theorem (excluding proof) – Simple applications involving

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cubes and rectangular parallelopipeds.		
Unit – V	**ORDINARY DIFFERENTIAL EQUATIONS**	**12 Periods**
Higher order linear differential equations with constant coefficients – Method of variation of parameters. Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.		

Text Books:	[1] Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016. [2] Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018. [3] James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents Problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area Problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].
Reference Books:	[1] Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016. [2] Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009. [3] Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016. [4] Narayanan. S. and ManicavachagomPillai. T. K.,"Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009. [5] Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016. [6] Srimantha Pal and Bhunia. S.C, "Engineering Mathematics " Oxford University Press, 2015. [7] Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.
MOOC/Web Platforms:	https://nptel.ac.in/courses/122104018 https://archive.nptel.ac.in/courses/111/106/111106146/ https://onlinecourses.nptel.ac.in/noc21_ma16/preview https://digimat.in/nptel/courses/video/111105122/L01.html

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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Use the matrix algebra methods for solving practical Problems.	Apply (K3)
CO2	Able to use differential calculus ideas on several variable functions.	Apply (K3)
CO3	Apply integral calculus and multiple integral tools in solving various application Problems.	Apply (K3)
CO4	Understand the concepts of Gradient, divergence and curl of a vector point function and related applications.	Understand (K2)
CO5	Apply various techniques in solving ordinary differential equations.	Apply (K3)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	1	-	-	-	-	2	-	2	3	-	-
CO-2	3	3	1	1	-	-	-	-	2	-	2	3	-	-
CO-3	3	3	1	1	-	-	-	-	2	-	2	3	-	-
CO-4	3	3	1	1	-	-	-	-	2	-	2	3	-	-
CO-5	3	3	-	-	-	-	-	-	2	-	-	2	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23PH101 ENGINEERING PHYSICS

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B.E./B.TECH. COMMON FOR CIVIL, CSE, EEE, MECH, IT AND AI&DS,CSE(AI&ML)	I	BSC	3	0	0	3

II - Course Objectives

1.	To instill the essentials of properties of matter.
2.	To gain knowledge of electromagnetic waves and its applications.
3.	To amplify the information on optical fiber for communication purposes.
4.	To describe the principles of quantum mechanics and their various applications.
5.	To provide the fundamental understanding of crystals and their numerous crystal formations.

III - Course Content

Preamble:
The aim of the Engineering Physics Program is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes.

Unit – I	**PROPERTIES OF MATTER**	**9 Periods**
Elasticity – stress - strain - Hooke 's law- S-S diagram - factors affecting elastic modulus and tensile strength – Torsion pendulum - moment of inertia of a body - young's modulus – cantilever method, uniform and non-uniform bending – I-shaped girders - Poisson's ratio.		
Unit – II	**ELECTROMAGNETIC FIELD AND WAVES**	**9 Periods**
The Maxwell's equations - wave equation; plane electromagnetic waves in vacuum, conditions on the wave field - properties of electromagnetic waves - energy and momentum in EM waves: intensity, waves from localized sources, momentum and radiation pressure – smart phone reception.		
Unit – III	**LASER AND FIBER OPTICS**	**9 Periods**
LASER- interaction of light radiation with materials - Einstein's coefficients - Nd:YAG, CO_2, quantum dot laser – LIDAR. Fiber optics: modes of propagation of light – numerical aperture and acceptance angle - fiber optical communication system - fiber optic displacement sensors.		
Unit – IV	**QUANTUM PHYSICS**	**9 Periods**
Comparison between classical and quantum theory – Compton scattering: experimental description- uncertainty principle – physical significance of wave function - Schrödinger's wave equation – time dependent and time independent equations – particle in a box - quantum confinement.		
Unit – V	**CRYSTAL PHYSICS**	**9 Periods**

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Crystallography – unit cell, primitive cell - crystal systems, Bravais lattices, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP structures- diamond & NaCl Crystal structure - crystal defect and dislocation. crystal growth techniques: Bridgman method.

Books for study & Reference:	[1] Tipler Mosca, Physics For Scientists and Engineers 6th Edition, 2015 [2] Gaur R.K. and Gupta S.L, Engineering Physics, Dhanpat Rai Publications, 2013. [3] Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, 2015. [4] S. O. Pillai, Solid State Physics, New Age International Private Limited, 10th edition,2022 [5] Marikani A, Engineering Physics, PHI, New Delhi, 2013.
MOOC/Web Platforms:	https://onlinecourses.nptel.ac.in/noc20_mm13/preview https://www.noaa.gov/jetstream/satellites/electromagnetic-waves https://fractory.com/fibre-lasers-explained/ https://www.livescience.com/33816-quantum-mechanics-explanation.html https://archive.nptel.ac.in/courses/115/104/115104109/

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	Choose the correct materials based on their qualities for any intended applications and learn the basics of elasticity and its engineering-related applications.	Apply (K3)
CO2	Express their knowledge in electromagnetic waves.	Understand (K2)
CO3	Infer the characteristics of laser for various Engineering applications and expand the understanding of optical fibers use in communications.	Understand (K2)
CO4	Apply quantum theory's sophisticated physics notions to the matter characterization.	Apply (K3)
CO5	Know the fundamentals of crystal formations and growth methods.	Understand (K2)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking skills based action verb, then the corresponding PO must be mapped with High Correlation)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	3	3	-	-	2	-	-	-	-	3	-	-
CO-2	3	2	3	2	-	-	2	-	-	-	-	3	-	-
CO-3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO-4	3	3	3	2	-	-	3	-	-	-	-	2	-	-
CO-5	3	2	3	3	-	-	-	-	-	-	-	1	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CY101 ENGINEERING CHEMISTRY

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B.E./B.TECH. COMMON TO ALL BRANCHES	I	BSC	3	0	0	3

II - Course Objectives

1.	To inculcate sound understanding of water quality parameters and water treatment techniques.
2.	To impart knowledge on the basic principles and preparatory methods of nanomaterials.
3.	To introduce the basic concepts and applications of polymers and composites.
4.	To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
5.	To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

III - Course Content

Preamble:

The objective of this course is to bestow the better understanding of basic concepts of chemistry and its applications in Engineering and Technology. This course provides exposure on properties of water and its treatment methods. It also imparts knowledge on properties and application of nano-materials in data storage devices. This course also highlights preparation, properties and applications of polymers and composite materials. It also imparts knowledge on fuel types and applications of energy conversion and storage devices.

Unit – I	**WATER AND ITS TREATMENT**	**9 Periods**

Water: sources and impurities, water quality parameters: colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: reverse osmosis. Boiler troubles: scale and sludge, boiler corrosion, caustic embrittlement, priming & foaming. Treatment of boiler feed water: internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and external treatment: ion exchange demineralisation and zeolite process.

Unit – II	**NANO CHEMISTRY**	**9 Periods**

Basics: distinction between molecules, nanomaterials and bulk materials; size-dependent properties (optical, electrical, mechanical and magnetic); types of nanomaterials: definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

Unit – III	**POLYMERS AND COMPOSITES**	**9 Periods**

Introduction: classification of polymers – natural and synthetic; thermoplastic and thermosetting. Functionality – preparation properties and uses of PVC, teflon, nylon 6,6 and epoxy resins. Composites: introduction: definition & need for composites; constitution: matrix materials (Polymer matrix, metal matrix and ceramic matrix) and reinforcement (fiber, particulates, flables and whiskers). Properties and

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applications of: metal matrix composites (MMC), ceramic matrix composites and polymer matrix composites. Hybrid composites - definition and examples.		
Unit – IV	**FUELS AND COMBUSTION**	**9 Periods**
Fuels: introduction, classification of fuels; coal and coke: analysis of coal (proximate and ultimate), carbonization, manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and diesel: manufacture of synthetic petrol (Bergius process), knocking - octane number, diesel oil - cetane number; power alcohol and biodiesel. Combustion of fuels: introduction: calorific value - higher and lower calorific values, theoretical calculation of calorific value; ignition temperature: spontaneous ignition temperature, explosive range; flue gas analysis - ORSAT Method. CO_2 emission and carbon footprint.		
Unit – V	**ENERGY STORAGE DEVICES**	**9 Periods**
Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: principle, working and applications of solar cells; recent developments in solar cell materials. Wind energy; geothermal energy; batteries: types of batteries, primary battery – dry cell, secondary battery -lead acid storage battery and lithium-ion-battery; electric vehicles-working principles; fuel cells: H_2-O_2 fuel cell, super capacitors		

Text Books:	[1] P. C. Jain and Monica Jain, "Engineering Chemistry",Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 17th Edition, 2018. [2] Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 6th Edition 2012. [3] S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.
Reference Books:	[1] B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018. [2] O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017. [3] Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2nd Edition,2017. [4] Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2nd Edition, 2019. [5] O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013. [6] Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.,) Chennai, 4thEdition, 2021.
MOOC/Web Platforms:	https://nptel.ac.in/courses

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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Summarize the water related Problems in boilers and their treatment techniques.	Remember (K1)
CO2	Discuss the applications of nanomaterial in medicine, agriculture, energy, electronics and catalysis.	Understand (K2)
CO3	Discuss the types, properties and applications of polymers and composites.	Apply (K3)
CO4	Summarize the fuels used for engineering processes and applications of fuels.	Understand (K2)
CO5	Summarize the principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.	Apply (K3)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	1	-	-	-	3	-	-	-	-	2	-	-
CO-2	2	1	1	-	-	-	3	-	-	-	-	2	-	-
CO-3	2	1	1	-	-	-	3	-	-	-	-	2	-	-
CO-4	2	1	1	-	-	-	1	-	-	-	-	2	-	-
CO-5	3	2	2	-	-	-	3	-	-	-	-	3	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23GE101 PROBLEM SOLVING AND C PROGRAMMING

Prerequisite	Program Name	Sem	Category	L	T	P	C
Computer Basics	B.E/B.Tech. – Common to CSE, IT, ECE, EEE, ,CSE(AI&ML)	I	ESC	3	0	2	4

II - Course Objectives

1	To understand the fundamentals of Problem-solving using Algorithm and Flowchart
2	To teach the basic programming constructs for solving simple Problems
3	To introduce the basic concepts of arrays and strings
4	To acquaint the students about functions and pointers
5	To develop applications in C using structures and union
6	To impart knowledge on the concepts of file handling

III - Course Content

Preamble: C programmers will always have a scope. There are two aspects, i. C at Application level ii. C at System level. C at application-level work is being replaced by Modern Languages. But C at system level is still used very heavily. For system level programs, the programmers should know the platform/processor understanding/knowledge/Assembly, strong data structures and algorithms, hardware understanding, In-Depth OS Knowledge, computer architecture.

Unit – I	**INTRODUCTION TO ALGORITHM AND C**	**10 Periods**
Algorithms, building blocks of algorithms, notation, algorithmic Problem solving, simple strategies for developing algorithms. Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives - Compilation process.		
Unit – II	**ARRAYS AND STRINGS**	**8 Periods**
Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search		
Unit – III	**FUNCTIONS AND POINTERS**	**9 Periods**
Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions –Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.		
Unit – IV	**STRUCTURES AND UNION**	**9 Periods**
Structure - Nested structures – Pointer and Structures – Array of structures – Self referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility.		
Unit – V	**FILE PROCESSING**	**9 Periods**
Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments.		

TOTAL : 45 Periods

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LIST OF EXPERIMENTS:

Note: The lab instructor is expected to design Problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. I/O statements, operators, expressions
2. Decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion
8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.

TOTAL : 30 Periods

TOTAL : 45+30=75 Periods

Text Books:	1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016. 2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
Reference Books:	1. B. Gottfried, Programming with C, Schaum Outline Series, Fourth Edition, 2018 2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. 3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw- Hill Education, 1996. 4. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second 5. Edition, Oxford University Press, 2013. 6. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
MOOC/Web Platforms:	Introduction to C (w3schools.com) Learn C Programming (programiz.com) C Tutorial - Learn C Programming Language (geeksforgeeks.org)

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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the basic concepts of Problem solving and C programming constructs	Understand (K2)
CO2	Construct and implement C programs for solving computational Problems using arrays and strings	Apply (K3)
CO3	Implement simple real-time applications in C using functions and pointers	Apply (K3)
CO4	Implement the applications in C using structures	Apply (K3)
CO5	Implement the applications using file handling.	Apply (K3)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	-	3	-	-	-	-	-	2	-	2	-
CO-2	3	3	3	-	3	-	-	-	-	-	2	-	2	-
CO-3	3	3	2	-	3	-	-	-	-	-	2	-	2	-
CO-4	3	2	2	-	3	-	-	-	-	-	2	-	2	-
CO-5	3	3	3	-	3	-	-	-	-	-	2	-	2	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23GE103 தமிழர் மரபு /HERITAGE OF TAMILS

Prerequisite	Programme	Sem	Category	L	T	P	C
Nil	B.E./B.TECH. COMMON TO ALL BRANCHES	I	HSMC	1	0	0	1

II - Course Content

Unit – I	**LANGUAGE AND LITERATURE**	**3 Periods**
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.		
Unit – II	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	**3 Periods**
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		
Unit – III	**FOLK AND MARTIAL ARTS**	**3 Periods**
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		
Unit – IV	**THINAI CONCEPT OF TAMILS**	**3 Periods**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
Unit – V	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3 Periods**
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.		

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Text Cum Books:	[1] தமிழகவரலாறுமக்களும்பண்பாடும்கே.கே. பிள்ளை (வெளியீடு–தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்). [2] கணினித்தமிழ்முனைவர்இலசுந்தரம் (விகடன்பிரசுரம்). [3] கீழடி–வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு) [4] பொருநை–ஆற்றங்கரைநாகரிகம். (தொல்லியல்துறைவெளியீடு) [5] Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print) [6] Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
Reference Books:	[1] Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies). [2] The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies) [3] Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) [4] Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) [5] Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) [6] Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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I - Course Name: 23BS111 PHYSICS AND CHEMISTRY LABORATORY

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B.E./B.TECH. COMMON FOR CIVIL, CSE, EEE, MECH, IT AND AI&DS, CSE(AI&ML)	I	BSC	0	0	4	2

II - Course Objectives (Physics Laboratory)

1.	To learn the correct usage of several types of physics lab equipment.
2.	To learn, how to gather, present, and understand facts in a simple and succinct manner.
3.	To learn Physics-related Problem-solving abilities and experimental data interpretation.
4.	To identify experimental measurement error and the methods used to reduce it
5.	To encourage active participation from the learner in all aspects of the lab exercises.

III - Course Content

Preamble:

This course aims to provide practical training in the estimation of physical parameters like band gap, ultrasound velocity, liquid compressibility, thin wire thickness, Young's modulus, and knowledge of the operation of the photoelectric effect, Michelson interferometer, laser, and fibre optics as well as to provide project-based skills development.

PHYSICS LABORATORY: (Any seven experiments to be conducted)

1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc.
2. Uniform bending (or) Non-uniform Bending– Determination of young's modulus.
3. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.
4. Laser- Determination of the wave length of the laser using grating.
5. (a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   (b) Compact disc- Determination of width of the groove using laser.
6. Air wedge – Determination of thickness of a thin sheet/wire.
7. Determination of Band gap of a semiconductor.
8. Particle size determination using LASER.
9. Simple harmonic oscillations of cantilever.
10. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

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IV - Course Outcome (Physics Laboratory)

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Apprehend the concepts of interference, diffraction of light and recognize the resonance concept of waves.	Understand (K2)
CO2	Apply the principles of operations of optical fibers, semiconductor using simple circuits and interaction of electromagnetic waves and crystalline solids.	Apply (K3)
CO3	Measure the elastic moduli and moment of inertia of given materials with the help of suggested procedures.	Apply (K3)
CO4	Experiment the relationship between the light and matter & properties of liquids.	Analyze (K4)
CO5	Estimate the velocity of sound and compressibility of liquid.	Understand (K2)

V - Course Objectives (CHEMISTRY LABORATORY)

1.	To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
2.	To induce the students to familiarize with electro analytical techniques such as, pH metry and potentiometry
3.	To Make the student to acquire practical skills conductometry in the determination of impurities in aqueous solutions.
4.	To demonstrate the analysis of metals and alloys.
5.	To demonstrate the synthesis of nanoparticles

VI - Course Content

Preamble:
This course aims to provide the students, a basic practical knowledge in chemistry. The objective of this course is to develop intellectual and psychomotor skills of the students by providing hands on experience in quantitative, electrochemical and photo-chemical analysis.

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CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer.
10. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
11. Pseudo first order kinetics-ester hydrolysis.
12. Corrosion experiment-weight loss method.
13. Phase change in a solid.
14. Conduct metric titration of strong acid vs strong base.

Reference Books:	1. Vogel's Textbook of Quantitative Chemical Analysis(8thedition,2014).

VII - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.	Analyze(K4)
CO2	Determine the amount of metal ions through volumetric and spectroscopic techniques.	Apply(K3)
CO3	Analyse and determine the composition of alloys.	Analyze (K4)
CO4	Learn simple method of synthesis of nanoparticles	Understand (K2)
CO5	Quantitatively analyse the impurities in solution by electro analytical methods.	Analyze (K4)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

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VIII - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	1	-	-	-	-	-	1	3	2	-	-	-	-
CO-2	3	1	-	-	-	-	-	1	2	1	-	-	-	-
CO-3	3	3	-	-	-	-	-	2	2	1	-	-	-	-
CO-4	3	2	-	-	-	-	-	1	3	2	-	-	-	-
CO-5	3	2	-	-	-	-	-	2	1	2	-	-	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23GE112 ENGLISH LABORATORY -I

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B.E./B.TECH. COMMON TO ALL BRANCHES	I	EEC	0	0	2	1

II - Course Objectives

1.	To improve the communicative competence of learners
2.	To help learners use language effectively in academic /work contexts
3.	To develop various listening strategies to comprehend various types of audio materialslike lectures, discussions, videos etc.
4.	To build on students' English language skills by engaging them in listening, speaking andgrammar learning activities that are relevant to authentic contexts.
5.	To use language efficiently in expressing their opinions via various media.

III - Course Content

Preamble: This course is designed to equip students with the necessary skills to listen and speak so as to develop their linguistic and communicative competencies.		
Unit – I	**INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION**	**6 Periods**
Listening for general information-specific details- conversation: Introduction to classmates - Audio /video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; -politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions (filling out a bank application for example).		
Unit – II	**NARRATION AND SUMMATION**	**6 Periods**
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities- Note Taking. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations - describing experiences and feelings- engaging in small talk- describing requirements and abilities.		
Unit – III	**DESCRIPTION OF A PROCESS / PRODUCT**	**6 Periods**
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities (large & small)-talking about precautions.		
Unit – IV	**CLASSIFICATION AND RECOMMENDATIONS**	**6 Periods**
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – SmallTalk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation.		

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Unit – V	EXPRESSION	6 Periods
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking – making predictions - talking about a given topic-giving opinions-understanding a website-describing processes.		

Recommended Software:	[1] Globarena Software
	[2] Open-Source Software and YouTube Videos in Career Lab.
Manual	[1] English Laboratory Manual, Department of English, NPR College of Engineering & Technology College, Dindigul.
MOOC/Web Platforms:	https://www.digitalteacher.in/english-language-lab

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	To listen to and comprehend general as well as complex academic information.	Understand (K2)
CO2	To listen to and understand different points of view in a discussion.	Understand (K2)
CO3	To speak fluently and accurately in formal and informal communicative contexts.	Apply (K3)
CO4	To describe products and processes and explain their uses and purposes clearly and accurately.	Create (K6)
CO5	To express their opinions effectively in both formal and informal discussions.	Create (K6)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-2	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-3	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-4	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-5	-	-	-	-	-	-	-	-	3	3	-	2	-	-

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SEMESTER II

I - Course Name: 23HS201 PROFESSIONAL ENGLISH - II

Prerequisite	Program Name	Sem	Category	L	T	P	C
Professional English - I	B.E./B.TECH. COMMON TO ALL BRANCHES	II	HSMC	2	0	0	2

II – Course Objectives

1.	To engage learners in meaningful language activities to improve their reading and writing skills.
2.	To learn various reading strategies and apply in comprehending documents in professionalcontext.
3.	To help learners understand the purpose, audience, contexts of different types of writing.
4.	To develop analytical thinking skills for Problem solving in communicative contexts.
5.	To demonstrate an understanding of job applications and interviews for internship and placements.

III - Course Content

Preamble:
This course is designed to impart required levels of Communication Skills in Reading and Writing and Proficiency in English language in writing necessary for different professional contexts.

Unit – I	**MAKING COMPARISONS**	**6 Periods**
Reading - Reading advertisements, user manuals, brochures; - Discourse markers (connectives & sequence words), Writing — Compare and Contrast Essay; Grammar – Active & Passive Voice- Impersonal Passive Voice.		
Unit – II	**EXPRESSING CAUSAL RELATIONS**	**6 Periods**
Reading - Reading longer technical texts– Cause and Effect Essays, and Formal Letters / emails of complaint, Writing - Writing responses to complaints – Jumbled sentences. Grammar - Infinitive and Gerunds.		
Unit – III	**CRITICAL THINKING AND PROBLEM SOLVING**	**6 Periods**
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Drafting of Circulars, Agenda & Minutes of the meeting, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences.		
Unit – IV	**REPORTING OF EVENTS**	**6 Periods**
Reading –Newspaper articles; Writing – Accident Report with Recommendations, Survey Report; Grammar – Reported Speech, Modals – Conjunctions- Sentence pattern		
Unit – V	**COHESIVE WRITING**	**6 Periods**
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.		

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Text Books:	[1] English for Engineers & Technologists (2020 edition) Orient Kackswan Private Ltd. Department of English, Anna University.
	[2] English for Science & Technology Cambridge University Press 2021.
	[3] Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN.Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
Reference Books:	[1] Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw-Hill India, 2017.
	[2] Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press.New Delhi.
	[3] Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001,New Delhi.
	[4] Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003.
	[5] Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, TataMcGraw Hill & Co. Ltd., 2001, New Delhi.
MOOC/Web Platforms:	https://onlinecourses.nptel.ac.in/noc23_hs115/preview

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	To compare and contrast products and ideas in technical texts and write analytical essays.	Apply (K2)
CO2	To identify and report cause and effects in events, industrial processes through technical texts and draft a report with suggestions.	Create (K6)
CO3	To analyze Problems in order to arrive at feasible solutions and communicate them in thewritten format.	Analyze (K4)
CO4	To present their ideas and opinions in a planned and logical manner in industrial nature.	Create (K6)
CO5	To draft effective resumes in the context of job application.	Create (K6)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

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✓ **Mapping Table Mapping of COs with POs and PSOs**

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-2	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-3	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-4	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO-5	-	-	-	-	-	-	-	-	3	3	-	2	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23MA901 PROBABILITY AND STATISTICS

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B. E / B. TECH. COMMON FOR CSE, CSE(AI&ML) & IT	II	BSC	3	1	0	4

II - Course Objectives

1.	To provide necessary basic concepts in probability.
2.	To understand the basic concepts of one - dimensional random variable and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
3.	To understand the basic concepts of two - dimensional random variables.
4.	To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life Problems.
5.	Apply the basic concepts of classifications of design of experiments in the field of agriculture.

III - Course Content

Preamble: This course is enabled to apply drawn inferences to difference machine learning models, exposing to data clustering, data classification, data validation and data fitting.		
Unit – I	**PROBABILITY AND RANDOM VARIABLES**	**12 Periods**
Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Mean and variance of random variables - Moments – Moment generating functions.		
Unit – II	**PROBABILITY DISTRIBUTIONS**	**12 Periods**
Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Transformation of a random variable.		
Unit – III	**TWO DIMENSIONAL RANDOM VARIABLES**	**12 Periods**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of two random variables		
Unit – IV	**TESTING OF HYPOTHESIS**	**12 Periods**
Statistical hypothesis –small samples Tests based on t-test, F-test– Chi square test for goodness of fit – Independence of attributes - Large sample tests based on Normal distribution for mean and difference of means – proportion.		
Unit – V	**DESIGN OF EXPERIMENTS**	**12 Periods**
Analysis of variance - One way and two way classifications: Completely randomized design – Randomized block design – Latin square design.		

Text Books:	[1] Johnson. R.A., Miller. I and Freund. J., "Miller and Freunds Probability and Statistics

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	for Engineers", Pearson Education, Asia, 9th Edition, 2016. [2] Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007. [3] Grewal.B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44th Edition, 2018.
Reference Books:	[1] Devore. J.L., "Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, 8th Edition, 2014. [2] Papoulis. A. and Unnikrishnapillai . S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010. [3] Ross . S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition, Elsevier, 2014. [4] Spiegel. M.R., Schiller. J. and Srinivasan . R.A., "Schaums Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012. [5] Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.
MOOC/Web Platforms:	https://onlinestatbook.com/2/probability/basic.html https://www.youtube.com/watch?v=b5VUnapu-qs https://www.youtube.com/watch?v=q01b-lV6y5Q https://webspace.maths.qmul.ac.uk/b.bogacka/MS_NotesWeek4.pdf

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	To Understand the fundamental concepts of probability.	Understand (K2)
CO2	By applying the knowledge of one-dimensional random variables to standard distributions which can describe real life phenomenon.	Apply (K3)
CO3	Understand the basic concepts of two-dimensional random variables and apply in engineering applications.	Understand (K2)
CO4	Apply the concept of testing of hypothesis for small and large samples in real life Problems.	Apply (K3)
CO5	Apply the basic concepts of classifications of design of experiments in the field of agriculture.	Apply (K3)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	-	-	-	-	2	-	-	2	-	-
CO-2	3	3	-	-	-	-	-	-	2	-	-	2	-	-
CO-3	3	3	-	-	-	-	-	-	2	-	-	2	-	-
CO-4	3	3	1	1	1	-	-	-	2	-	2	3	-	-
CO-5	3	3	1	1	1	-	-	-	2	-	2	3	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23PH203 PHYSICS FOR INFORMATION SCIENCE

Prerequisite	Program Name	Sem	Category	L	T	P	C
Engineering Physics	B.E. /B.TECH. COMMON FOR CSE, CSE(AI&ML), IT AND AI&DS	II	BSC	3	0	0	3

II - Course Objectives

1.	To understanding the fundamental physics of conducting materials, superconductors, and material characteristics.
2.	To impart fundamental knowledge of semiconductor device and electron transport characteristics.
3.	To get expertise in magnetic materials.
4.	To know how superconducting materials with null resistance and optical materials for optoelectronics work.
5.	To learn how nano electronic devices operate on a fundamental level.

III - Course Content

Preamble: Students who complete this course will have a broader understanding of conducting, semiconducting, magnetic, superconducting, optical, and nanomaterials as well as an understanding of how different fields of knowledge are interconnected.		
Unit – I	**CONDUCTING MATERIALS**	**9 Periods**
Classical free electron theory - electrical and thermal conductivity expression - Wiedemann-Franz law - electrons in metals - motion of a particle in a three-dimensional box - Fermi- Dirac statistics - density of energy states - electron in periodic potential - Kronig-Penney Model (Qualitative) - energy bands in solids - Zone theory - electron effective mass.		
Unit – II	**SEMICONDUCTING MATERIALS**	**9 Periods**
Intrinsic semiconductors - direct and indirect band gap semiconductors - carrier concentration in intrinsic semiconductors - extrinsic semiconductors - carrier concentration in N-type & P-type semiconductors - variation of carrier concentration with temperature - variation of fermi level with temperature and impurity concentration - carrier transport in Semiconductor: random motion, drift, mobility and diffusion - Hall effect and experiment - Ohmic contacts - Schottky diode.		
Unit – III	**MAGNETIC MATERIALS**	**9 Periods**
Magnetic dipole moment - atomic magnetic moments - magnetic permeability and susceptibility - magnetic material classification: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism - ferrimagnetism - ferromagnetism: origin and exchange interaction - domain theory - M versus H behavior - hard and soft magnetic materials - applications - magnetic principle in computer data storage - magnetic hard disc - GMR sensor.		
Unit – IV	**SUPERCONDUCTING AND OPTICAL MATERIALS**	**9 Periods**

Super conductivity - type-I and type-II superconductors - properties and applications - classification of optical materials - carrier generation and recombination processes - photo current in a P-N diode - solar cell - LED - Organic LED - optical data storage techniques and devices.		
Unit – V	**NANO DEVICES**	**9 Periods**
Introduction - size dependence of fermi energy - quantum structures - density of states in quantum well, quantum wire and quantum dot structure - band gap of nanomaterials - tunneling: single electron phenomena and single electron transistor - carbon nanotubes: preparation, properties and applications.		
Books for study & Reference:	[1] S.O.Pillai, "Solid State Physics, New Academic Science", 2017. [2] V.Raghavan. Materials Science and Engineering: A First Course, Prentice Hall India Learning Private Limited, 2015. [3] A. Marikani, Materials Science, PHI Learning Pvt Ltd, 2017 [4] D.K.Bhattacharya & PoonamTandon., "Physics for Information Science and Electronics Engineering", Oxford Higher Education",2017. Rogers, B., Adams, J. &Pennathur, S., "Nanotechnology: Understanding Small Systems", CRC Press, 2014.	
MOOC/Web Platforms:	https://onlinecourses.nptel.ac.in/noc20_ph10/preview https://www.electronics-notes.com/articles/basic_concepts/conductors-semiconductors-insulators/semiconductor-materials-types-groups.php https://advancedmagnetsource.com/types-magnetic-materials/ https://nptel.ac.in/courses/115103108 https://onlinecourses.nptel.ac.in/noc22_ee47/preview	

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	To recognize the fundamental ideas behind different free-electron theories and establish the solids' electrical characteristics.	Understand (K2)
CO2	To evaluate the functions of semiconductors and their uses.	Apply (K3)
CO3	To employing quantum principles to examine the mechanisms at work in magnetic materials.	Apply (K3)
CO4	To understand about the uses of superconducting and Optical properties of materials.	Understand (K2)
CO5	To show the fundamentals of how micro- and nano-electronic equipment functions.	Understand (K2)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	3	3	-	3	-	-	-	-	-	-	-	-	-	-
CO-3	3	3	-	3	-	-	-	-	-	-	-	-	-	-
CO-4	3	3	3	-	2	-	-	-	-	-	-	2	-	-
CO-5	3	3	3	-	3	1	1	-	-	-	-	3	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23BE201 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Prerequisite	Program Name	Sem	Category	L	T	P	C
Engineering Physics I	B.E/B.TECH.Commom to CSE, CSE(AI&ML), IT,and AI & DS	II	ESC	3	0	0	3

II - Course Objectives

1.	To introduce the basics of electric circuits and analysis
2.	To import knowledge in the basics of working principles and application of electrical Machines
3.	To introduce analog devices and their characteristics
4.	To educate on the fundamental concepts of digital electronics
5.	To introduce the functional elements and working of measuring instruments

III - Course Content

Preamble:
It is an introductory course which emphasizes the fundamental concepts and overview of Electrical Engineering. The concepts discussed herein are intended to provide clarification on basic electrical engineering for beginners of all engineering graduates.

Unit – I	**ELECTRICAL CIRCUITS**	**9 Periods**
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Independent and Dependent Sources – Simple Problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor (Simple Problems only)		
Unit – II	**ELECTRICAL MACHINES (Qualitative Analysis)**	**9 Periods**
Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, working principle and Applications of Transformer, Single phase Induction Motor, Working types and Applications		
Unit – III	**ANALOG ELECTRONICS (Qualitative Analysis)**	**9 Periods**
Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing (CB Characteristics only) JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications		
Unit – IV	**DIGITAL ELECTRONICS**	**9 Periods**
Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).		
Unit – V	**MEASUREMENTS AND INSTRUMENTATION**	**9 Periods**

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Functional elements of an instrument, Standards and calibration, Operating Principle, types -Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, DSO- block diagram- Data acquisition.

Text Books:	[1] Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020 [2]S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
Reference Books:	[1] Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019. [2] Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017 [3]H.S. Kalsi, 'Electronic Instrumentation and Measurements', Tata McGraw-Hill, New Delhi, 2019
MOOC/Web Platforms:	https://www.classcentral.com/course/swayam-fundamentals-of-electrical-engineering-14074

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Compute the electric circuit parameters for simple Problems	Apply (K3)
CO2	Examine the working principle and applications of electrical machines	Understand (K2)
CO3	Illustrate the characteristics of analog electronic devices	Understand (K2)
CO4	Examine the basic concepts of digital electronics	Analyze (K4)
CO5	Apply the concepts of principles of measuring instruments for real time applications	Apply (K2)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	2	1	-	-	-	-	1	-	-	-	2	2	-	-
CO-2	2	2	1	-	-	-	-	1	-	-	-	2	2	-	-
CO-3	2	1	1	-	-	-	-	1	-	-	-	2	2	-	-
CO-4	2	2	1	-	-	-	-	1	-	-	-	2	2	-	-
CO-5	2	2	1	-	-	-	-	1	-	-	-	2	2	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23GE901 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	NIL B.E. /B.TECH. COMMON FOR CSE, CSE(AI&ML), ECE, AND IT	II	BSC	2	0	0	2

II - Course Objectives

1.	To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on t biodiversity of India and its conservation.
2.	To impart knowledge on the causes, effects and control or prevention measures of environmental pollution.
3.	To study the dynamic processes and understand the features of the earth's interior and surface.
4.	To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
5.	To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

III - Course Content

Preamble:
The objective of this course is intended to Make the students to understand the basic concepts of environment, ecology and pollution of the current environmental issues and to participate in various activities on conserving and protecting the environment.

Unit – I	**ENVIRONMENT AND BIODIVERSITY**	**6 Periods**
Definition, scope and importance of environment – need for puKic awareness. Eco-system and energy flow – ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ.		
Unit – II	**ENVIRONMENTAL POLLUTION**	**6 Periods**
Causes, effects and preventive measures of water, soil, air and noise pollutions. Solid, hazardous and e-waste management. case studies on occupational health and safety management system (OHASMS). Environmental protection - environmental protection acts.		
Unit – III	**SOCIAL ISSUES AND THE ENVIRONMENT**	**6 Periods**
Water conservation, rain water harvesting, watershed management – Issues and possiKe solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.		
Unit – IV	**RENEWABLE SOURCES OF ENERGY**	**6 Periods**

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Energy management and conservation, new energy sources: need of new sources. Different types new energy sources. Applications of - hydrogen energy, ocean energy resources, tidal energy conversion. Concept, origin and power plants of geothermal energy.		
Unit – V	**SUSTAINABILITY PRACTICES**	**6 Periods**
Zero waste and R concept, circular economy, ISO 14000 series, material life cycle assessment, environmental impact assessment. Sustainable habitat: green buildings, green materials, energy efficiency, Sustainable transports. Sustainable energy: non-conventional sources, energy cycles carbon cycle, emission and sequestration, green engineering: sustainable urbanization - socio economical and technological change.		

Text Books:	1. Anubha Kaushik and C. P. Kaushik's 'Perspectives in Environmental Studies', 6th Edition, New Age International Publishers, 2018. 2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2017. 3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004. 4. Allen, D. T. and Shonnard, D. R., 'Sustainability Engineering: Concepts, Design and Case Studies', Prentice Hall. 5. Bradley. A.S; Adebayo, A.O., Maria, P. 'Engineering applications in sustainable design and development', Cengage learning. 6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
Reference Books:	1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media, 2010. 2. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015. 3. Erach Bharucha'Textbook of Environmental Studies for Under graduate Courses' Orient Kackswan Pvt. Ltd. 2021.
MOOC/Web Platforms:	https://onlinecourses.nptel.ac.in/

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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.	Remember (K1)
CO2	To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.	Understand (K2)
CO3	To identify the causes, effects of natural disasters and contribute to the preventive measures in the society.	Apply (K3)
CO4	To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.	Understand (K2)
CO5	To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.	Apply (K3)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	-	-	-	2	3	-	1	-	-	2	-	-
CO-2	3	2	-	-	-	3	3	-	1	-	-	2	-	-
CO-3	3	1	1	-	-	2	2	-	-	-	-	2	-	-
CO-4	3	1	1	1	-	2	2	-	1	-	-	2	-	-
CO-5	3	2	1	-	-	2	2	-	1	-	-	1	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS201 PYTHON PROGRAMMING

Prerequisite	Program Name	Sem	Category	L	T	P	C
C Programming	B.E/B.Tech. – Common to CSE , CSE(AI&ML),IT & ECE	II	PCC	3	0	0	3

II - Course Objectives

1	To guide students in problem-solving using Python conditionals and loops effectively.
2	To guide students in problem-solving using Python conditionals and loops effectively.
3	To enable students to utilize Python data structures such as lists, tuples, and dictionaries for representing complex data.
4	To assist students in performing input/output operations with files in Python.
5	To support students in using Python exceptions and libraries proficiently.

III - Course Content

Preamble: Python is an open-sourced programming language that combines the features of *C* and *Java*. It has exceptional procedural as well as object-oriented capabilities. Having said this, always remember that everything in Python is an object.

Unit – I	DATA TYPES, EXPRESSIONS, STATEMENTS	9 Periods

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Unit – II	CONTROL FLOW, FUNCTIONS, STRINGS	9 Periods

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Unit – III	LISTS, TUPLES, DICTIONARIES	9 Periods

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

Unit – IV	FILES, MODULES, PACKAGES	9 Periods

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

Unit – V	EXCEPTIONS, LIBRARIES	9 Periods

Exception Handling – Built-in Exceptions – Application Development with Python: Integrated Development Environment, Python Standard Library

TOTAL : 45 PERIODS

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Text Books:	1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016. 2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
Reference Books:	1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021. 2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021. 3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021 4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019. 5. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.
MOOC/Web Platforms:	Introduction to C (w3schools.com) https://www.python.org/

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the concepts of python data types, expressions and statements	Understand (K2)
CO2	Implement Python programs for solving real-time computational Problems by using conditionals, looping, functions and strings	Apply (K3)
CO3	Understand the concepts of compound data using Python lists, tuples and dictionaries	Understand (K2)
CO4	Implement the python programs for solving computational Problems by using modules, files and python packages	Apply (K3)
CO5	Implement the python programs for solving computational Problems by using Exceptions and Libraries	Apply (K3)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	-	-	-	-	-	-	-	2	-	2	2
CO-2	3	3	3	2	2	-	-	-	-	-	2	3	2	2
CO-3	3	3	3	2	2	-	-	-	-	-	2	3	2	2
CO-4	3	2	2	-	-	-	-	-	-	-	2	-	2	2
CO-5	3	3	3	2	3	-	-	-	-	-	2	3	2	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - **Course Name: 23GE201 - தமிழரும் தொழில்நுட்பமும் / Tamils and Technology**

Perquisite	Program Name	Sem	Category	L	T	P	C
Nil	B.E./B.TECH. COMMON TO ALL BRANCHES	II	HSMC	1	0	0	1

II - **Course Content**

Unit – I	**WEAVING AND CERAMIC TECHNOLOGY**	**3 Periods**
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.		
Unit – II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3 Periods**
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period		
Unit – III	**MANUFACTURING TECHNOLOGY**	**3 Periods**
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.		
Unit – IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3 Periods**
Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
Unit – V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3 Periods**
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.		
		TOTAL:**15 Periods**
Text Cum Books:	[1]தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு–தமிழ்நாடுபாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்). [2] கணினித்தமிழ் முனைவர் இலசுந்தரம் (விகடன்பிரசுரம்). [3] கீழடி–வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு). [4] பொருநை–ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு). [5] Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print) [6] Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.	
Reference Books:	[1] Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies). [2] The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies) [3] Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of	

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	Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) [4] Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) [5] Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) [6] Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

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I – Course Code & Name: 23GE211 ENGINEERING PRACTICES LABORATORY

Prerequisite	Program Name	Sem	Category	L	T	P	C
Nil	B.E./B.TECH. – COMMON TO ALL BRANCHES	II	ESC	0	0	3	1.5

II - Course Objectives

1.	Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2.	Wiring various electrical joints in common household electrical wire work.
3.	Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipment; Making a tray out of metal sheet using sheet metal work.
4.	Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

III - Course Content

Preamble:

Engineering Practices Laboratory – a hands-on learning experience that complements your theoretical knowledge with practical skills essential for success in the field of engineering. This laboratory course is designed to bridge the gap between classroom learning and real-world application, providing a platform to develop crucial engineering skills and gain confidence in working with tools, equipment, and techniques commonly used in engineering practice.

GROUP – A (CIVIL & MECHANICAL)

PART 1	CIVIL ENGINEERING PRACTICES PLUMBING WORK	12 Periods

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows, and other components which are commonly used in households.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump.

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic, and flexiKe pipes used in household appliances.

WOOD WORK:

a) Sawing,

b) Planing and

c) Making joints like T-Joint, Mortise joint and Tenon joint, and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture.

b) Studying common industrial trusses using models.

PART 2	MECHANICAL ENGINEERING PRACTICES	12 Periods

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

b) Practicing gas welding.
BASIC MACHINING WORK:
a) (simple) Turning.
b) (simple) Drilling.
c) (simple) Tapping.
ASSEMBLY WORK:
a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.
SHEET METAL WORK:
a) Making of a square tray

GROUP – B (ELECTRICAL AND ELECTRONICS)

PART 3	**ELECTRICAL ENGINEERING PRACTICES**	**12 Periods**

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin sockets
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

PART 4	**ELECTRONIC ENGINEERING PRACTICES**	**12 Periods**

SOLDERING WORK:
a) Soldering simple electronic circuits and checking continuity.
ELECTRONIC ASSEMBLY AND TESTING WORK:
a) Assembling and testing electronic components on a small PCB.
ELECTRONIC EQUIPMENT STUDY:
a) Study an element of smart phone.
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/laptop

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IV - Course Outcome

	On completion of the course, the students will be able to	Bloom's Level Mapped
CO1	Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; Make joints in wood materials used in common household wood work.	Apply (K3)
CO2	Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.	Apply (K3)
CO3	Wire various electrical joints in common household electrical wire work.	Apply (K3)
CO4	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.	Apply (K4)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	-	-	1	1	1	-	-	-	-	2	1	1
CO-2	3	2	-	-	1	1	1	-	-	-	-	2	1	1
CO-3	3	2	-	-	1	1	1	-	-	-	-	2	1	1
CO-4	3	2	-	-	1	1	1	-	-	-	-	2	1	1

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS211 PYTHON PROGRAMMING LABORATORY

Prerequisite	Program Name	Sem	Category	L	T	P	C
C Programming	B.E/B.Tech. – Common to CSE, CSE(AI&ML),IT & ECE	II	PCC	0	0	3	1.5

II - Course Objectives

1	To ensure students acquire proficiency in basic programming constructs in Python.
2	To provide opportunities for students to apply various computational strategies to develop Python-based solutions for real-world problems.
3	To enable students to effectively utilize Python data structures such as lists, tuples, and dictionaries.
4	To guide students in performing input/output operations with files in Python.
5	To support students in utilizing Python exceptions and libraries appropriately.

III - Course Content

EXPERIMENTS
1. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
2. Scientific Problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
3. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
4. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
5. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
6. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
7. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy))
8. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
9. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
10. Exploring Pygame tool.
11. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL : 45 PERIODS

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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the concepts of data types, expressions and statements of python	Understand (K2)
CO2	Implement the Python programs using conditionals, looping, functions and strings for solving real-time computational Problems.	Apply (K3)
CO3	Implement the Python programs using lists, tuples and dictionaries	Apply (K3)
CO4	Implement the python programs for solving Problems by using modules, files and python packages	Apply (K3)
CO5	Utilize the Python packages for developing real-world software applications	Apply (K3)

Text Books:	1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition,O'Reilly Publishers, 2016. 2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving andProgramming", 1st Edition, BCS Learning & Development Limited, 2017.
Reference Books:	1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021. 2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021. 3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021 4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.
MOOC/Web Platforms:	Introduction to Python (w3schools.com) Learn Python Programming (programiz.com) https://www.python.org/

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	-	2	-	-	2	-	3	2	2	-	2
CO-2	3	3	3	2	2	-	-	2	-	3	2	3	3	2
CO-3	3	2	1	2	-	-	-	2	-	3	2	3	3	2
CO-4	3	2	2	2	2	-	-	-	2	-	2	3	-	2
CO-5	3	3	3	2	2	-	-	-	2	-	2	3	3	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23GE212 ENGLISH LABORATORY -II

Prerequisite	Program Name	Sem	Category	L	T	P	C
English Laboratory - I	B.E./B.TECH. COMMON TO ALL BRANCHES	II	EEC	0	0	2	1

II - Course Objectives

1.	To identify varied group discussion skills and apply them to table part in effective discussionsin a professional context.
2.	To analyze concepts and Problems and Make effective presentations explaining them clearlyand precisely.
3.	To enhance the Employability and Career Skills of students and acquire professional skills required for workplace / higher education.
4.	To develop their confidence and help them to attend interviews successfully.
5.	To Make them Employable Graduates and use English language skills effectively in various situations.

III - Course Content

Preamble:
This course is designed to impart necessary skills to listen, speak, read and write in order to obtain better professional communication skills.

Unit – I	**ROLE PLAY**	**12 Periods**
Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences- talking about events in life- discussingpast events.		
Unit – II	**TRAVELOGUE**	**12 Periods**
Speaking: Discussing news stories-talking about frequency-talking about travel Problems- discussing travel procedures - talking about travel Problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms.		
Unit – III	**PROFESSIONAL SPEAKING**	**12 Periods**
Speaking: Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – Practicing individual presentation— Presenting the visuals effectively (5-minute presentations).		
Unit – IV	**GROUP DISCUSSION**	**12 Periods**
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies - improving GD skills through activities.		
Unit – V	**INTERVIEW**	**12 Periods**
Interview etiquette – dress code – body language – Job interviews through telephone/skype -one to one interview & panel interview – FAQs related to job interviews.		

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Recommended Software:	[1] Globarena Software.
	[2] Open-Source Software and YouTube Videos in Career Lab.
Reference Books:	[1] E. Suresh Kumar et al. Communication for Professional Success. Orient blackswan: Hyderabad, 2015.
	[2] Interact English Lab Manual for Undergraduate Students, Orient BalckSwan: Hyderabad, 2016
	[3] English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw HillEducation, ISBN : 0070264244.
	[4] Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
	[5] Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.
MOOC/Web Platforms:	https://www.digitalteacher.in/english-language-lab

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	Speak effectively in group discussions held in a formal/semi-formal contexts.	Create (K 6)
CO2	Discuss, analyze and present concepts and Problems from various perspectives to arrive atsuitable solutions.	Analyze (K 4)
CO3	Make effective presentations in an attractive way using appropriate vocabulary.	Apply (K 3)
CO4	Attend job interviews and be successful in them.	Create (K 6)
CO5	Develop adequate Soft Skills required for the workplace.	Apply (K 3)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	-	-	-	3	3	-	3	-	-
CO-2	-	-	-	-	-	-	-	-	3	3	-	3	-	-
CO-3	-	-	-	-	-	-	-	-	3	3	-	3	-	-
CO-4	-	-	-	-	-	-	-	-	3	3	-	3	-	-
CO-5	-	-	-	-	-	-	-	-	3	3	-	3	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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SEMESTER III

I - Course Name: 23MA302 DISCRETE MATHEMATICS

Prerequisites	Program Name	Sem	Category	L	T	P	C
NIL	B. E / B. TECH.COMMON FOR CSE, IT AI&DS, ,CSE(AI&ML)	III	BSC	3	1	0	4

II - Course Objectives

1.	To extend student's logical and mathematical maturity and ability to deal with abstraction.
2.	To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
3.	To understand the basic concepts of combinatorics and graph theory.
4.	To familiarize the applications of algebraic structures.
5.	To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.

III - Course Content

Preamble:
This course is enabled to apply in programming languages, software development, cryptography, and algorithm. The fundamentals of Machine Learning are deeply rooted in discrete mathematics. Digital image processing uses discrete mathematics to merge images or apply filters.

Unit – I	**LOGIC AND PROOFS**	**12 Periods**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

Unit – II	**COMBINATORICS**	**12 Periods**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

Unit – III	**GRAPHS**	**12 Periods**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

Unit – IV	**ALGEBRAIC STRUCTURES**	**12 Periods**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

Unit – V	**LATTICES AND BOOLEAN ALGEBRA**	**12 Periods**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra – Sub Boolean Algebra – Boolean Homomorphism.

TOTAL – 60 Periods

Text Books:	[1] Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.

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	[2] Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011
Reference Books:	[1] Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2013. [2] Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006. [3] Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
MOOC/Web Platforms:	https://www.math.cmu.edu/~mradclif/teaching/127S19/Notes/Logic%20and%20Proof.pdf https://math.libretexts.org/Bookshelves/Combinatorics_and_Discrete_Mathematics http://www.cectl.ac.in/images/pdf_docs/studymaterial/cse/s3/dcs4.pdf https://onlinecourses.nptel.ac.in/noc20_cs82/preview

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	Apply the engineering knowledge to solve the logic of a program.	Apply (K3)
CO2	Understand and analyze the structures of problems on mathematical induction and counting principle.	Understand (K2)
CO3	Apply the fundamentals of graph theory using modern tools in computer networking to manage projects	Apply (K3)
CO4	Apply the notion of groups, rings and fields to design and solve the algebraic structures problems.	Apply (K3)
CO5	Acquire the knowledge of engineering in real life phenomena by solving Lattices and Boolean algebra	Apply (K3)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	3	3	2	-	-	-	-	-	-	-	-	2	-	-
CO-2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-3	-	3	2	-	-	2	-	-	-	3	-	-	-	-
CO-4	-	2	2	2	-	-	-	-	-	-	-	-	-	-
CO-5	-	2	2	2	-	-	-	-	-	2	-	-	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS901 DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

Prerequisites	Program Name	Sem	Category	L	T	P	C
Nil	B. E / B. TECH.COMMON FOR CSE, IT AI&DS and ,CSE(AI&ML)	III	ESC	3	0	2	4

II - Course Objectives

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

III - Course Content

Unit – I	**COMBINATIONAL LOGIC**	**9 Periods**
Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers		
Unit – II	**SYNCHRONOUS SEQUENTIAL LOGIC**	**9 Periods**
Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters		
Unit – III	**COMPUTER FUNDAMENTALS**	**9 Periods**
Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High-Level Language		
Unit – IV	**PROCESSOR**	**9 Periods**
Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control – Pipelining – Data Hazard – Control Hazards		
Unit – V	**MEMORY AND I/O**	**9 Periods**
Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA		
		TOTAL:45 Periods
PRACTICAL EXERCISES:		**30 Periods**
1. Verification of Boolean theorems using logic gates. 2. Design and implementation of combinational circuits using gates for arbitrary functions. 3. Implementation of 4-bit binary adder/subtractor circuits. 4. Implementation of code converters. 5. Implementation of BCD adder, encoder and decoder circuits. 6. Implementation of functions using Multiplexers. 7. Implementation of the synchronous counters.		

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8. Implementation of a Universal Shift register. 9. Simulator based study of Computer Architecture
TOTAL: 75Periods

Text Books:	1. M. Morris Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018. 2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020
Reference Books:	1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012. 2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016. 3. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.
MOOC/Web Platforms:	https://nptel.ac.in/courses/117106086 https://ieeexplore.ieee.org/document/1463186 https://www.youtube.com/watch?v=AtfXJ0PNesk

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	Design various combinational digital circuits using logic gates	Apply (K3)
CO2	Describe the operation and construction of various flip flops.	Understand (K2)
CO3	Design sequential circuits and analyze the design procedures.	Apply (K3)
CO4	State the fundamentals of computer systems and analyze the execution of an instruction.	Understand (K2)
CO5	Analyze different types of control design and identify hazards.	Analyze (K4)
CO6	Identify the characteristics of various memory systems and I/O communication.	Understand (K2)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	3	3	2	-	-	-	-	-	-	2	-	-
CO-2	3	3	3	3	1	-	-	-	-	-	-	1	-	-
CO-3	3	3	3	3	2	-	-	-	-	-	-	2	-	-
CO-4	3	3	3	3	1	-	-	-	-	-	-	1	-	-
CO-5	3	3	3	3	2	-	-	-	-	-	-	2	-	-
CO-6	3	3	3	3	1	-	-	-	-	-	-	1	-	-

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS301 DATA STRUCTURES AND ALGORITHMS

Prerequisite	Program Name	Sem	Category	L	T	P	C
Python Programming	B.E – CSE & CSE(AI&ML)	III	PCC	3	0	2	4

II - Course Objectives

1.	To ensure students comprehend the concepts of Abstract Data Types (ADTs).
2.	To guide students in designing linear data structures including lists, stacks, and queues.
3.	To facilitate understanding of sorting, searching, and hashing algorithms.
4.	To enable students to apply Tree structures effectively.
5.	To guide students in applying Graph structures proficiently.

III - Course Content

Preamble: Python is an open-sourced programming language that combines the features of *C* and *Java*. It has exceptional procedural as well as object-oriented capabilities. Having said this, always remember that everything in Python is an object.

Unit – I	**ABSTRACT DATA TYPES**	**9 Periods**
Abstract Data Types (ADTs) – Abstract Data Types (ADTs) and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying Introduction to analysis of algorithms – asymptotic notations – divide & conquer – recursion – analyzing recursive algorithms		
Unit – II	**LINEAR STRUCTURES**	**9 Periods**
List Abstract Data Type (ADT) – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – Stack ADT – Queue Abstract Data Type (ADT) – double ended queues – applications		
Unit – III	**SORTING AND SEARCHING**	**9 Periods**
Bubble sort – selection sort – insertion sort – merge sort – quick sort – analysis of sorting algorithms – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency.		
Unit – IV	**TREE STRUCTURES**	**9 Periods**
Tree Abstract Data Type (ADT) – Binary Tree Abstract Data Type (ADT) – tree traversals – binary search trees – AVL trees – heaps – multiway search trees.		
Unit – V	**GRAPH STRUCTURES**	**9 Periods**
Graph Abstract Data Type (ADT) – representations of graph – graph traversals – DAG – topological ordering – greedy algorithms – dynamic programming – shortest paths – minimum spanning trees – introduction to complexity classes and intractability		
		TOTAL: 45 PERIODS

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LIST OF EXPERIMENTS:

Note: The lab instructor is expected to design problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. Implement simple Abstract Data Types (ADTs) as Python classes
2. Implement recursive algorithms in Python
3. Implement List Abstract Data Types (ADT) using Python arrays
4. Linked list implementations of List
5. Implementation of Stack and Queue Abstract Data Types (ADTs)
6. Applications of List, Stack and Queue Abstract Data Types (ADTs)
7. Implementation of sorting and searching algorithms
8. Implementation of Hash tables
9. Tree representation and traversal algorithms
10. Implementation of Binary Search Trees
11. Implementation of Heaps
12. Graph representation and Traversal algorithms
13. Implementation of single source shortest path algorithm
14. Implementation of minimum spanning tree algorithms

TOTAL: 30 PERIODS

TOTAL: 45+30=75 PERIODS

Text Books:	1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", An Indian Adaptation, John Wiley & Sons Inc., 2021.
Reference Books:	1. Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" Springer Edition 2015. 2. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011 3. Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education, 1983. 4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002. 5. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2014.
MOOC/Web Platforms:	https://www.geeksforgeeks.org/courses/Data-Structures-With-Python https://onlinecourses.nptel.ac.in/noc22_cs26/preview https://www.youtube.com/@freecodecamp https://www.javatpoint.com/data-structures-and-algorithms-in-python https://www.programiz.com/dsa

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IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Explain abstract data types	Understand (K2)
CO2	Apply and analyze linear data structures, such as lists, queues, and stacks, according to the needs of different applications	Analyze (K4)
CO3	Apply searching, sorting, and hashing algorithms to solve real-world problems.	Apply (K3)
CO4	Implement effectively and analyze various tree structures to solve computational problems for efficient data management.	Apply (K3)
CO5	Implement efficient graph algorithms and Analyze graph modeling to solve them.	Apply (K3)

(Action verb of each CO to be matched with the next mapping table) (For example: if CO-1 uses the High Order Thinking Skills based action verb, then the corresponding PO must be mapped with High Correlation)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	2	3	1	-	-	-	2	-	2	1	1	1
CO-2	2	3	2	2	2	-	-	-	2	-	2	2	3	2
CO-3	2	2	3	2	3	-	-	-	3	-	2	2	3	2
CO-4	3	3	3	3	1	-	-	-	3	-	2	2	3	2
CO-5	3	3	3	3	1	-	-	-	3	-	2	2	3	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS302 FOUNDATIONS OF DATA SCIENCE

Prerequisite	Program Name	Sem	Category	L	T	P	C
Problem Solving and Python Programming	B.E/B. Tech. – Common to CSE, IT & ,CSE(AI&ML)	III	PC	3	0	0	3

II - Course Objectives

1.	To understand the data science fundamentals and process
2.	To learn to describe the data for the data science process
3.	To learn to describe the relationship between data
4.	To utilize the Python libraries for Data Wrangling
5.	To present and interpret data using visualization libraries in Python

III - Course Content

Preamble: This course covers the foundational aspects of Data Science with understanding and describing different types of data and variables. It explores various techniques for analysing relationships within data sets, gain practical skills in data manipulation using Python libraries such as Numpy and Pandas. Also, it focuses on data visualization techniques using Matplotlib and Seaborn libraries in Python.

Unit – I	**INTRODUCTION**	**9 Periods**

Data Science: Benefits and uses - facets of data - Data Science Process: Overview - Defining research goals - Retrieving data - Data preparation - Exploratory Data analysis - build the model - presenting findings and building applications - Data Mining - Data Warehousing - Basic Statistical descriptions of Data.

Unit – II	**DESCRIBING DATA**	**9 Periods**

Types of Data - Types of Variables -Describing Data with Tables and Graphs - Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores.

Unit – III	**DESCRIBING RELATIONSHIPS**	**9 Periods**

Correlation - Scatter plots - correlation coefficient for quantitative data - computational formula for correlation coefficient - Regression - regression line - least squares regression line - Standard error of estimate - interpretation of r2 - multiple regression equations - regression towards the mean.

Unit – IV	**PYTHON LIBRARIES FOR DATA WRANGLING**	**9 Periods**

Basics of Numpy arrays - aggregations - computations on arrays - comparisons, masks, boolean logic - fancy indexing - structured arrays - Data manipulation with Pandas - data indexing and selection - operating on data - missing data - Hierarchical indexing - combining datasets - aggregation and grouping - pivot tables.

Unit – V	**DATA VISUALIZATION**	**9 Periods**

Importing Matplotlib - Line plots - Scatter plots - visualizing errors - density and contour plots - Histograms - legends - colors - subplots - text and annotation - customization - three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn - Seaborn categorical plots-Case Study: Stock market.

TOTAL: 45 Periods

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Text Books:	1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, ¡§Introducing Data Science¨, Manning Publications, 2016. (Unit I) 2. Robert S. Witte and John S. Witte, "Statistics¨, Eleventh Edition, Wiley Publications, 2017. (Units II and III) 3. Jake VanderPlas, "Python Data Science Handbook¨, O'Reilly, 2016. (Units IV and V)
Reference Books:	1. Allen B. Downey, Think Stats: Exploratory Data Analysis in Python¨, Green Tea Press, 2014.
MOOC/Web Platforms:	https://nptel.ac.in/courses/106106179 https://nptel.ac.in/courses/106106212

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	Understand the data science process	Understand (K2)
CO2	Understand different types of data description for data science process	Understand (K2)
CO3	Explain the relationships between data in data science	Understand (K2)
CO4	Use the Python Libraries for Data Wrangling	Apply(K3)
CO5	Apply visualization Libraries in Python to interpret and explore data	Apply (K3)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	3	2	3	3	3	-	-	2	2	3	2	3	2	2
CO-2	2	2	2	3	3	-	-	3	2	2	2	2	2	2
CO-3	2	3	2	2	3	-	-	2	2	2	1	2	2	2
CO-4	2	2	2	2	3	-	-	3	2	2	1	2	3	2
CO-5	2	2	3	2	1	-	-	1	2	2	1	2	3	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS303 OBJECT ORIENTED PROGRAMMING Using JAVA

Prerequisite	Program Name	Sem	Category	L	T	P	C
Problem Solving and C Programming	B.E/B. Tech. – Common to CSE, IT & CSE(AI&ML)	III	PCC	3	0	0	3

II - Course Objectives

1.	To understand Object Oriented Programming concepts and basics of Java programming language
2.	To know the principles of packages, inheritance and interfaces
3.	To develop a java application with threads and generics classes
4.	To define exceptions and use I/O-streams
5.	To design and build Graphical User Interface Application using JAVAFX

III - Course Content

Preamble: This course enables the student to learn the fundamentals of Java with Object Oriented Programming. They will be able to create, modify, and work with classes and objects in order to use them for handling exceptions and solving problems in the real world. Java swing, event handling and multi-threading concept will be useful for them to design Graphical User Interfaces for various applications.

Unit – I	**INTRODUCTION TO OOP AND JAVA**	**9 Periods**

Overview of OOP – Object oriented programming paradigms – Features of Object-OrientedProgramming – Java Buzzwords –Java Ecosystem: JDK – JRE – JVM – Running a Java Program – Defining a class and creating objects – Constructors – Access control – static keyword – arrays – strings – inner class – package.

Unit – II	**INHERITANCE, PACKAGES AND INTERFACES**	**9 Periods**

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

Unit – III	**EXCEPTION HANDLING AND MULTITHREADING**	**9 Periods**

Exception Handling: Definition – Exception Hierarchy – try – throw – catch paradigm – finally – handling multiple exceptions. Multithreaded Programming: Java Thread Model–Creating aThread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

Unit – IV	**I/O, GENERICS, STRING HANDLING**	**9 Periods**

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

Unit – V	**JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS**	**9 Periods**

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – Scroll Pane. Layouts – Flow Pane – Hbox and Vbox – Border Pane – Stack Pane – Grid Pane. Menu basics. JDBC: ODBC – JDBC basics – Steps to build database applications

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	TOTAL: 45 Periods

Text Books:	1. Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, NewDelhi, 2019. 2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, NewDelhi, 2015.
Reference Books:	1. Paul J. Deitel, and Harvey M. Deitel, "Java for Programmers", Pearson Education,2nd Edition, 2012. 2. Cay Horstmann, and Gary Cornell, "Core Java Volume – I Fundamentals", Prentice Hall, 9th Edition, 2011. 3. Herbert Schildt, "The Complete Reference JAVA 2" , Tata McGraw Hill, 5th Edition, 2002. 4. Oracle Java Documentation, "The Java Tutorials", 5.
MOOC/Web Platforms:	1. https:// docs.oracle.com/ javase/tutorial/ index.html. 2. https://www.javatpoint.com/javafx-tutorial

IV – Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	Summarize classes with access controls to create objects for real world scenarios.	Understanding (K2)
CO2	Utilize the principle of Inheritance, Packages and Interface.	Apply (K3)
CO3	Use of exception handling mechanisms and multithreaded model to solve real world problems	Apply (K3)
CO4	Illustrate Java applications with I/O packages, string classesand generics concepts	Understand (K2)
CO5	Develop and Design Graphical User Interface Application using JAVAFX.	Apply (K3)

V – Mapping Table Mapping of Cos with Pos and PSOs

Cos/ Pos	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	1	3	1	3	-	-	-	3	2	2	2	3	1
CO-2	2	1	3	2	1	-	-	-	2	1	1	3	3	3
CO-3	3	3	1	2	2	-	-	-	3	2	1	2	3	1
CO-4	3	1	2	2	2	-	-	-	1	2	1	3	3	1
CO-5	1	1	2	3	2	-	-	-	3	2	1	2	3	3

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I – Course Name: 23CS311 DATA SCIENCE LABORATORY

Prerequisite	Program Name	Sem	Category	L	T	P	C
Problem Solving and Python Programming	B.E/B. Tech. – Common to CSE, IT & CSE(AI&ML)	III	PC	0	0	3	1.5

II - Course Objectives

1.	To understand the python libraries for data science
2.	To understand the basic Statistical and Probability measures for data science
3.	To learn descriptive analytics on the benchmark data sets
4.	To apply correlation and regression analytics on standard data sets
5.	To present and interpret data using visualization packages in Python

LIST OF EXPERIMENTS:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Implementation of python programs using NumPy arrays.
3. Implementation of python programs using Pandas data frames.
4. Implementation of python programs to perform descriptive analytics on the Iris data set by reading text files, Excel and the web of Iris data set.
5. Implementation of python programs to perform the following analysis on diabetes data set from UCI and Pima Indians Diabetes data set:
   a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   b. Bivariate analysis: Linear and logistic regression modeling
   c. Multiple Regression analysis
   d. Compare the results of the above analysis for the two data sets.
6. Implementation of python programs to apply and explore various plotting functions on UCI data sets.
   a. Normal curves
   b. Density and contour plots
   c. Correlation and scatter plots
   d. Histograms
   e. Three-dimensional plotting
7. Implementation of python programs for visualizing Geographic Data with Basemap

LIST OF EQUIPMENTS :(30 Students per Batch)

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh
Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

TOTAL: 45 PERIODS

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Text Books:	4. David Cielen, Arno D. B. Meysman, and Mohamed Ali, ¡§Introducing Data Science¨, Manning Publications, 2016. (Unit I) 5. Robert S. Witte and John S. Witte, "Statistics¨, Eleventh Edition, Wiley Publications, 2017. (Units II and III) 6. Jake VanderPlas, "Python Data Science Handbook¨, O'Reilly, 2016. (Units IV and V)
Reference Books:	2. Allen B. Downey, Think Stats: Exploratory Data Analysis in Python¨, Green Tea Press, 2014.
MOOC/Web Platforms:	https://nptel.ac.in/courses/106106179 https://nptel.ac.in/courses/106106212

IV - Course Outcome

On completion of the course, the students will be able to		**Bloom's Level Mapped**
CO1	Use of the python libraries for data science	Apply (K3)
CO2	Use of the basic Statistical and Probability measures for data science.	Apply (K3)
CO3	Apply descriptive analytics on the benchmark data sets.	Apply (K3)
CO4	Apply correlation and regression analytics on standard data sets	Apply(K3)
CO5	Interpret data using visualization packages in Python.	Apply (K3)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	3	2	1	1	-	-	-	-	1	3	3	3	2	2
CO-2	3	2	2	3	1	-	-	-	3	1	3	2	2	2
CO-3	3	2	1	3	1	-	-	-	2	1	1	1	3	2
CO-4	2	3	1	3	-	-	-	-	2	3	2	3	3	3
CO-5	1	2	3	1	1	-	-	-	2	1	3	1	3	3

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS312 OBJECT ORIENTED PROGRAMMING Using JAVA LABORATORY

Prerequisite	Program Name	Sem	Category	L	T	P	C
Problem Solving and C Programming	B.E/B.Tech. – Common to CSE, IT & CSE(AI&ML)	III	PCC	0	0	3	1.5

II - Course Objectives

1.	To cultivate software development proficiency through object-oriented programming techniques applicable to real-world scenarios.
2.	To foster understanding and implementation of fundamental concepts including classes, packages, interfaces, inheritance, exception handling, and file processing within software development.
3.	To facilitate comprehension and practical application of event handling mechanisms in software development.

III - Course Content

EXPERIMENTS
1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area( ) that prints the area of the given shape.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8. Write a program to perform file operations.
9. Develop applications using JavaFX controls, layouts and menus.
10. Develop a mini project for any application using the constructs of Java.

LIST OF EQUIPMENTS :(30 Students per Batch)

Tools: NetBeans IDE/ Eclipse/ Visual Studio/Spring tool SDS

TOTAL: 45 PERIODS

IV - Course Outcome

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On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Implement the simple java programs using object-oriented programming concepts	Apply (K3)
CO2	Illustrate simple applications using package and exceptions.	Understand (K2)
CO3	Implement the applications using multithreading and files.	Apply (K3)
CO4	Create GUIs and event driven programming applications.	Create (K6)
CO5	Execute the real-world problem in team by applying the appropriate features of object-oriented programming paradigm with best practices and document its methodology	Apply (K3)

Text Books:	1. Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New Delhi, 2019. 2.Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, New Delhi, 2015.
Reference Books:	1.Paul J. Deitel, and Harvey M. Deitel, "Java for Programmers", Pearson Education,2nd Edition, 2012. 2.Cay Horstmann, and Gary Cornell, "Core Java Volume - I Fundamentals", Prentice Hall, 9th Edition, 2011. 3.Herbert Schildt, "The Complete Reference JAVA 2" , Tata McGraw Hill, 5th Edition, 2002. 4.Oracle Java Documentation, "The Java Tutorials".
MOOC/Web Platforms:	https:// docs.oracle.com/ javase/tutorial/ index.html. https://www.javatpoint.com/javafx-tutorial

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	2	1	2	-	-	-	1	2	2	2	1	2
CO-2	2	1	3	1	2	-	-	-	2	3	3	2	1	3
CO-3	2	2	1	2	2	-	-	-	1	2	1	3	2	3
CO-4	2	2	1	3	2	-	-	-	3	1	1	1	2	1
CO-5	1	3	3	1	2	-	-	-	1	1	1	1	2	1

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CSAO1-Git and GitHub (Value Added Course)

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B.E-CSE(AI&ML)	III	EEC	0	0	2	1

II - Course Objectives

1.	To understand the basics of version control and Git.
2.	To learn how to create and manage Git repositories.
3.	To collaborate with others using GitHub.
4.	To perform basic Git operations such as branching and merging.
5.	To gain familiarity with handling conflicts and using GitHub for collaboration.

III - Course Content

Preamble:
This Value-Added Course is structured to provide a balanced mix of theoretical knowledge and practical experience, ensuring that participants not only understand the concepts but also can apply them in real-world scenarios. By the end of the course, students will have a strong foundation in modern development practices, ready to take on the challenges of today's software development landscape.

Module 1	**INTRODUCTION TO VERSION CONTROL AND GIT**	**6 Periods**
Introduction to Version Control Systems (VCS)- Overview of Git: Key features and benefits -Installing Git on various operating systems- Basic Git commands: git init, git status, git add, git commit		
Module 2	**WORKING WITH REPOSITORIES**	**6 Periods**
Creating a local Git Repository-Cloning a repository from GitHub- Understanding the Git directory structure -Exploring commit history with git log		
Module 3	**BRANCHING AND MERGING**	**6 Periods**
Understanding branches in Git- Creating and switching branches: git branch, git checkout- Merging branches: git merge- Resolving simple merge conflicts		
Module 4	**INTRODUCTION TO GITHUB**	**6 Periods**
Creating a GitHub account and overview of GitHub features- Cnreating a new repository on GitHub- Pushing local changes to GitHub: git push- Pulling changes from GitHub: git pull- Understanding issues and project boards in GitHub		
Module 5	**COLLABORATIVE WORKFLOWS WITH GIT AND GITHUB**	**6 Periods**
Forking a repository on GitHub- Creating pull requests and reviewing code- best practices for collaborative development- Using GitHub for project management		
	ASSESSMENT	

Total Hours :30 Periods

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IV- Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the fundamental concepts of version control systems and the role of Git in software development.	Understand (K2)
CO2	Apply basic Git commands to create, manage, and navigate local repositories, including initializing a repository and committing changes.	Apply (K3)
CO3	Apply switch, and merge branches in Git, including resolving simple merge conflicts.	Apply (K3)
CO4	Apply GitHub to create and manage remote repositories, push and pull changes, and collaborate with others on software projects.	Apply (K3)
CO5	Analyze collaborative workflows by forking repositories, creating pull requests, and participating in code reviews using GitHub.	Analyze (K4)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	1	1	2	1	-	1	1	2	1	2	3	1
CO-2	3	3	2	2	3	2	-	1	2	2	1	2	3	2
CO-3	3	3	2	2	3	2	-	1	2	2	2	2	3	2
CO-4	3	3	3	2	3	2	-	2	2	3	2	3	3	2
CO-5	3	3	3	3	3	2	-	2	3	3	2	3	3	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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SEMESTER IV

I- Course Name: 23AL401 – ARTIFICIAL INTELLIGENCE

Prerequisite	Program Name	Sem	Category	L	T	P	C
Problem Solving and Python Programming	B.E CSE(AI&ML)	IV	PCC	3	0	0	3

II - Course Objectives

1.	To understand the various characteristics of Intelligent agents.,
2.	To learn the different Problem solving agents in AI
3.	To learn the Game theory and CSP techniques.
4.	To perform logical reasoning
5.	To perform the probabilistic reasoning

III - Course Content

Preamble:
This course introduces the fundamental concepts and principles that are essential for learningthe AI Approaches and Intelligent systems.They are needed to understand how to perform logical and probabilistic reasoning with Intelligent systems.

Unit – I	INTELLIGENT AGENTS	9 Periods

Introduction to AI – Recent Trends in AI – Agents and Environments – concept of rationality – nature of environments – structure of agents- Problem solving agents – search algorithms – uninformed search strategies - Case study -Customer Support Chatbot

Unit – II	PROBLEM SOLVING	9 Periods

Heuristic search strategies – Heuristic functions. Local search and optimization problems –Local search in continuous space – Search with non-deterministic actions – Search in partially observable environments – Online search agents and unknown environments

Unit – III	GAME PLAYING AND CSP	9 Periods

Game theory – Optimal decisions in games – Alpha-beta search – Monte- Carlo tree search– Stochastic games – partially observable games. Constraint satisfaction problems– Constraint propagation – structure of CSP backtracking search for CSP – Local search for CSP

Unit – IV	LOGICAL REASONING	9 Periods

Knowledge-based agents – Propositional logic –Propositional theorem proving –Propositional model checking – Agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – Inferences in first order logic – Forward chaining – Backward chaining – Resolution

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Unit – V	PROBABILISTIC REASONING	9 Periods
Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesiannetworks –Exact inference in BN – Approximate inference in BN – Causal networks- Utility Based System - Case study - Weather Prediction Using Naive Bayes		
		TOTAL:45 Periods

Text Books:	[1] Stuart Russell and Peter Norvig, "Artificial Intelligence – A ModernApproach", Fourth Edition, Pearson Education, 2021. [2] Wolfgang Ertel – *Introduction to Artificial Intelligence*, 3rd Edition, Springer, 2023.
Reference Books:	[1] David Poole & Alan Mackworth – *Artificial Intelligence: Foundations of Computational Agents*, 2nd Edition, Cambridge University Press, 2023 [2] Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education,2013. [3] Artificial Intelligence by Example: Develop machine intelligence fromscratch using real artificial intelligence use cases - by Dennis Rothman,2018
MOOC/Web Platforms:	https://nptel.ac.in/courses/106102220 https://www.edx.org/learn/artificial intelligence/columbia-university- artificial-intelligence-ai https://www.coursera.org/professional-certificates/applied-artifical- intelligence-ibm-watson-ai#courses

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	To understand the foundational knowledge of Intelligent Systems	Understand (K 2)
CO2	Utilize problem-solving techniques to achieve optimal solutions or navigate complex environments	Apply (K 3)
CO3	Utilize game playing and CSP approaches to design intelligent systems to solve Problems with optimal decisions and complex constraints.	Apply (K 3)
CO4	Utilize logical reasoning to empower intelligent systems and reasoning techniques to solve the Problem	Apply (K 3)
CO5	Integrate probabilistic reasoning techniques reasoning under uncertainty in intelligent systems	Apply (K 3)

(Action verb of each CO to be matched with the next mapping table)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	1	3	3	1	-	-	-	-	-	-	1	2	1
CO-2	2	2	1	1	1	-	-	-	-	-	-	1	3	1
CO-3	2	1	2	1	2	-	-	-	-	-	-	2	1	1
CO-4	2	1	2	2	2	-	-	-	-	-	-	2	1	1
CO-5	3	2	2	1	2	-	-	-	-	-	-	2	2	1

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in

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I-Course Name: 23AL402-MACHINE LEARNING

Prerequisite	Program Name	Sem	Category	L	T	P	C
Foundations of Data Science	B.E CSE(AI&ML)	IV	PCC	3	0	0	3

II- Course Objectives

1.	To understand the basic concepts of machine learning.
2.	To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance
3.	To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance.
4.	To build the graph based learning models for standard data sets.
5.	To compare the performance of different ML algorithms and select the suitable one based on the application

III- Course Content

Preamble:

- This course provides a comprehensive foundation in the principles and methodologies of Machine Learning, empowering to understand how algorithms can learn from data, make data-driven predictions, and ultimately solve complex problems across diverse disciplines.
- This course equips to leverage the power of Machine Learning, transforming data into intelligent systems that solve real-world problems

Unit – I	INTRODUCTION TO MACHINE LEARNING	8 Periods

Review of linear algebra for machine learning -Introduction and motivation for machine learning; Real time examples of machine learning applications, Introduction to ML workflows: Data collection, preprocessing, model selection, and deployment-Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

Unit – II	SUPERVISED LEARNING	11 Periods

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

Unit – III	ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING	9 Periods

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

Unit – IV	NEURAL NETWORKS	9 Periods

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error back propagation – Unit saturation – ReLU, hyperparameter tuning, batch normalization, regularization, dropout. Case Study: Real-world applications: Image classification, speech recognition.

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Unit – V	DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS	8 Periods
Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test.		
		TOTAL:45 Periods

Text Books:	1. Aurelien Geron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 3rd Edition, 2023. 2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, *Machine Learning*, 2nd Edition, Pearson India, 2024.
Reference Books:	1. Kevin P. Murphy, *Probabilistic Machine Learning: Advanced Topics*, MIT Press, 2023. 2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
MOOC/Web Platforms:	https://onlinecourses.nptel.ac.in/noc23_cs18 https://www.edx.org/learn/machine-learning/massachusetts-institute-of-technology-machine-learning-with-python-from-linear-models-to-deep-learning https://www.coursera.org/specializations/machine-learning-introduction

IV- Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Gain foundational knowledge of machine learning concepts, applications, theoretical aspects	Understand (K 2)
CO2	Apply various supervised learning models for continuous and categorical prediction tasks and evaluate the performance.	Apply(K 3)
CO3	Apply ensemble techniques and unsupervised learning to improve model performance and discover hidden patterns in unlabeled data and evaluate the performance.	Apply(K 3)
CO4	Design, train, and optimize neural networks to address challenges and improve performance for standard data sets	Apply(K 3)
CO5	Design and analyze machine learning experiments using best practices, to evaluate and compare the performance of different ML algorithms and select the suitable one based on the application.	Apply(K 3)

(Action verb of each CO to be matched with the next mapping table)

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V- Mapping Table Mapping of COs with POs and PSOs

COs/ P Os	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	2	1	-	-	-	-	3	-	2	2	2	2
CO-2	1	3	3	1	2	-	-	-	2	-	2	1	3	1
CO-3	2	1	3	3	2	-	-	-	1	-	1	1	1	2
CO-4	2	3	3	2	1	-	-	-	3	-	3	2	1	2
CO-5	1	1	3	3	1	-	-	-	3	-	1	3	3	3

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I-Course Name: 23AL403 - DATABASE SYSTEM DESIGN AND MANAGEMENT

Prerequisite	Program Name	Sem	Category	L	T	P	C
Data Structures Design	B.E CSE (AI&ML)	IV	PCC	3	0	0	3

II - Course Objectives

1.	To introduce database development life cycle and conceptual modeling
2.	To learn SQL for data definition, manipulation and querying a database.
3.	To learn relational database design using conceptual mapping and normalization
4.	To learn transaction concepts and serializability of schedules
5.	To learn data model and querying in object-relational and No-SQL databases

III - Course Content

Preamble:
Database Design and Management, is meticulously crafted to equip you with the foundational knowledge and practical skills necessary to navigate the complexities of data management. Through a comprehensive exploration of data modeling techniques, database architecture, and optimization strategies, Students will gain a deep understanding of the principles and best practices that underpin successful database systems.

Unit – I	CONCEPTUAL DATA MODELING	8 Periods
Database environment – Database system development lifecycle – Requirements collection –Database design - Entity-Relationship model – Enhanced-ER model – UML class diagrams.		
Unit – II	**RELATIONAL MODEL AND SQL**	**10 Periods**
Relational model concepts — Integrity constraints — SQL Data manipulation – SQL Datadefinition Views–triggers — SQL programming		
Unit – III	**RELATIONAL DATABASE DESIGN AND NORMALIZATION**	**9 Periods**
ER and EER-to-Relational mapping – Update anomalies – Functional dependencies – Inference rules –Minimal cover – Properties of relational decomposition – Normalization (upto BCNF).		
Unit – IV	**TRANSACTION MANAGEMENT**	**9 Periods**
Transaction concepts – properties – Schedules - Serializability – Concurrency Control – Two-phase locking techniques. Recovery Mechanisms: Recovery and atomicity, Log-based recovery. Data Storage–SQL Injection		

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Unit – V	OBJECT RELATIONAL AND NO-SQL DATABASES	9 Periods
Mapping EER to ODB schema – Object identifier – reference types – row types – UDTs – Sub types and super types – user-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document- based: MongoDB data model and CRUD operations; Column-based: Hbase data model and CRUD operations.		
		TOTAL : 45 Periods

Text Books:	[1] Thomas M. Connolly, Carolyn E. Begg, Database Systems – A PracticalApproach to Design, Implementation, and Management, Sixth Edition, Global Edition, Pearson Education, 2015. [2] Ramez Elmasri, Shamkant B. Navathe, Fundamentals of DatabaseSystems, 7th Edition, Pearson, 2017.
Reference Books:	[1] Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, DATABASE MODELING AND DESIGN – Logical Design, Fifth Edition, Morgan KaufmannPublishers, 2011. [2] Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012. [3] Abraham Silberschatz, Henry F Korth, S Sudharshan, Database SystemConcepts", 7th Edition, Tata Mc Graw Hill, 2019.
MOOC/Web Platforms:	https://archive.nptel.ac.in/courses/106/106/106106093/ https://www.coursera.org/learn/database-design-postgresql https://www.edx.org/certificates/professional-certificate/ibm-sql-nosql-and-relational- database-fundamentals

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand the database development life cycle and apply conceptual modeling	Understand (K 2)
CO2	Apply SQL and programming in SQL to create, manipulate and query the database	Apply (K3)
CO3	Apply the conceptual-to-relational mapping and normalization todesign relational database.	Apply (K3)
CO4	Determine the serializability of any non-serial schedule usingconcurrency techniques	Apply (K3)
CO5	Apply the data model and querying in Object-relational and No-SQL databases.	Apply (K3)

(Action verb of each CO to be matched with the next mapping table)

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V - Mapping Table Mapping of COs with POs and PSOs

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CO-1	2	2	3	3	1	-	-	-	-	-	-	1	2	2
CO-2	2	2	1	3	2	-	-	-	-	-	-	2	2	2
CO-3	2	2	2	1	2	-	-	-	-	-	-	2	1	2
CO-4	2	2	2	1	2	-	-	-	-	-	-	2	1	2
CO-5	2	2	3	2	2	-	-	-	-	-	-	3	2	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS403 OBJECT ORIENTED SOFTWARE ENGINEERING

Prerequisite	Program Name	Sem	Category	L	T	P	C
Programming Basics ,Basic Data Structures and Algorithm	B.E/B.Tech. – Common to CSE , IT & CSE(AI&ML)	IV	PCC	3	0	2	4

II - Course Objectives

1.	To understand Software Engineering Lifecycle Models
2.	To Perform software requirements analysis
3.	To gain knowledge of the System Analysis and Design concepts using UML.
4.	To understand software testing and maintenance approaches
5.	To work on project management scheduling using DevOps

III - Course Content

Preamble: It is at the core of software development processes. Hence all software development companies have a need for the same. These include – Microsoft, Samsung, Xerox, Yahoo, Google, IBM, TCS, Infosys, Amazon, Flipkart, etc.

Unit – I	SOFTWARE PROCESS AND AGILE DEVELOPMENT	9 Periods

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility-Agile Process-Extreme programming-XP Process-Case Study. (Agile Implementation in Real-world Projects)

Unit – II	REQUIREMENTS ANALYSIS AND SPECIFICATION	9 Periods

Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Deployment Diagram-Component diagram- CASE TOOLS.

Unit – III	SOFTWARE DESIGN	9 Periods

Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller-Architectural styles – Layered - Client Server - Tiered - Pipe and filter- User interface design-Case Study.

Unit – IV	SOFTWARE TESTING AND MAINTENANCE	9 Periods

Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing- Internal Acceptance Testing (IAT) - User Acceptance Testing (UAT)– Debugging -Automated Software Testing Tools– Symbolic execution – Model Checking-Case Study: Selenium and Cucumber.

Unit – V	PROJECT MANAGEMENT	9 Periods

Software Project Management-Software Configuration Management - Project Scheduling- Resource Allocation and Effort Estimation- Integration in Project Management-Collaboration Tools: Slack, Microsoft Teams, and Confluence- Risk Management- Case Study- ARENA.

TOTAL : 45 Periods

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Text Books:	1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009. 2. Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, First Edition, Mc Graw-Hill International Edition, 2014.
Reference Books:	1.Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010. 2.Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005. 3.Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", Pearson Education, 2016 4. Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009. 5. Stephen Schach, Object-Oriented and Classical Software Engineering, 8th ed, McGraw-Hill, 2010.
MOOC/Web Platforms:	https://archive.nptel.ac.in/courses/106/105/106105153/

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Understand software engineering concepts and agile development methods (K2).	Understand(K2)
CO2	Analyze and model software requirements using UML and tools (K4).	Analyze (K4)
CO3	Design software systems using modern patterns and architectures (K5).	Design(K5)
CO4	Apply testing techniques and tools for software quality assurance (K3).	Apply (K3)
CO5	Develop software projects using risk management, scheduling, and DevOps practices (K5).	Develop (K5)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	2	1	2	2	-	-	-	-	1	1	2	2	2
CO-2	3	3	2	3	3	-	-	-	-	2	2	3	3	2
CO-3	2	3	3	2	2	-	-	-	-	2	2	3	2	3
CO-4	3	3	2	3	3	-	-	-	-	2	2	3	2	3
CO-5	2	3	2	2	3	-	-	-	-	1	2	2	3	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

PRACTICAL EXERCISES: 30 PERIODS
LIST OF EXPERIMENTS:

1. Identify a software system for development and document the problem statement.
2. Prepare the **Software Requirements Specification (SRS)** document for the identified system.
3. Identify use cases and create the **Use Case Model**.
4. Develop a **Domain Model** and derive the **Class Diagram** based on conceptual classes.
5. Analyze object interactions and represent them using **UML Sequence and Collaboration Diagrams**.
6. Create **State Chart** and **Activity Diagrams** for key processes in the system.
7. Implement the system based on the detailed design specifications.
8. Perform comprehensive testing for all scenarios defined in the **Use Case Diagram**.
9. Enhance the software system's reusability and maintainability by applying appropriate **Design Patterns**.
10. Implement the updated system with design improvements and test it for various scenarios.

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

TOTAL : 45 + 30 = 75 Periods

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I - Course Name: 23CS404 OPERATING SYSTEMS

Prerequisite	Program Name	Sem	Category	L	T	P	C
Introduction to Operating System	B.E/B.Tech.– Common to CSE,IT,ECE,EEE, CSE(AI&ML)	IV	PCC	3	0	0	3

II - Course Objectives

1	To understand the basic concepts, objectives, and evolution of operating systems and their components.
2	To analyze process management techniques, including scheduling, synchronization, and deadlock management.
3	To explore memory management strategies and their implementation in modern operating systems.
4	To understand storage management, file systems, and input/output systems.
5	To gain hands-on experience with modern operating systems like Linux, iOS, and Android, and explore emerging challenges in virtualized environments.

III - Course Content

Preamble: This course makes the students to learn the basic concepts and functions of operating systems. It helps to understand the process and threads. It also helps the students to recognize and various methods to solve problems relevant to process, process scheduling and deadlocks and illustrates the various memory management techniques and also describe the I/O management and file storage structures. This subject enables the students to be familiar with the basis of Linux system and mobile OS like IOS and Android.

Unit – I	INTRODUCTION	9 Periods
Operating System Overview - Objectives and Functions - Types of Operating system-Operating System Structures - User Operating system Interface- System Calls– Security Measures on Operating system.		
Unit – II	**PROCESS MANAGEMENT**	**9 Periods**
Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock .		
Unit – III	**MEMORY MANAGEMENT**	**9 Periods**
Memory Management Strategies - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement algorithm–Thrashing		
Unit – IV	**STORAGE MANAGEMENT**	**9 Periods**
Storage system –Disk Scheduling Algorithm-Directory Structure - Directory implementation - Directory organization - File System concept - Access methods - File system mounting-File Sharing and Protection; File System Implementation - File System Structure - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.		

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Unit – V	CASE STUDY	9 Periods
Linux Operating system-Mobile OS - iOS and Android-RTOS-Emerging challenges in New Hardware- VM Ware and its implementation.		
		TOTAL : 45 Periods

Text Books:	1.Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018. 2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition,2022 New Delhi.
Reference Books:	1. Achyut S. Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016. 2. Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces," Paperback, Imported Edition, 1 September 2018.
MOOC/Web Platforms:	https://archive.nptel.ac.in/courses/106106144/%20 - Introduction to to operating system https://archive.nptel.ac.in/courses/106105172/ - Realtime Operating system(RTOS) https://archive.nptel.ac.in/courses/106102132/ - Operating System https://archive.nptel.ac.in/courses/106105214/ - Operating System Fundamentals

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Explain the evolution, objectives, and types of operating systems, including their structure, system calls, and security measures.	K2 (Understand)
CO2	Analyze process management techniques such as process scheduling, inter-process communication, synchronization, and deadlock handling.	K4 (Analyze)
CO3	Apply memory management strategies, including paging, segmentation, and virtual memory, to solve allocation and performance issues.	K3 (Apply)
CO4	Demonstrate the functioning of storage systems, disk scheduling, and file systems, and assess their implementation methods.	K4 (Analyze)
CO5	Evaluate case studies of operating systems like Linux, iOS, Android, and RTOS, and discuss challenges in modern hardware and virtualization.	K5 (Evaluate)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	1	2	2	-	-	-	-	3	2	3	3	1	1
CO-2	2	2	3	1	1	-	-	-	2	1	2	1	2	2
CO-3	1	3	2	2	1	-	-	-	2	2	1	1	1	1
CO-4	1	3	3	3	-	-	-	-	1	2	1	1	2	1
CO-5	3	1	2	1	1	-	-	-	3	2	3	3	2	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CS405-THEORY OF COMPUTATION

Prerequisite	Program Name	Sem	Category	L	T	P	C
Discrete Mathematics	B.E/B.Tech. – Common to CSE,IT,CSE(AI&ML)	IV	PCC	3	0	0	3

II - Course Objectives

1	To learn the mathematical notations and analyze deterministic finite automata (DFA) and nondeterministic finite automata (NFA), including their equivalence and differences
2	To understand and infer the relationship of finite automate and regular expressions
3	To understand the language hierarchy, relationship between context free grammar and its language and to construct a PDA of CFG.
4	To examine deterministic pushdown automata and the conversion between CFGs and PDAs
5	To understand the foundational model of Turing machines (TM) and their role in language acceptance as well as undecidability concepts.

III - Course Content

Preamble: Discrete Mathematics covers the mathematical topics most directly related to computer science. Topics includes: logic, count ability and counting arguments, proof techniques. Software engineering uses graphs, trees and other data structures. Logic is used in AI research in theorem proving and in database query systems		
Unit – I	**AUTOMATA THEORY**	**9 Periods**
Basic Concepts of Automata-Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata-Myhill-Nerode Theorem.		
Unit – II	**REGULAR EXPRESSIONS AND LANGUAGES**	**9 Periods**
Regular expression – Regular Languages- Equivalence of Finite Automata and regular expressions – Pumping Lemma– Closure properties of regular languages.		
Unit – III	**CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA**	**9 Periods**
Types of Grammar - Chomsky 's hierarchy of languages -Context-Free Grammar (CFG) and Languages – Derivations and Parse trees – Ambiguity in grammars and languages – Push Down Automata (PDA): Definition – Moves - Instantaneous descriptions -Languages of pushdown automata – Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG – Deterministic Pushdown Automata.		
Unit – IV	**NORMAL FORMS**	**9 Periods**
Normal forms for CFG – Simplification of CFG- Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) – Pumping lemma for CFL – Closure properties of Context Free Languages.		
Unit – V	**TURING MACHINE**	**9 Periods**
Turing machines (TM)- Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, Universal TM, Recursive and recursively enumerable		

languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP.
TOTAL : 45 Periods

Text Books:	1. Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2008 2. John C Martin , "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill, 2011.
Reference Books:	1. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2nd Edition, Prentice Hall of India, 2015. 2. Peter Linz, "An Introduction to Formal Language and Automata", 6th Edition, Jones & Bartlett, 2016. 3. K.L.P.Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata Languages and Computation", 3rd Edition, Prentice Hall of India, 2006.
MOOC/Web Platforms:	https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/#introduction https://onlinecourses.nptel.ac.in/noc21_cs83/preview

IV - Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Construct deterministic and nondeterministic finite automata	Apply (K3)
CO2	Apply regular expressions and regular languages for any pattern.	Apply (K3)
CO3	Construct context-free grammar and push down automata for any language.	Apply (K3)
CO4	Convert context-free grammars(CFGs) into standard normal forms for efficient parsing and language processing.	Apply (K3)
CO5	Design Turing machine for computational functions,and undecidable problems.	Apply (K3)

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V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	2	-	-	-	-	-	-	-	2	3	2
CO-2	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO-3	3	3	2	3	-	-	-	-	-	-	-	2	3	3
CO-4	3	2	3	3	-	-	-	-	-	-	-	3	3	2
CO-5	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23AL411 Artificial Intelligence and Machine Learning Laboratory

Prerequisites	Program Name	Sem	Category	L	T	P	C
Data Structure and Algorithm	B.E CSE(AI & ML)	IV	PCC	0	0	3	1.5

II - Course Objectives

1	To learn and implement uninformed and informed search techniques
2	To build a knowledge base in Prolog and process queries to perform inference.
3	To build supervised learning models.
4	To explore the regression models.
5	To learn to compare and evaluate the performance of different models

III - Course Content

LIST OF EXPERIMENTS:

1. BFS & DFS algorithm implementation
2. A* algorithm implementation
3. Hill Climbing implementation
4. Develop a small KB using Prolog and answer simple queries.
5. Inference through Prolog/Python.
6. Write a program to implement the naïve Bayesian classifier for credit card analysis and compute the accuracy with a few test data sets.
7. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
8. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
9. Evaluate the performance of Linear regression, logistic regression, naïve Bayes and SVM based prediction models for heart disease diagnosis.
10. Implement K-Means Clustering for Customer Segmentation.
11. Implement PCA (Principal Component Analysis) for Dimensionality Reduction.
12. Implement Support Vector Machine (SVM) for Handwritten Digit Recognition

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

TOTAL: 45 PERIODS

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IV - Course Outcome

	On completion of the course, the students will be able to	Bloom's Level Mapped
CO1	Implement uninformed and informed search techniques	Apply(K3)
CO2	Build a knowledge base in Prolog and process queries to perform inference	Create(K6)
CO3	Develop supervised learning models	Create(K6)
CO4	Develop regression models	Create(K6)
CO5	Compare and evaluate the performance of different models	Evaluate(K5)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	3	3	2	3	3	-	1	-	-	-	1	3	3
CO-2	2	3	3	2	3	3	-	1	-	-	-	1	3	3
CO-3	2	3	3	2	3	3	-	1	-	-	-	1	3	3
CO-4	2	3	3	2	3	3	-	1	-	-	-	1	3	3
CO-5	2	3	3	2	3	3	-	1	-	-	-	1	3	3

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO

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I- Course Name: 23AL412- DATABASE SYSTEM DESIGN AND MANAGEMENT LABORATORY

Prerequisite	Program Name	Sem	Category	L	T	P	C
Data Structures Design Laboratory	B.E CSE(AI&ML)	IV	PCC	0	0	3	1.5

II - Course Objectives

1.	To understand the database development life cycle
2.	To learn database design using conceptual modeling, Normalization
3.	To implement database using Data definition, Querying using SQL manipulation and SQL programming
4.	To implement database applications using IDE/RAD tools
5.	To learn querying Object-relational databases

III - LIST OF EXPERIMENTS

LIST OF EXPERIMENTS **Total Hours: 45 Periods**

Tools: Pro SQL, Net Beans, Oracle, Rational rose or star UML,

1. Database Development Life cycle: Problem definition and Requirement analysis Scope and Constraints
2. Database design using Conceptual modeling (ER-EER) – top-down approach
3. Mapping conceptual to relational database and validate using Normalization
4. Implement the database using SQL Data definition with constraints, Views
5. Query the database using SQL Manipulation
6. Querying/Managing the database using SQL Programming
   a. Stored Procedures/Functions
   b. Constraints and security using Triggers
7. Database design using Normalization – bottom-up approach
8. Develop database applications using IDE/RAD tools (Eg., NetBeans, VisualStudio)
9. Database design using EER-to-ODB mapping / UML class diagrams
10. Object features of SQL-UDTs and sub-types, Tables using UDTs, Inheritance, Method definition
11. Querying the Object-relational database using Objet Query language
12. Build a front-end application with database connectivity for storage and retrieval.

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IV- Course Outcome

	On completion of the course, the students will be able to	Bloom's Level Mapped
CO1	Understand the database development life cycle	Understand (K2)
CO2	Design relational database using conceptual-to-relational mapping, Normalization	Apply (K3)
CO3	Apply SQL for creation, manipulation and retrieval of data	Apply (K3)
CO4	Develop a database applications for real-time problems	Apply (K3)
CO5	Design and query object-relational databases	Apply (K3)

(Action verb of each CO to be matched with the next mapping table)

V- Mapping Table Mapping of COs with POs and PSOs

COs / POs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO - 10	PO - 11	PO - 12	PSO -1	PSO -2
CO-1	2	3	3	1	1	-	-	1	2	1	2	1	2	3
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CO-3	2	3	3	2	1	-	-	2	2	3	1	2	2	2
CO-4	3	2	2	2	-	-	-	1	1	2	1	2	2	2
CO-5	2	3	3	3	-	-	-	2	2	1	1	2	1	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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I - Course Name: 23CSAO2- MongoDB (Value Added Course)

Prerequisite	Program Name	Sem	Category	L	T	P	C
NIL	B.E CSE(AI&ML)	IV	EEC	0	0	2	1$

II - Course Objectives

1.	To provide foundational and advanced knowledge of modern JavaScript
2.	To develop proficiency in React.js
3.	To introduce MongoDB as a NoSQL database
4.	To enable learners to integrate frontend and backend technologies
5.	To foster the ability to build, test, and deploy scalable and maintainable full-stack solutions

III - Course Content

Preamble:
This Value-Added Course is structured to provide a balanced mix of theoretical knowledge and practical experience, ensuring that participants not only understand the concepts but also can apply them in real-world scenarios. By the end of the course, students will have a strong foundation in modern development practices, ready to take on the challenges of today's software development landscape.

Module 1	Modern JavaScript & ECMAScript	6 Periods

Introduction to JavaScript & ECMAScript- ES6–ES2023 Features: Template literals, async/await, top-level await- let, const, arrow functions- Classes & Inheritance- Promises, async/await, error handling- Array methods: map, reduce, flat, includes- Spread/Rest operators, destructuring, default parameters- Advanced concepts: Generators, Iterators, Sets, Maps

Module 2	Frontend Development with React.js	6 Periods

Introduction to React 19- JSX Syntax & Environment Setup-Functional vs. Class Components-React Hooks: useState, useEffect, useRef, useContext, etc.- State & Props Management- Context API for global state-Concurrent rendering, React Suspense, Server Components

Module 3	Advanced React Features & Routing	6 Periods

React Router v6: Nested, dynamic routes- Lazy loading: React.lazy & Suspense-Forms: Controlled & uncontrolled components- Form validation & event handling- Lifecycle hooks: useEffect, useLayoutEffect- Error Boundaries- use Transition and useSyncExternalStore for async UI updates

Module 4	Backend Development with MongoDB	6 Periods

Introduction to MongoDB & MongoDB Atlas-Schema Design using Mongoose-CRUD Operations (Insert, Find, Update, Delete)-Aggregation Framework-Indexing for performance-Transactions: Multi-document ACID operations

Module 5	Full Stack Integration with Node.js & Express	6 Periods

Introduction to Node.js and Express- Connecting Express.js with MongoDB- Building RESTful API Endpoints-Storing and retrieving data- Error handling and middleware in Express- Integration with frontend (React) for full-stack app

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	ASSESSMENT	
		Total :30 Periods

IV- Course Outcome

On completion of the course, the students will be able to		Bloom's Level Mapped
CO1	Apply modern JavaScript features to build dynamic and modular client-side functionality	Apply (K3)
CO2	Develop responsive and stateful user interfaces using React 19 and its advanced hooks	Apply (K3)
CO3	Implement complex navigation and form handling using React Router v6 and lifecycle management	Apply (K3)
CO4	Design efficient database schemas and perform CRUD and advanced queries using MongoDB	Apply (K3)
CO5	Build and integrate full-stack applications using Node.js, Express, React, and MongoDB	Apply (K3)

V - Mapping Table Mapping of COs with POs and PSOs

COs/ POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
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CO-4	3	3	2	2	3	-	-	2	2	3	2	3	3	2
CO-5	3	3	3	3	2	-	-	2	3	3	2	3	3	2

Mapping: 1-Low, 2-Medium, 3-High (Mapping value based on usage of Action verbs in each CO)

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