P.S. R. ENGINEERING COLLEGE

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

Approved by AICTE, New Delhi & Accredited by NBA and

by NAAC with A+ Grade, Recognized under 12(B) of the UGC Act, 1956)

An ISO 9001: 2015 Certified Institution

Sevalpatti (P.O), Sivakasi – 626140.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM AND SYLLABI

Regulations – 2023

B.Tech., Artificial Intelligence and Data Science

(Full-time)

(Candidates admitted from 2023–2024 onwards)

Department of

Artificial Intelligence and Data Science

CURRICULUM AND SYLLABI

UG Regulations- 2023

INSTITUTE VISION & MISSION

Vision	• To contribute to the society through excellence in technical education with societal values and thus a valuable resource for industry and the humanity.
Mission	• To create an ambience for quality learning experience by providing sustained care and facilities. • To offer higher-level training encompassing both theory and practices with human and social values. • To provide knowledge based services and professional skills to adapt tomorrow's technology and embedded global changes.

DEPARTMENT VISION & MISSION

Vision	• To encourage the professionals in the field of Artificial Intelligence and Data Science contributing globally to the benefit of industry and society.
Mission	• Offering well-balanced curriculum to engage the students in a smart learning ambiance for developing competent AI professionals. • To enlighten students to experience in learning, research and industrial collaboration to update their knowledge in the field of Artificial Intelligence and Data Science. • To equip the professionals with high ethical values and ability to solve real-life problems.

Programme Educational Objectives (PEO's)

PEO 1: To enable graduates to pursue higher education and research and have a successful Career in industries associated with Engineering.

PEO 2: Graduates will be able to handle the challenges of rapidly changing technology in Real- life problems.

PEO 3: Embrace lifelong learning to meet ever-changing developments in Artificial Intelligence and Data science

PEO 4: Graduates will attain **e**ntrepreneurial skills that allow them to contribute ethically to the need of society

Programme Specific Outcomes (PSO's)

PSO1: Apply mathematical and statistical models along with suitable AI algorithms to address and solve computational tasks.

PSO2: Apply the Data Science & Artificial Intelligence techniques to achieve effective insights and decision making to solve real-life problems.

PSO3: Develop software applications and solutions to meet the needs of industry and society.

PROGRAMME OUTCOMES (PO's)

Engineering Graduates will be able to:

PO1 Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3 Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4 Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5 Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6 The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7 Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8 Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9 Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10 Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11 Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

Semester	Theory Courses						Theory Cum Practical Courses		Institution Non-Credit Courses	Practical Courses			Special Courses	Value Added / Mandatory Courses	Total Credits
1	231HS11 Functional English (3)	231BS11 Matrices and Calculus (3)	231BS12 Engineering Physics (3)	231BS13 Engineering Chemistry (3)	231ES11 Basic Electrical & Electronics Engineering (3)	231ESF1 Problem Solving and Python Programming (3)	-	-	-	231HS17- English Communication Laboratory – I (1)	231BS17 Physics and Chemistry Laboratory (1.5)	231ESF7 Python Programming Laboratory (1.5)	231HS12 தமிழர் மரபு (Heritage of Tamil) (1)	-	***23***
2	231HS21 English for Engineer (3)	231BS21 Partial Differential Equations and Numerical Methods (3)	231BS22 Physics of Materials(3)	231BS24EnvironmentalScience (3)	231CS21 Programming in C (3)	-	231ESF2 Engineering Drawing(3)	-	NCC Credit Course Level 1-	231HS27 English Communication Laboratory – II (1)	231ESF8 Engineering Practices Laboratory (1.5)	231CS27 C Programming Laboratory (1.5)	231HS22 தமிழரும் தொழில் நுட்பமும் (Tamil and Technology)(1)	-	***23***
3	231BS31 Transforms and Complex Analysis (3)	231AD31 Artificial Intelligence (3)	231AD32 Computer System and Architecture (3)	231CS32 Data Structures (3)	-	-	231AD33 Object Oriented Programming with JAVA (4)	231AD34 Data Exploration and Visualization (4)	-	231AD37 Artificial Intelligence Laboratory (1.5)	231CS37 Data Structures Laboratory (1.5)	-	231HS37 Enhancing Communication skills(1*)	231MC0x Mandatory Course – I	***23***
4	231BS42 Probability and Statistics (3)	231AD41 Data Analytics (3)	231CS41 Database management Systems (3)	231CS42 Design and Analysis of Algorithms (3)	-	-	231CS45 Operating Systems (4)	231CS46 Computer Networks(4)	NCC Credit Course Level 2	231CS47 Database Management Systems Laboratory (1.5)	-	-	231HS47 Enhancing Aptitude and Reasoning Skills(1*)	VACCS0x Value Added Course-I	***21.5***
5	231AD51 Machine Learning Algorithms (3)	231AD52 Introduction to IOT (3)	231ADxx Program Elective - I (3)	231ADxx Program Elective – II (3)	-	231OExx Open Elective -I (3)	231AD53 Computer Vision and Image Processing (4)	-	-	-	231AD57 Machine Learning Laboratory (1.5)	-	-	231MCxx Mandatory Course – II	**20.5**
6	231AD61 Deep Learning Techniques (3)	231AD62 Data and Information Security (3)	231AD63 Big Data Frameworks (3)	231ADxx Program Elective – III (3)	231ADxx Program Elective – IV (3)	231OExx Open Elective -II (3)	-	-	-	231AD67 Big Data Frameworks Laboratory (1.5)	231AD68 Deep Learning Techniques Laboratory (1.5)	231AD69 Mini Project (1)	-	VACCS0x Value Added Course-II	**22**
7	231ADxx Program Elective – V (3)	231ADxx Program Elective – VI (3)	231OExx Open Elective -III (3)	231BAE* Mgmt. Elective – I (3)	-	-	231AD71 AI based Diagnostics tools (4)	231AD72 Linguistics and Language Theory (4)	-	231AD79 Project – I (2)	231AD70 Internship (1)	-	-	-	**23**
8	-	-	-	-	-	-	-	-	-	231AD89 Project – II (8)	-	-	-	-	**8**

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
CHOICE BASED CREDIT SYSTEM – UG REGULATION–2023
B.Tech. (AI&DS) Curriculum &Syllabus

Semester – I

S. No.	Category	Course Code	Course Title	Hours/ Week			Total Periods	Credits
				L	T	P		
1.	HS	231IP00	Induction Programme	-	-	-	-	0
THEORY:								
2.	HS	231HS11	Functional English	3	0	0	3	3
3.	BS	231BS11	Matrices and Calculus	2	1	0	3	3
4.	BS	231BS12	Engineering Physics	3	0	0	3	3
5.	BS	231BS13	Engineering Chemistry	3	0	0	3	3
6.	ES	231ES11	Basic Electrical and Electronics Engineering	3	0	0	3	3
7.	ES	231ESF1	Problem Solving and Python Programming	3	0	0	3	3
8.	HS	231HS12	தமிழர் மரபு (Heritage of Tamil)	1	0	0	1	1
PRACTICAL:								
9.	BS	231BS17	Physics and Chemistry Laboratory	0	0	3	3	1.5
10.	ES	231ESF7	Python Programming Laboratory	0	0	3	3	1.5
11.	EEC	231HS17	English Communication Laboratory –I	0	0	2	2	1
Total Number of Periods				**18**	**1**	**8**	**27**	
Total Number of Credits								**23**

Semester – II

S. No.	Category	Course Code	Course Title	Hours/ Week			Total Periods	Credits
				L	T	P		
THEORY								
1.	HS	231HS21	English for Engineer	3	0	0	3	3
2	BS	231BS21	Partial Differential Equations and Numerical Methods	3	1	0	4	3
3	BS	231BS22	Physics of Materials	3	0	0	3	3
4	BS	231BS24	Environmental Science	3	0	0	3	3
5	ES	231ESF2	Engineering Drawing	1	0	4	5	3
6	ES	231CS21	Programming in C	3	0	0	3	3
7	HS	231HS22	தமிழரும் ததொழில் நுட்பமும் (Tamil and Technology)	1	0	0	1	1
PRACTICAL								
8	BS	231ESF8	Engineering Practices Laboratory	0	0	3	3	1.5
9	PC	231CS27	C Programming Laboratory	0	0	3	3	1.5
10	EEC	231HS27	English Communication Laboratory – II	0	0	2	2	1
11		NCC -L1	NCC Credit Course Level 1*					-
Total Number of Periods				**17**	**1**	**12**	**30**	
Total Number of Credits								**23**

Semester – III

S. No.	Category	Course Code	Course Title	Hours / Week			Total Periods	Credits
				L	T	P		
THEORY:								
1	BS	231BS31	Transforms and Complex Analysis	3	0	0	3	3
2	PC	231AD31	Artificial Intelligence	3	0	0	3	3
3	PC	231AD32	Computer System and Architecture	3	0	0	3	3
4	PC	231CS32	Data Structures	3	0	0	3	3
THEORY–CUM–PRACTICAL:								
5	PC	231AD33	Object Oriented Programming with JAVA	3	0	2	5	4
6	PC	231AD34	Data Exploration and Visualization	3	0	2	5	4
MANDATORY COURSE:								
7	MC	231MC0x	Mandatory Course – I	2	0	0	2	1*
PRACTICAL:								
8	BS	231HS37	Enhancing Communication Skills	0	0	2	2	1*
9	PC	231AD37	Artificial Intelligence Laboratory	0	0	3	3	1.5
10	PC	231CS37	Data Structures Laboratory	0	0	3	3	1.5
Total Number of Periods				**20**	**0**	**12**	**32**	
Total Number of Credits								**23**

Semester – IV

S. No.	Category	Course Code	Course Title	Hours / Week			Total Periods	Credits
				L	T	P		
THEORY:								
1.	BS	231BS42	Probability and Statistics	3	0	0	3	3
2	PC	231AD41	Data Analytics	3	0	0	3	3
3	PC	231CS41	Database Management Systems	3	0	0	3	3
4	PC	231CS42	Design and Analysis of Algorithms	3	0	0	3	3
THEORY–CUM–PRACTICAL:								
5	PC	231CS45	Operating System	3	0	2	5	4
6	PC	231CS46	Computer Networks	3	0	2	5	4
PRACTICAL:								
7	PC	231CS47	Database Management Systems Laboratory	0	0	3	3	1.5
8	EEC	231HS47	Enhancing Aptitude and Reasoning Skills	0	0	1	1	1*
9	EEC	VACCS0x	Value Added Course-I	0	0	1	1	1*
10	HS	NCC –L2	NCC Credit Course Level 2	-	0	0	0	2*
Total Number of Periods				**18**	**0**	**9**	**27**	
Total Number of Credits								**21.5**

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Semester – V

S. No.	Category	Course Code	Course Title	Hours / Week			Total Periods	Credits
				L	T	P		
THEORY:								
1	PC	231AD51	Machine Learning Algorithms	3	0	0	3	3
2	PC	231AD52	Introduction to IOT	3	0	0	3	3
3	PC	231ADXX	Program Elective -I	3	0	0	3	3
4	PC	231ADXX	Program Elective -II	3	0	0	3	3
5	OE	23OEXX	Open Elective -I	3	0	0	3	3
THEORY–CUM–PRACTICAL:								
6	PC	231AD53	Computer Vision and Image Processing	3	0	2	5	4
MANDATORY COURSE:								
7	MC	231MC0x	Mandatory Course – II	2	0	0	2	1*
HONORS COURSES:								
8	PE	231ADH0x	*Honors Course – I*	3	0	0	3	3#
9	PE	231ADH0x	*Honors Course – II*	3	0	0	3	3#
PRACTICAL:								
10	PC	231AD57	Machine Learning Laboratory	0	0	3	3	1.5
Total Number of Periods				**20**	**0**	**05**	**25**	
Total Number of Credits								**20.5**

Semester – VI

S. No.	Category	Course Code	Course Title	Hours / Week			Total Periods	Credits
				L	T	P		
THEORY:								
1	PC	231AD61	Deep Learning Techniques	3	0	0	3	3
2	PC	231AD62	Data and Information Security	3	0	0	3	3
3	PC	231AD63	Big Data Frameworks	3	0	0	3	3
4	PC	231ADXX	Program Elective -III	3	0	0	3	3
5	PC	231ADXX	Program Elective -IV	3	0	0	3	3
6	OE	23OEXX	Open Elective- II	3	0	0	3	3
PRACTICAL:								
7	PC	231AD67	Big Data Frameworks Laboratory	0	0	3	3	1.5
8	PC	231AD68	Deep Learning Techniques Laboratory	0	0	3	3	1.5
9	EEC	VACCS0x	Value Added Course-II	0	0	1	1	1*
HONORS COURSES:								
10	PE	231ADH0x	*Honors Course – III*	3	0	0	3	3#
11	PE	231ADH0x	*Honors Course – IV*	3	0	0	3	3#
MINI PROJECT								
12	EEC	231AD69	Mini Project	0	0	2	0	1
Total Number of Periods				**20**	**0**	**08**	**28**	
Total Number of Credits								**22**

Semester – VII

S. No.	Category	Course Code	Course Title	Hours/ Week			Total Periods	Credits
				L	T	P		
THEORY–CUM–PRACTICAL:								
1.	PC	231AD71	AI based Diagnostics tools	3	0	2	5	4
2	PC	231AD72	Linguistics and Language Theory	3	0	2	5	4
PROGRAM ELECTIVE:								
3	PE	231ADxx	Program Elective –V	3	0	0	3	3
4	PE	231ADxx	Program Elective –VI	3	0	0	3	3
OPEN ELECTIVE:								
5	OE	231OExx	Open Elective–III	3	0	0	3	3
MANAGEMENT ELECTIVE:								
6	HS	231BAEx	Management Elective–I	3	0	0	3	3
HONORS COURSES:								
7	PE	231ADH0x	*Honors Course – V*	3	0	0	3	3#
8	PE	231ADH0x	*Honors Course – VI*	3	0	0	3	3#
PRACTICAL:								
9	EEC	231AD79	Project–I	0	0	4	4	2
10	EEC	231AD70	Internship/Field Project	0	0	1	0	1
Total Number of Periods				**18**	**0**	**9**	**27**	
Total Number of Credits								**23**

Semester–VIII

S. No.	Category	Course Code	Course Title	Hours/ Week			Total Periods	Credits
				L	T	P		
PRACTICAL:								
1	EEC	231AD89	Project–II	0	0	16	16	8
Total Number of Periods				**0**	**0**	**16**	**16**	
Total Number of Credits								**8**

Total Number of Credits = 23+23+23+21.5+20.5+22+23+8 = 164

VERTICAL V – ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

S. No.	Category	Course Code	Course Title	Hours / Week			Total Periods	Credits
				L	T	P		
1.	PE	231ADV51	Pattern Recognition	3	0	0	3	3
2	PE	231ADV52	Text and Speech Analysis	3	0	0	3	3
3	PE	231ADV53	Prompt Engineering	3	0	0	3	3
4	PE	231ADV54	Medical Image Processing	3	0	0	3	3
5	PE	231ADV55	Applied GenAI Systems	3	0	0	3	3
6	PE	231ADV56	Recommender System	3	0	0	3	3
7	PE	231ADV57	Ethics and AI	3	0	0	3	3
8	PE	231ADV58	Privacy and Security in AI	3	0	0	3	3

VERTICAL VI – DATA SCIENCE

S. No.	Category	Course Code	Course Title	Hours / Week			Total Periods	Credits
				L	T	P		
1.	PE	231ADV61	Data Science using R	3	0	0	3	3
2	PE	231ADV62	Computational Social Network Analysis	3	0	0	3	3
3	PE	231ADV63	Image and Video Analytics	3	0	0	3	3
4	PE	231ADV64	Health Care Data Analytics	3	0	0	3	3
5	PE	231ADV65	Predictive Analytics	3	0	0	3	3
6	PE	231ADV66	Cognitive Science	3	0	0	3	3
7	PE	231ADV67	Stream Processing	3	0	0	3	3
8	PE	231ADV68	Knowledge Engineering	3	0	0	3	3

LIST OF OPEN ELECTIVES OFFERED BY AI&DS

S. No.	Category	Course Code	Course Title	L-T-P	Credits
1	OE	231OE9A	Fundamentals of Data Science	3-0-0	3
2	OE	231OE9B	Data Analytics using R	3-0-0	3
3	OE	231OE9C	Information Storage and Retrieval	3-0-0	3
4	OE	231OE9D	Fundamentals of AI and ML	3-0-0	3

LIST OF HONORS

S. No.	Category	Course Code	Course Title	L-T-P	Credits
1	PE	231ADH01	Human Centered Computing	3-0-0	3
2	PE	231ADH02	Business Intelligence and Analytics	3-0-0	3
3	PE	231ADH03	Statistical Machine Learning	3-0-0	3
4	PE	231ADH04	Intelligent and Learning Agents	3-0-0	3
5	PE	231ADH05	Information Theory and Cryptography	3-0-0	3
6	PE	231ADH06	Operation and Supply Chain Analytics	3-0-0	3

LIST OF MANDATORY COURSES

S. No.	Category	Course Code	Course Title	L-T-P	Credits
1	MC	231MC11	Women and Gender Studies	1-0-0	1*
2	MC	231MC13	Design Thinking	1-0-0	1*
3	MC	231MC15	Essential of First Aid	1-0-0	1*
4	MC	231MC16	Basics of Yoga, Ayurveda and Siddha	1-0-0	1*
5	MC	231MC17	History of Science and Technology	1-0-0	1*

LIST OF MANAGEMENT ELECTIVES OFFERED BY MBA

S. No.	Category	Course Code	Course Title	L-T-P	Credits
1	HS	231BAEA	Engineering Economics and Accounting	3-0-0	3
2	HS	231BAEB	Entrepreneurship	3-0-0	3
3	HS	231BAEC	Essentials of Management	3-0-0	3
4	HS	231BAED	Intellectual Property Rights	3-0-0	3
5	HS	231BAEE	Professional Ethics in Engineering	3-0-0	3
6	HS	231BAEF	Women Studies and Women Empowerment	3-0-0	3

HS: Humanities & Social Sciences including Management
Course BS: Basic Science Course
ES: Engineering Science
Course PC: Programme
Core Course PE: Program
Elective Course
EEC: Employability Enhancement
Course OE: Open Elective Course
MC: Mandatory Course
*NCC Course Level#1is offered to the students enrolled for NCC only. The grades earned will not be considered for the computation of CGPA.

VALUE ADDED COURSES

The value-added courses on recent trends are offered in Semester III, V and VII for the knowledge enrichment of the student

231IP00	INDUCTION PROGRAMME				
Programme:	B.E. Computer Science and Engineering	**Sem:**	**1**	**Category:**	**-**

This is a mandatory 2-week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen, and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity, and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. The methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real-life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

The literary activity would encompass reading, writing, and possibly, debating, enacting a play, etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity, etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking, etc.) that are relevant to the particular branch of Engineering / Technology / Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests/assessments during this programme.

References:

1. Guide to Induction program from AICTE

231HS11	FUNCTIONAL ENGLISH			L	T	P	C
				3	0	0	3
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**HS**	
Prerequisites:	Basic Language Proficiency						
Aim:	To acquire basic Language Skills (LSRW) in order to communicate confidently in academic, professional, and social contexts						
Course Outcomes: The Students will be able to							
CO1:	Uunderstand the extensive vocabulary usage in formal English Learning .						
CO2:	Read and comprehend the content in general and professional contexts						
CO3:	Write definitions, descriptions, narrations, and essays on various topics						
CO4:	Express their opinions effectively in both oral and written communication						
CO5:	Develop listening skills and participate effectively in conversations .						
CO6:	Apply basics of Language & Grammar relating to English communication						

UNIT I: GENERAL READING AND FREE WRITING	**9**
Listening– Listening to comprehension (story), native accents **Speaking**- Greetings, introducing one's self, one's family, asking for directions **Reading** – Casual reading, skimming & scanning, summarizing, note taking, reading comprehension. **Writing**- Paragraph writing, letter writing (formal & informal), **Grammar**- Parts of Speech. **Vocabulary**- Synonyms & Antonyms	
UNIT II: DEVELOPING CONVERSATIONAL ABILITY	**9**
Listening- Listening to short and long conversations from different domains, telephonic conversations. **Speaking**-Narrating personal experiences/events; Interviewing celebrity, task based speeches, giving instructions. **Reading**- Detecting meaning from context, reading biographies, travelogues, newspaper reports, and technical blogs. **Writing**- e-mail writing, report writing. **Grammar**- Subject Verb Agreement; WH question, Yes or No type questions. **Vocabulary**- misplaced modifiers.	
UNIT III: OPINION READING AND WRITING	**9**
Listening –Watching animated stories, and documentaries & responding to questions, **Speaking**- Product description, stress, and intonates- pronunciation skills, discussing various current issues (GD). **Reading**– Critical reading, short stories, verbal reasoning, reading editorials & opinion blocks. **Writing**-Writing definitions; instructions and interpreting charts. **Grammar**-Degrees of comparison; relative pronoun. **Vocabulary**–Homonyms and Homophones,	
UNIT IV: ACCENTS AND MEDIA WRITING	**9**
Listening – Listening to the talks of great personalities, news videos, and phonetic sounds**. Speaking** – summarizing documentaries, interviews, podcasts, and mini presentations. **Reading** – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc.) **Writing** – Note-making/Note taking (*studies skills to be taught, not tested) Writing recommendations; from nonverbal (chart, graph, etc, to verbal mode) **Grammar** – Articles; simple tenses **Vocabulary-** Root words	
UNIT V: DESCRIPTIVES AND NARRATIVES	**9**
Listening–Listening to debates, discussions, scientific lectures & educational videos. **Speaking**– Picture descriptions, Debates, Role play. **Reading** – silent reading (newspapers, books, pamphlets), understanding captions. **Writing** – Essay Writing (Descriptive or narrative). **Grammar**– Continuous and Perfect tenses. **Vocabulary-**Idioms and Phrases.	
Total Periods:	**45**

Text Book:

1. Dr.Veena Selvam, Dr.Sujatha Priyadarshini – English for Engineering Students S. Chand Edition Jan-2005
2. Jean Susan – English for Science and Technology, Cambridge University Press, 2021.

References:

1. Technical Communication–Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ.Press, 2016, New Delhi.
2. Kumar Kul Bhushan - Effective Communication Skills, Khanna Book Publishing, 2016
3. Viswamohan Aysha – English for Technical Communication, Mcgraw Hill Education, May 2008

Extensive Reading

Shiv Khera, *You Can Win*, Macmillan Books, New Delhi, 2003.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1						1		2	3	1	2		1	1
CO2						1		2	3	1	2		1	1
CO3						1		2	3	1	2		1	1
CO4						1		2	3	1	2		1	1
CO5						1		2	3	1	2		1	1
CO6						1		2	3	1	2		1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS11	MATRICES AND CALCULUS			L	T	P	C
				2	1	0	3
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**BS**	
Prerequisites:	Basic knowledge in matrices, differentiation, and integration at the school level.						

Aim:	To acquire knowledge and skills in handling matrices and calculus in their field of specialization
Course Outcomes: The Students will be able to	
CO1:	Solve the problems using matrices
CO2:	Explain the ordinary differential equation
CO3:	Apply the concept of multi variable calculus to solve the problems
CO4:	Use double and triple integrals to compute areas and volumes
CO5:	Apply the concepts of Differentiation and Integration in Vectors..
CO6:	Compute areas and volumes by the application of vector calculus theorems

UNIT I: MATRICES	**9**
Review of Basic Matrices -Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications only) Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation	
UNIT II: ORDINARY DIFFERENTIAL EQUATIONS	**9**
Higher order linear differential equations with constant coefficients – Method of variation of Parameters – Cauchy's and Legendre's linear equations.	
UNIT III: MULTIVARIABLE CALCULUS	**9**
Partial Derivatives – Total Derivative – Differentiation of Implicit function – Jacobian – Taylor's Expansion - Maxima/Minima for function of two variables – Method of Lagrange's multipliers.	
UNIT IV: MULTIPLE INTEGRALS	**9**
Double integration – Change the order of integration – Change of variables(Polar Co-ordinators) – Area as double integral – Triple integration – Volume as Triple Integral.	
UNIT V: VECTOR CALCULUS	**9**
Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's and Gauss divergence theorems (without proof) – Verification of the above theorems and evaluation of integrals using them.	
Total Periods:	**45**
The students may be practiced to solve the problems using Software packages	

Text Book:

1. Grewal B.S., "Higher **Engineering Mathematics** ", 44th Edition, Khanna Publishers, New Delhi, 2018.
3. Kreyszig E, "**Advanced Engineering Mathematics** ", 10th Edition, John Wiley, New Delhi, India, 2018.

References:

1. Veerarajan.T., "**Engineering Mathematics for First Year**", Fourth Edition, Tata Mc-Graw – Hill, New Delhi, 2008.
2. G.B. Thomas and R.L. Finney, "**Calculus and Analytic Geometry**" 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, "**A Text Book of Engineering Mathematics**", Laxmi Publications, Reprint, 2008.
4. Ramana B V, "**Higher Engineering Mathematics**", 1st Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.

Cos	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	1					2	1	1	1
CO2	2	3	2	1	1	1					2	1	1	1
CO3	3	3	2	1	1	1					2	1	1	1
CO4	3	3	2	1	1	1					2	1	1	1
CO5	3	3	2	1	1	1					2	1	1	2
CO6	3	3	2	1	1	1					2	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS12	ENGINEERING PHYSICS			L	T	P	C
				3	0	0	3
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**BS**	
Prerequisites:	Basic Knowledge in Physics at the School level						

Aim:	To endow the students with the fundamentals of Physics for a better understanding of Engineering and Technology

Course Outcomes: The Students will be able to

CO1:	Acquire fundamental knowledge on elasticity and its applications relevant to the field of engineering
CO2:	Gain knowledge about the basic concepts of Acoustics and Ultrasonic
CO3:	Know and acquire the basic concepts of Laser, types of lasers and applications
CO4:	Understand the principles behind fiber optic communications and fiber optic sensors
CO5:	Apply the advanced physics concepts of quantum theory to characterize the matters
CO6:	Get a clear idea about the basics of crystals, structures, and crystal growth techniques

UNIT I: PROPERTIES OF MATTER **9**

Elasticity-Stress-strain diagram and its uses-Poisson's ratio- Factors affecting elastic modulus and tensile strength - Twisting couple - shaft - Torsion pendulum: theory and experiment - Bending of beams – Bending moment - cantilever: theory and experiment-Uniform and non-uniform bending: theory and experiment- I-shaped girders

UNIT II: ACOUSTICS AND ULTRASONICS **9**

ACOUSTICS: Classification of Sound-Loudness and Intensity-Weber-Fechner Law-standard intensity and intensity level-Decibel-Reverberation-Reverberation time-Jaeger's method-Absorption coefficient and its determination–Factors affecting acoustics of buildings focusing, interference, echo, Echelon effect, resonance -Noise and their remedies.

ULTRASONICS: Ultrasonic - Production – Magnetostriction and piezoelectric methods - Acoustical grating –Industrial applications-NDT..

UNIT III: LASERS AND FIBER OPTICS **9**

LASERS: Population of energy levels, Einstein's A and B coefficients derivation-pumping methods-resonantcavity, optical amplification (qualitative)- three level and four level laser-CO_2 Laser-Semiconductor lasers: Homo junction and Hetero junction. Industrial Application-Cutting, welding, soldering, drilling.

FIBER OPTICS: Principle, Numerical aperture, and Acceptance angle - Types of optical fibers (material, refractive index, mode)-Fiber Optical Communication system(Block diagram) –Fiber optic sensors: pressure and displacement.

UNIT IV: QUANTUM PHYSICS **9**

Blackbody radiation-Planck's theory (derivation)–Photoelectric Effect-wave particle duality–DE Broglie wavelength - Concept of the wave function and its physical significance - Schrödinger's wave equation-Time independent and Time dependent equations-Particle in a box(one dimensional motion)

UNIT V: CRYSTAL PHYSICS **9**

Single crystalline, Polycrystalline and Amorphous materials - Unit cell, crystal systems, Braais lattices, directions and planes in a crystal -Miller indices – Inter planar distance – Calculation of number of atoms per unit cell-Atomic radius-Coordination number - Packing factor for SC, BCC, FCC and HCP structures – PolymorphismandallotropyCrystalgrowthtechniques-Solution,melt(BridgemanandCzochralski)..

Total Periods: **45**

Text Book:

1. M.N. Avadhanulu & P.G. Kshirshagar,"A Text Book of Engineering Physics",S. Chand & Co Ltd. 2021.
2. R.K.Gaur & S.L.Gupta,"Engineering Physics".Dhanpat Rai Publishers, 2012..

References:

1. D. Halliday, Resnick & J.Walker," Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W.Jewett, "Physics for Scientists and Engineers", Cengage Learning,2010.
3. N. K.Verma, "Physics for Engineers", PHI Learning Private Limited, 2014.
4. P.A.Tipler & G.Mosca,"Physics for Scientists and Engineers",W.H.Freeman,2020.

Cos	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1									1			
CO2	3	3	3			2		1			1		1	
CO3	3	2	3	3		1		1			1	1	1	
CO4	3	3	3	3		1		1			1	1		
CO5	3	2	2	1		1					1			
CO6	3	1	2	1		1		1			1	1		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS13	ENGINEERING CHEMISTRY			L	T	P	C
				3	0	0	3
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**BS**	
Prerequisites:	Basic Knowledge in Chemistry at the School level						

Aim:	To impart a required knowledge on the principles of chemistry involving the different applications required for the engineering fields.

Course Outcomes: The Students will be able to

CO1:	Demonstrate the essential concept of water, its properties, and applications
CO2:	Know the treatment of water for potable and industrial purposes
CO3:	Acquire knowledge of electrochemistry, corrosion, and its control
CO4:	Understand the basic principles, preparatory methods, and applications of nanomaterials
CO5:	Elaborate different types of important polymers, techniques, and their uses.
CO6:	Explain the concepts of batteries and lubricants

UNIT I: WATER AND ITS TREATMENT	**9**

Hardness –Types and Estimation by EDTA method – alkalinity – types of alkalinity and determination. Domestic water treatment – disinfection methods – Boiler feed water – internal conditioning – external conditioning – desalination and reverse osmosis.

UNIT II: ELECTROCHEMISTRY AND CORROSION	**9**

Electrode Potential – Nernst Equation– reference electrode – glass electrode – measurement of pH – electrochemical series – significance – Conductometric titrations (strong acid vs strong base and weak acid vs strong base). Corrosion: Types of corrosion – Factors influencing corrosion – Corrosion control – Sacrificial anode and impressed current cathodic methods – Corrosion inhibitors.

UNIT III: NANOCHEMISTRY	**9**

Basics: Distinction between molecules, nanomaterials, and bulk materials; Types of nanomaterials: Definition, properties, and uses of nanoparticle, nanocluster, nanorod, nanowire, and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, chemical vapour deposition, electrochemical deposition, and hydrothermal. Applications of nanomaterials in medicine, agriculture, energy, electronics, and catalysis.

UNIT IV: POLYMER CHEMISTRY	**9**

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical); condensation and copolymerization. Techniques of polymerization: Bulk, emulsion, solution, and suspension. Preparation, properties and uses of Nylon 6, 6, Bakelite, and Epoxy resin

UNIT V: ENERGY STORAGE DEVICES AND LUBRICANTS	**9**

Batteries – Primary battery – Dry cell and Lithium battery – Secondary battery – Lead acid battery, Ni-Cd battery, and Lithium-ion battery – Fuel cells – H_2-O_2 fuel cells. Lubricants – mechanism of lubrication, liquid lubricants – properties (viscosity index, flash point, fire point, cloud point, pour point, and oiliness) – solid lubricants – graphite and molybdenum disulphide – semisolid lubricants and emulsions.

Total Periods:	**45**

Text Book:

1. A. Ravikrishnan, “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2023.
2. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi, (2015)

References:

1. S.S. Dara, S.S. Umare, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2013.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, Principles of Physical Chemistry, Vishal Publishing Co., Punjab, 47th Edition, 2017.
3. 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.
4. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, “Polymer Science”, New Age International P (Ltd.,), Chennai, 2021.

Cos	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2		1					2	2	2	1		
CO2	2	2	2			2		1			2	1		
CO3	2	1	1	1			2				1	1		
CO4	2	1	1	1								1		
CO5	2	1		1			1					1		
CO6	2	2				1	2				1	1		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ES11	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

Programme:	B.E./B.Tech. (Common to CSE, AIDS, IT, CIVIL, MECH & BT)	Sem:	1	Category:	ES

Prerequisites:	Basic knowledge in solving problems with Algebra and Calculus.

Aim:	To provide comprehensive ideas on AC and DC circuit analysis, principles, and applications of basic electrical machines, electronics, and measurements.

Course Outcomes: The Students will be able to

CO1:	Mention the basic Electric Laws and the various representation of AC signals
CO2:	Explain the operation of Electrical machines and their applications
CO3:	Describe the types of Measuring Instruments and their applications
CO4:	Explain the construction and principle of various diodes along with their applications
CO5:	Summarize the concepts of Bipolar Junction Transistors and their applications.
CO6:	Understand the concepts of Digital Electronics and its applications

UNIT I: ELECTRICAL CIRCUITS **9**

Ohm's Law – Kirchhoff's Laws – Reduction of series and parallel circuit – Introduction to AC measurements - RMS, Average, Form factor and peak factor - phasor representation – Single Phase AC series circuits with R, RL, RC - Resistance and Impedance – Power and Power factor.

UNIT II: ELECTRICAL MACHINES **9**

DC Machines – Generators – construction, operation, and types; Motors – working principle and applications; AC Machines –Types and applications.

UNIT III: ELECTRICAL MEASURING INSTRUMENTS **9**

Fundamental Elements – Types – MI, MC – Wattmeter – Energy meter – Calibration – Applications

UNIT IV: SEMICONDUCTOR DEVICES (Qualitative treatment only) **9**

Introduction to semiconductors – PN Junction Diode – characteristics and applications - Halfwave and Full wave rectifiers, Zener Diode – characteristics and application; Bipolar Junction Transistor – operation – CE & CC Configurations

UNIT V: DIGITAL ELECTRONICS (Qualitative treatment only) **9**

Number Systems – Binary, BCD, Hexadecimal – Logic Gates – Half and Full Adders – Encoder and Decoder – Flip-Flops – Counters – up/down binary counters – Shift registers – Right/Left Shift registers

Total Periods: **45**

Text Book:

1. Muthusubramanian R, Salivahanan S, "Basic Electrical, Electronics and Computer Engineering", McGrawHill, New Delhi, 2017.
2. B L Theraja, AK Theraja,'A Textbook of Electrical Technology: Volume 2 AC and DC Machines',S.Chand, 2021.

References:

1. V N Mittle, Arvind Mittle "Basic Electrical Engineering", McGraw Hill, New Delhi, 2020.
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford University press, 2016.
3. V K Mehta, Rohitmehta "Principles of Electronics", S.Chand & Company Ltd, 2015.
4. NPTEL Video Lecture Notes on "Basic Electronics " by Prof. M.B Patil, IIT Bombay.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3									2			
CO2	3										1			
CO3	3										1		1	
CO4	3										2		1	
CO5	3										2		1	
CO6	3	3	2								2		1	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ESF1	PROBLEM SOLVING AND PYTHON PROGRAMMING			L	T	P	C
				3	0	0	3
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**ES**	
Prerequisites:	Nil .						

Aim:	To provide basic knowledge in problem solving and the use of Python programming.
Course Outcomes: The Students will be able to	
CO1:	Develop algorithmic solutions to simple computational problems
CO2:	Write and execute simple Python programs
CO3:	Apply conditionals and loop concepts in Python programming
CO4:	Decompose a Python program into functions
CO5:	Represent compound data using Python lists, tuples, dictionaries, etc.
CO6:	Read and write data from/to files in Python programs

UNIT I:	**COMPUTATIONAL THINKING AND PROBLEM SOLVING**	**9**

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find the minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

UNIT II:	**DATA TYPES, EXPRESSIONS, STATEMENTS**	**9**

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, the distance between two points.

UNIT III:	**CONTROL FLOW, FUNCTIONS, STRINGS**	**9**

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 IV:	**LISTS, TUPLES, DICTIONARIES**	**9**

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

UNIT V:	**FILES, MODULES, PACKAGES**	**9**

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).

Total Periods:	**45**

Text Book:

1. Paul Deitel and Harvey Deitel, "*Python for Programmers*", Pearson Education, 1/e, 2021.
2. Karl Beecher, "*Computational Thinking: A Beginner's Guide to Problem Solving and Programming*", 1/e, BCS Learning & Development Limited, 2017.

References:

1. Allen B. Downey, "*Think Python: How to Think like a Computer Scientist*", 2/e, O'Reilly Publishers, 2016.
2. G Venkatesh and Madhavan Mukund, "*Computational Thinking: A Primer for Programmers and Data Scientists*", 1/e, Notion Press, 2021.
3. John V Guttag, "*Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data*", 3/e, MIT Press, 2021.
4. Eric Matthes, "*Python Crash Course, A Hands–on Project Based Introduction to Programming*", 2/e, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "*Python: The Complete Reference*", 4/e, Mc-Graw Hill, 2018.

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1									2	3	2
CO2	3	3	3	1								3	3	2
CO3	3	3										3	3	2
CO4	3	3	3	2								3	3	2
CO5	3	3	3	1								3	3	2
CO6	3	3	3	2								3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231HS12	HERITAGE OF TAMILS/ தமிழர் மரபு			L	T	P	C
				3	0	0	3
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**ES**	
Prerequisites:	Read and Write in English or Tamil						

Aim:	Know about the heritage of Tamil language .

Course Outcomes: The Students will be able to

CO1:	Understand of the heritage of Tamil language and its literature
CO2:	Know about the Tamil ethics and Bakthi literature
CO3:	Know about the development of sculptures, Musical instruments and Handicrafts
CO4:	Understand about the folk and martial arts of ancient tamils
CO5:	Know about the thinai concepts being followed in Sangam literature of Tamil.
CO6:	Contribution of Tamils in national movement and Indian culture and Medicinal system

UNIT I: LANGUAGE AND LITERATURE	**9**
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	**9**
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	**9**
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils	
UNIT IV: THINAI CONCEPT OF TAMILS	**9**
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	**9**
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	
Total Periods:	**45**

Text Book:

3. Paul Deitel and Harvey Deitel, "*Python for Programmers*", Pearson Education, 1/e, 2021.
4. Karl Beecher, "*Computational Thinking: A Beginner's Guide to Problem Solving and Programming*", 1/e, BCS Learning & Development Limited, 2017.

References:

1. jkpof tuyhW – kf;fSk; gz;ghLk; - Nf.Nf. gps;is (ntspaPL jkpo;ehL ghlEhy; kw;Wk; fy;tpapay; gzpfs; fofk;)
2. fzpdpj; jkpo; - Kidth; ,y.Re;juk; (tpfld; gpuRuk;)
3. fPob - itif ejpf;fiuapy; rq;ffhy efu ehfhpfk; (njhy;ypay; Jiw ntspaPL)
4. nghUie – Mw;wq;fiu ehfhpfk; (njhy;ypay; Jiw ntspaPL)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)7
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
    1. 12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)https://www.python.org/
    2. Martin C. Brown, "*Python: The Complete Reference*", 4/e, Mc-Graw Hill, 2018.

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1						3	1			2	2			
CO2						3	1			2	2			
CO3						3	1			2	2			
CO4						3	1			2	2			1
CO5						3	1			2	2			1
CO6						3	1			2	2			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS17	PHYSICS AND CHEMISTRY LABORATORY			L	T	P	C
				0	0	0	1.5
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**BS**	
Prerequisites:	Engineering Physics and Chemistry						

Aim:	To provide basic knowledge in problem solving and the use of Python programming.
Course Outcomes: The Students will be able to	
CO1:	Understand the basic concept of LASER application, Interference, and velocity of sound & Compressibility of liquid
CO2:	Gain knowledge on elastic properties of beams & strings and the thermal conductivity of a bad conductor.
CO3:	Interpret the fundamentals of the viscosity of a liquid, the wavelength of the mercury spectrum by diffraction, the band gap of the semiconductor and the photo electric effect.
CO4:	Analyze the quality of water samples with respect to their alkalinity, hardness, and DO
CO5:	Determine the amount of metal ions through volumetric and gravimetric techniques.
CO6:	Determine the amount of particles in an unknown solution

LIST OF EXPERIMENTS - PHYSICS PART (A minimum of six to seven experiments shall be offered)		
S.No	**NAME OF THE EXPERIMENT**	
1.	Determination of wavelength of the LASER source	3
2.	(a) Determination of Particle Size using Diode LASER. (b) Determination of Acceptance angle and Numerical aperture of an optical fiber.	3
3.	Determination of thickness of thin wire–Air wedge method	3
4.	Determination of Velocity of sound and compressibility of liquid–Ultrasonic Interferometer.	3
5.	Determination of Young's modulus of the material-Non uniform bending	3
6.	Torsional pendulum – Determination of rigidity modulus.	3
7.	Determination of viscosity of liquid – Poiseuille's method.	3
8.	Determination of wavelength of mercury spectrum- Spectrometer Grating.	3
9.	Determination of Band Gap of semiconductor material.	3
10.	Determination of Planck's constant - Photoelectric effect	3

LIST OF EXPERIMENTS – CHEMISTRY PART (A minimum of six to seven experiments shall be offered)		
S.No	**NAME OF THE EXPERIMENT**	
1.	Estimation of Total Hardness of water by EDTA method.	3
2.	Determination of types and amount of Alkalinity of a water sample.	3
3.	Determination of DO content of water sample by Winkler's method.	3
4.	Determination of Chloride content of water sample by Argentometric method.	3
5.	Estimation of copper content of the given solution by Iodometry.	3
6.	Estimation of TDS of a water sample by gravimetric.	3
7.	Determination of strength of given hydrochloric acid using pH meter.	3
8.	Determination of strength of acids in a mixture of acids using pH meter.	3
9.	Conduct metric titration of barium chloride against sodium sulphate (Precipitation titration)	3
10.	Estimation of Iron content of the given solution using a Potentiometer.	3

Total Periods 45

References	
1. "Experiments in Physics", Indian Academy of Sciences, India (2018) 2. Engineering Physics Laboratory Manual. 3. A. Ravikrishnan "Practical Engineering Chemistry", Sri Krishna Publications, Chennai (2002). 4. Engineering Chemistry Laboratory Manual.	

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1		2		1				1	1		
CO2	1	2	2				1				1			
CO3	2	2	2				1				1			
CO4	2	2	1		1		2				1			
CO5	3	2	1	2	2		1				2	1		
CO6	2	1	3		2		2				2	1		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ESF7	PYTHON PROGRAMMING LABORATORY			L	T	P	C
				0	0	3	1.5
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**ES**	
Prerequisites:	Nil						

Aim:	To familiarize the use of Python for solving problems
Course Outcomes: The Students will be able to	
CO1:	Solve simple real life problems and use simple statements and expressions in programming
CO2:	Apply conditional and iterative loops, Lists, Tuples, etc. in applications .
CO3:	Implement the programs using sets, dictionaries, and functions .
CO4:	Use strings and standard libraries like pandas, numpy, scipy and matplotlib.
CO5:	Develop programs using file handling like copy, word count, longest word, etc., and exceptional handling like divide by zero error, age validity, etc
CO6:	Use the Pygame tool and develop simple games application

LIST OF EXPERIMENTS – CHEMISTRY PART

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

S.No	NAME OF THE EXPERIMENT
1	Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2	Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3	Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4	Implementing real-time/technical applications using Lists, Tuples. (Items present in a library / Components of a car/Materials required for construction of a building – operations of list & tuples)
5	Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6	Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7	Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8	Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9	Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10	Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)

Total Periods 45

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1									2	2	1
CO2	3	3	3	1	1							2	2	2
CO3	3	3			1							2	3	2
CO4	3	3	3	2	1							2	3	3
CO5	3	3	3	1	1							2	3	2
CO6	3	3	3	2	1							2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231HS17	ENGLISH COMMUNICATION LABORATORY - I			L	T	P	C
				0	0	2	1
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**1**	**Category:**		**EEC**	
Prerequisites:	Basic Language Proficiency						

Aim:	To acquire basic Language Skills (LSRW) in order to communicate confidently in academic, Professional and social context
Course Outcomes: The Students will be able to	
CO1:	Introduce self and others confidently in English, discuss the events, and fill out forms.
CO2:	Understand the documentaries, narrate the events, experiences, places of visit, and interview others in English.
CO3:	Describe a product and picture and their uses, devise an advertisement of a product
CO4:	Listen to video lectures and make summaries and inferences
CO5:	Make event and travel plans and describe arrangements.
CO6:	Perform debates, panel discussions, express views and opinions on the issues

INTRODUCTION	**6**
Self-Introduction, Introducing Others, Conversation on the events, Listening and Filling forms.	
NARRATION AND SUMMATION	**6**
Listen to the documentaries and event narration, Narrating personal experiences and events, Interviewing others, Describing the Places of Interest..	
DESCRIPTION OF A PROCESS / PRODUCT	**6**
Listen to the description of a product, Advertisement of a product, Description of a Picture, and use of the products.	
CLASSIFICATIONS AND RECOMMENDATIONS	**6**
Listen to lectures and educational videos, making and describing the plans, arrangements of an event, travel plans, etc.	
EXPRESSIONS	**6**
Listen to debates, panel discussions, expressing the views on an issue, giving brief talk on a topic, giving opinions	
Total Periods:	**30**

Text Book:

1. Dr.P.Rathna and Jewelcy Jawahar ,English Communication Laboratory .June 2023

References:

https://www.skillsyouneed.com/ips/conversational-skills.html

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1					2	1	1	2	3		1		1	1
CO2					2	3	1	1	3		1		1	1
CO3					2	2	1	1	3		1		1	1
CO4					2	3	1	1	3		1		1	1
CO5					2	2	1	1	3	3	1		1	1
CO6					2	3	1	3	3		1		1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231HS21	ENGLISH FOR ENGINEERS			L	T	P	C
				3	0	0	3
Programme:	**B.E./B.Tech. (Common to all branches)**	**Sem:**	**2**	**Category:**		**HS**	
Prerequisites:	Functional English .						

Aim:	To mould the Learners' style of Language Proficiency with modern aspects of communicative elements which an engineer requires

Course Outcomes: The Students will be able to

CO1:	Use the grammatical rules and semantic structures for flawless communication
CO2:	Recognize the importance of listening and to comprehend the connect between interactors
CO3:	Apply the professional aspects of language pattern and to formulate the stylish accent
CO4:	Analyze the various exposure levels of multi-dimensional skill-based language usage
CO5:	Evaluate the situational attempts with better learning mechanism...
CO6:	Create the extended mode of thinking in expressions both in oral and written communication

UNIT I: SENTENTIAL SEMANTICS	**9**

Listening – Cambridge English Listening practice for beginners (A Level), celebrity interview; **Speaking**- Greetings- self introductory session – collaborative task based topics; **Reading** – Reading editorials, magazines, newspapers, knowing when to use dictionary**; Writing** – Enlist wish list, Blog writing, Processing technical reports; **Grammar**- Sentence pattern, Types of sentences, Simple, Complex and compound; **Vocabulary**- Conjunctions

UNIT II: VERBAL OPERATORS	**9**

Listening – British Council Listening (B1) level, Broadcasting network audios – Cambridge prep up audio clips; **Speaking** – Sharing experiences, Narratives on anecdotes, Brain Teasers**Reading** – Phonics reading practices, Reading pamphlets and catalogues; **Writing** – Fill up the templates/forms (Airline booking, reservations on train, hotel registration), Mapping out articles on press and media, Progress report writing; **Grammar**- Verbs and Verbals – Infinitives- Gerunds – Participles, Voice– Active and Passive voice; **Vocabulary**- Phrasal verbs, one word substitution.

UNIT III: CONTEXTUAL EXPRESSIONS	**9**

Listening– Saying 'Please' 'Thank You', and 'Sorry', Responding to ' Thanks' and 'Apologies' TED Talks , Excerpts from literary pieces, listening podcasts related to recent trends in mass media and communication- **Speaking** – Persuasive speech techniques- gimmicks and entrepreneurial speech strategies; **Reading** – exploratory reading and techniques on expository text reading, The Gender Division (Animals & Birds) , Knowing Relationships**Writing** – Controversial essay writing, Review Writing; **Grammar** – Use of Prepositions, Mixed tenses, If conditionals; **Vocabulary** – Minimal pairs.

UNIT IV: TECHNICAL BRIEFINGS	**9**

Listening – Virtual webinars on language consciousness, Oratory speech; **Speaking** – Short script deliverance, Thematic speech; **Reading –**Matching animal and its young ones (its cry) Deciphering technical texts; **Writing**- Announcement / declaration letter writing, Technical content creations; **Grammar** – Speech – Direct and Indirect speech, Spot the error; **Vocabulary**- Connotation and denotation, Mismatched words.

UNIT V: STIPULATE WRITINGS	**9**

Listening – Practicing audios on competitive elements – Peer/ Panel discussion, Event and specializations;, **Speaking** – Mock Interview, Pros and Cons of Advanced technological systems , Dimensions of engineering and its aspects, **Reading** – Industrial blogs, Meme theory**; Writing** – Profile development- Resume – Project proposal writing , Conceptual writing**; Grammar**- Semi-modal auxiliaries, Question tags; **Vocabulary** – Idiomatic expressions, Spelling and Punctuation.

Total Periods:	**45**

Text Book:

1. Allen, Alex. 1999. Communication at the English Speaking Union world members conference, Sydney, August.
2. Austin, J.L.1965, *How To Do Things With Words*, Oxford University Press.
3. Mayhugh, Paul W. "A Chinese-English intermediate Greek grammar." Theological Research Exchange Network (TREN), 1990.
4. McCarthy, Michael and Felicity O'Dell. *English Vocabulary in Use*: advanced. Cambridge: CUP, 2002. South Asian Edition, 2008.
5. Soundararaj, Francis.2012. *Basics of Communication in English. New Delhi: Macmillan*

References:

1. PushpaLata, Sanjay Kumar, English Language and Communication Skills for Engineers, 2018.
2. Means, L. Thomas and Elaine Langlois, English & Communication for Colleges.
3. John Seely. The Oxford Guide to Effective Writing and Speaking. OUP, 2005.

Cos	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1					2	1		1	1	3		1		1
CO2					2	1		1	1	3				
CO3					2	1		1	1	3				
CO4					2	1		1	1	3			1	
CO5					2	1		1	1	3				1
CO6					2	1		1	1	3				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS21	PARTIAL DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

Programme:	B.E./B.Tech. (Common to all branches)	Sem:	2	Category:	HS

Prerequisites:	Matrices and Calculus

Aim:	To impart a knowledge on the concept of partial differential equations and solve them by applying numerical methods.

Course Outcomes: The Students will be able to

CO1:	Solve the given standard partial differential equations
CO2:	Apply numerical methods to solve transcendental equations, system of equations and eigenvalue problems
CO3:	Use numerical difference interpolation for solving the equations
CO4:	Apply numerical methods to perform differentiation and integration
CO5:	Demonstrate the process of solving first and second-order ordinary differential equations using numerical methods .
CO6:	Solve the partial differential equations with boundary conditions

UNIT I: PARTIAL DIFFERENTIAL EQUATIONS	**9**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first-Order partial differential equations (without reducing the standard type) –Linear homogenous partial differential equations of second and higher order with constant coefficients.

UNIT II: SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	**9**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method-Solution of a linear system of equations - Gauss elimination method – Iterative method of Gauss-Seidel - Eigenvalues of a matrix by Power method.

UNIT III: NUMERICAL INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION	**9**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivate using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT IV: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	**9**

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method – Milne's predictor–corrector methods for solving first order equations – Finite difference methods for solving second order equations.

UNIT V: BOUNDARY VALUE PROBLEMS OF PARTIAL DIFFERENTIAL EQUATIONS	**9**

Finite differences solution of one-dimensional heat equation by explicit and implicit methods – One-dimensional wave equation and two-dimensional Laplace and Poisson equations.

Total Periods:	**45**

Text Book:

1. Greenberg. *M.D.* "Advanced Engineering Mathematics", Second Edition, Pearson Education Inc. (First Indian reprint), 2002

References:

2. Kreyszig, E., "Advanced Engineering Mathematics", 8th edition, John Wiley Sons, 2001.
3. Chapra S.C. and Canale R.P., "Numerical Methods for Engineers", Tata Mc-Graw Hill, New Delhi, (2007).
4. Gerald C.F., and Wheatley P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, (2006).

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	1						1	1	2	1
CO2	3	3	1	1	1						1	3	2	1
CO3	3	2									1	3	2	1
CO4	3	3			1						1	3	2	1
CO5	3	3		1	1						1	3	2	1
CO6	3	3	1	1							2	3	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS22	PHYSICS OF MATERIALS			L	T	P	C
				3	0	0	3
Programme:	**B.E./B.Tech. (ECE, CSE EEE, BM, AIDS, IT)**	**Sem:**	**2**	**Category:**		**BS**	
Prerequisites:	Engineering Physics						

Aim:	To impart knowledge on fundamentals of materials and their properties for Engineering applications.

Course Outcomes: The Students will be able to

CO1:	Describe the electrical properties of the materials
CO2:	Distinguish the semiconductor materials and their characteristics
CO3:	Explain the various dielectric materials and their properties
CO4:	Apply numerical methods to perform differentiation and integration
CO5:	Summarize the different types of optical devices and their characteristics.
CO6:	Outline the characteristics of nanomaterials and their applications

UNIT I: ELECTRICAL PROPERTIES OF MATERIALS **9**

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, Wiedemann-Franz law – Success and failures – Fermi Distribution function – Effect of temperature on Fermi function – Densityofenergystates–Electroninperiodicpotential–Energybandsinsolids–tightbindingapproximation–Electroneffectivemass –concept of hole.

UNIT II: SEMICONDUCTOR PHYSICS **9**

Energy band diagram – Direct and indirect band gap semiconductors – Intrinsic Semiconductors – Carrierconcentration 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–Hall effect-Determination of Hall Coefficient.

UNIT III: MAGNETICAND DIELECTRIC MATERIALS **9**

Magnetic materials: Origin of the magnetic moment–Bohrmagnet on–Dia and Paramagnetism–Ferromagnetism– Domain theory– Hysteresis–Soft and hard magnetic materials–Anti-ferro magnetic materials–Ferrites–applications**.**

DielectricMaterials: Polarization-Electronic, Ionic, Orientation and Space charge polarization–Frequency and temperature dependence of polarization–Dielectric loss–Dielectric breakdown–uses of dielectric Materials(capacitor and transformer) –Ferro electricity and applications.

UNIT IV: OPTICAL PROPERTIES OF MATERIALS **9**

Classificationofopticalmaterials–Carriergenerationandrecombinationprocesses–Absorption emission and scattering of light in metals, insulators, and semiconductors (concepts only) – Photocurrent in a P-N diode – solar cell-LED– Organic LED–Laser diodes– Optical data storage techniques.

UNIT V: NANODEVICES **9**

Quantum confinement – Quantum structures – Density of states for quantum wells, wires, and dots – Band gapof nanomaterials –Tunneling – Single electron phenomena – Single electron Transistor. Carbon nanotubes - Properties and applications

Total Periods: **45**

Text Book:

1. JaspritSingh,"Semiconductor Devices: Basic Principles", Wiley (Indian edition),2007.
2. S.O. Kasap. Optoelectronics and Photonics-Principles and practices, Dorling Kindersley Plt. (Indian Edition), 2009.
3. B. Rogers, J. Adams and S. Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2014.

References:

1. Charles Kittel, Introduction to Solid State Physics,Wiley India Edition,2019.
2. V.V. Mitin, V.A. Kochelap and M.A. Stroscio, Introduction to Nanoelectronics, Cambridge Univ. Press,2008.
3. B. Rogers, J. Adams and S. Pennathur, Nanotechnology: Understanding Small Systems, CRC Press,2014.
4. Y.B.BandandY.Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press,2013

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1								1			1
CO2	3	2	1								1			1
CO3	3	1									1			1
CO4	3	1									1			
CO5	3	1				1	1				1		1	1
CO6	3	1									1		2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS24	ENVIRONMENTAL SCIENCE			L	T	P	C
				3	0	0	3
Programme:	**B.E / B.Tech (Common to All Branches)**	**Sem:**	**2**	**Category:**		**BS**	
Prerequisites:	Nil						

Aim:	To raise awareness about environmental issues and potential solutions

Course Outcomes: The Students will be able to

CO1:	Describe the importance of environmental studies and energy resources
CO2:	Explain the concept ofvarious ecosystems and their impacts
CO3:	Outline the importance of biodiversity and its values
CO4:	Discuss thedifferent kinds of pollution and their causes and effects.
CO5:	Summarize the various types ofdisaster and their impacts
CO6:	Recognize the impacts of various social problems and climate change with potential Solutions

UNIT I: ENVIRONMENTAL STUDIES AND ENERGY RESOURCES **9**

Environment- definition, scope, and importance – Need for public awareness – Forest resources-deforestation - dams and their effects on forests and tribal people –Energy resources: Growing energy needs, renewable (solar energy and wind energy) and non-renewable energy sources- Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generation (block diagram only), Petroleum processing and fractions..

UNIT II: ECOSYSTEM AND BIODIVERSITY **9**

Ecosystem: Concept of an ecosystem – Structure and function of an ecosystem: Producers, Consumers and Decomposers-Nitrogen cycle, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the Forest ecosystem and Aquatic ecosystems (lake and rivers). **Biodiversity:** Introduction to Biodiversity – Definition– Value of biodiversity.

UNIT III: ENVIRONMENTAL POLLUTION **9**

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Marine pollution (d) Noise pollution (e) Nuclear hazards (f) Fireworks: Current environmental issues - Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution – Pollution case studies.

UNIT IV: DISASTER AND ITS IMPACTS **9**

Definition of Disaster, Hazard, Vulnerability, Risk – Types – Natural disasters (earthquake, landslides, flood, cyclones, tsunami and drought) – Man-made disasters (Chemical, nuclear and biological) – Disaster impacts (environmental, physical, social, ecological and economical) – Case studies.

UNIT V : SOCIAL ISSUES AND THE ENVIRONMENT **9**

Population-variation among Nation-Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rainwater harvesting– climate change, global warming, acid rain, Ozone layer depletion-Goal of Green chemistry.

Total Periods: **45**

Text Book:

1. A Ravikrishnan “Environmental Science”, Sri Krishna Hitech Publishing company private limited, 2023
2. Benny Joseph, “Environmental Science and Engineering “ Tata McGraw-Hill, New Delhi, 2017

References:

1. Anubha Kaushik, C.P. Kaushik, "Environmental Science and Engineering", New Age International Publishers, 2016.
2. Raman Sivakumar, Introduction to Environmental Science and Engineering, Tata McGraw Hill Education Private Limited, New Delhi, 2016.
3. ErachBharucha, Textbook for Environmental Studies, New Delhi, 2019.
4. G.Tyler Miller and Scott E. Spoolman," Environmental Science ", Cengage Learning India PVT, LTD, Delhi, 2014.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1			2	1				1		1	1
CO2	3	2	1			2	1				1		1	
CO3	3	2	1			2	1				1		1	2
CO4	3	2	1			2	1				1	1	1	1
CO5	3	2	1			2	1				1		1	2
CO6	3	2	1			2	1				1	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ESF2	ENGINEERING DRAWING			L	T	P	C
				1	0	4	3
Programme:	**B.E / B.Tech (Common to All Branches)**	**Sem:**	**2**	**Category:**		**ES**	
Prerequisites:	Nil						

Aim:	To develop basic graphic skills in students to understand the drawings in Engineering fields.

Course Outcomes: The Students will be able to

CO1:	Trace the plane curves and draw its tangent and normal
CO2:	Construct the orthographic projections of points, lines, and planes
CO3:	Draw the projections of simple solids
CO4:	Visualize the sectional views of solids.
CO5:	Develop the surfaces of solids
CO6:	Practice isometric and orthographic projections

Concepts and conventions (Not for Examination) – 5 hrs

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout, and folding of drawing sheets – Lettering and dimensioning

UNIT I: PLANE CURVES	**14**

Conics – Construction of ellipse, Parabola, and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II: PROJECTION OF POINTS, LINES, AND PLANE SURFACES	**14**

Projection of Points in all four quadrants - Projection of straight lines located in the first quadrant – inclined to both planes – Determination of true lengths and true inclinations – Projection of regular polygonal and circular lamina inclined to both reference planes.

UNIT III: PROJECTION OF SOLIDS	**14**

Projection of simple solids like Prisms, Pyramids, Cylinder, and Cone when the axis is inclined to one reference plane

UNIT IV: SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	**14**

Sectioning of above solids in a simple vertical position by cutting planes inclined to HP and perpendicular to VP – Obtaining true shape of section; Development of lateral surfaces of truncated solids – Prisms, Pyramids, Cylinder, and Cone

UNIT V : ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	**14**

Principles of isometric projection – isometric scale – isometric projections of truncated Prisms, Pyramids, cylinders, and cones; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Total Periods:	**75**

Text Book:

1. Basant Agarwal and Agarwal C.M., **"Engineering Drawing",** Tata McGraw Hill Publishing Company Limited, New Delhi, (2022).

References:

1. Venugopal K. and Prabhu Raja V., **"Engineering Graphics",** New Age International (P) Limited (2022).
2. Shah M.B. and Rana B.C., **"Engineering Drawing",** Pearson Education (2022).

3. John K.C., **"Engineering Graphics for degree"** PHI Learning Pvt. Ltd., New Delhi, (2022).
4. Kumar M.S., **"Engineering Graphics",** D.D. Publications, (2022)..

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3			1	2	1					1	1		
CO2	3	2	1		2	1					1	1		
CO3	3			1	2	1					1			
CO4	3	2		1	2	1					1			
CO5	3		1		2	1					1	1		
CO6	3	2	1		2	1					1			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS21	PROGRAMMING IN C			L	T	P	C
				3	0	0	3
Programme:	**B.E / B.Tech (Common to All Branches)**	**Sem:**	**2**	**Category:**		**PC**	
Prerequisites:	Nil						

Aim:	To understand the constructs of C programming language

Course Outcomes: The Students will be able to

CO1:	Demonstrate knowledge on C Programming constructs
CO2:	Develop simple applications in C using basic constructs
CO3:	Design and implement applications using arrays and strings
CO4:	Develop and implement modular applications using functions in C.
CO5:	Develop applications of C using structures and pointers
CO6:	Design applications using sequential and random-access file processing

UNIT I: BASICS OF C PROGRAMMING	**9**

Introduction to programming paradigms – Applications of C Language - 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	**9**

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**

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**

Structure - Nested structures – Pointer and Structures – Array of structures – Self-referential structures – Dynamic memory allocation - Singly linked list – typed of – Union - Storage classes and Visibility

UNIT V : FILE PROCESSING	**9**

Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments .

Total Periods:	**45**

Text Book:

1. ReemaThareja, "*Programming in C*", Oxford University Press, 2/e, 2016.
2. Kernighan, B.W and Ritchie,D.M, "*The C Programming language*", 2/e, Pearson Education, 2015.

References:

1. Paul Deitel and Harvey Deitel, "*C How to Program with an Introduction to C++*", 8/e, Pearson Education, 2018.
2. YashwantKanetkar, "*Let us C*", 17/e, BPB Publications, 2020.
3. Byron S. Gottfried, "*Schaum's Outline of Theory and Problems of Programming with C*", McGraw-Hill Education, 1996.

4. PradipDey, Manas Ghosh, "*Computer Fundamentals and Programming in C*", 2/e, Oxford University Press, 2013.
5. Anita Goel and Ajay Mittal, "*Computer Fundamentals and Programming in C*", 1/e, Pearson Education, 2013.

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	1	1					1		1	1	3	2
CO2	3	3	2	2					1		1	1	3	2
CO3	3	3	3	2					1		1	1	3	2
CO4	3	3	2	2					1		1	1	3	2
CO5	3	3	2	2					1		1	1	3	2
CO6	3	2	3	2					1		1	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231HS22	TAMILS AND TECHNOLOGY/ தமிழரும்தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

Programme:	B.E / B.Tech (Common to All Branches)	Sem:	2	Category:	HS

Prerequisites:	Nil

Aim:	To impart a knowledge about Tamils and their ancient technlogies

Course Outcomes: The Students will be able to

CO1:	Summarize the weaving and ceramic technology of ancient Tamils
CO2:	Recall the ancient design and construction technology of the Tamils
CO3:	Know about the Manufacturing Technology in old age Tamil
CO4:	Understand the Agriculture knowledge .
CO5:	Know about the Irrigation technology
CO6:	Development of Scientific Tamil to digital Tamil

UNIT I: WEAVING AND CERAMIC TECHNOLOGY	**3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries .

UNIT II: DESIGN AND CONSTRUCTION TECHNOLOGY	**3**

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**

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**

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**

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 Periods:	**15**

Text Book:

1. ReemaThareja, "*Programming in C*", Oxford University Press, 2/e, 2016.
2. Kernighan, B.W and Ritchie,D.M, "*The C Programming language*", 2/e, Pearson Education, 2015.

References:

1. Paul Deitel and Harvey Deitel, "*C How to Program with an Introduction to C++*", 8/e, Pearson Education, 2018.
2. YashwantKanetkar, "*Let us C*", 17/e, BPB Publications, 2020.

3. Byron S. Gottfried, "*Schaum's Outline of Theory and Problems of Programming with C*", McGraw-Hill Education, 1996.

4. PradipDey, Manas Ghosh, "*Computer Fundamentals and Programming in C*", 2/e, Oxford University Press, 2013.

5. Anita Goel and Ajay Mittal, "*Computer Fundamentals and Programming in C*", 1/e, Pearson Education, 2013.

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1						3			2		2			
CO2						3			2		2			
CO3						3			2		2			
CO4						3			2		2			
CO5						3			2		2		1	
CO6						3			2		2		1	

1.Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ESF8	ENGINEERING PRACTICES LABORATORY			L	T	P	C
				0	0	3	1.5
Programme:	**B.E / B.Tech (Common to All Branches)**	**Sem:**	**2**	**Category:**		**ES**	
Prerequisites:	Nil						

Aim:	To provide hands-on experience to the students in handling the basic Mechanical and Electrical tools and equipment.
Course Outcomes: The Students will be able to	
CO1:	Develop simple wooden joints using woodworking tools
CO2:	Understand the concepts of plumping and handling the various components of plumbing
CO3:	Make simple welds of lap and butt joints and fabricate a few models
CO4:	Demonstrate the concept of wiring circuits .
CO5:	Explain the measurement of Electrical quantities and the principles of diodes
CO6:	Classify the functions of basic gates

PART – A – MECHANICAL WORKSHOP (23 hrs)

CARPENTRY
Study of the joints in roofs, doors, windows, and furniture; Hands-on-exercise: Dismantling & Assembling of various wooden furniture; Preparation of T Joint, dovetail joint
PLUMBING
Study of pipeline joints, their location, and functions: valves, taps, couplings, unions, reducers, elbows in household fittings; Hands-on-exercise - basic pipe connections – Mixed pipe material connection – Connections with different joining components
WELDING AND SHEET METAL FORMING
Preparation of arc welding of butt joints and lap joints - Preparation of tray and funnel

PART – B – ELECTRICAL WORKSHOP (22 hrs)

NAME OF THE EXPERIMENT	
Practice on Simple wiring connections.	
Practice on wiring for Staircase setup.	
Practice on wiring Fluorescent lamp.	
Measurement of electrical quantities – current, voltage, power, and energy.	
Characteristics of semiconductor diode.	
Verifying the truth tables of Logic gates.	
Total Period	**45**

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1		1	1			3		2			
CO2	2	1	1		1	1			3		2			
CO3	2	1	1		1	1			3		2			
CO4	2	1	1		1	1			3		2	1		
CO5	2	1	1		1	1			3		2	1		
CO6	2	1	1		1	1			3		2	1		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS27	C PROGRAMMING LABORATORY			L	T	P	C
				0	0	3	1.5
Programme:	**B.E/B.TECH (CSE, IT & AIDS)**	**Sem:**	**2**	**Category:**		**PC**	
Prerequisites:	C Programming						

Aim:	To acquire knowledge in C Programming by doing exercises .
Course Outcomes: The Students will be able to	
CO1:	Demonstrate knowledge of C programming using constructs: I/O statements, operators, and expressions
CO2:	Construct programs in C using if-else, go-to, switch-case, break-continue, and loops
CO3:	Develop programs in C using arrays
CO4:	Know the use of strings, pointers, and functions in C programming
CO5:	Apply the concept of structures in programming
CO6:	Use the file processing commands in developing applications

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.	
S.No	**NAME OF THE EXPERIMENT**
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 Periods : 45

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1				2			1	3	3	3
CO2	3	2	2	1				2			1	3	3	3
CO3	3	2	2	1				2			1	3	2	2
CO4	3	3	2	1				2			1	3	2	2
CO5	3	2	2	1				2			1	3	3	2
CO6	3	2	2	1				2			1	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231HS27	ENGLISH COMMUNICATION LABORATORY -II			L	T	P	C
				0	0	2	1
Programme:	**B.E / B.Tech (Common to All Branches)**	**Sem:**	**2**	**Category:**		**EEC**	
Prerequisites:	English Communication Laboratory -I						

Aim:	To provide students with a digital learning platform to practice their language skills useful for their career

Course Outcomes: The Students will be able to

CO1:	Learn accurate pronunciation through stress on word accent, intonation and rhythm
CO2:	Improve technical language skills
CO3:	Effectively participate in situational conversations like JAM sessions
CO4:	Understand the importance of academic writing .
CO5:	Inculcate necessary writing skills to face certification exams
CO6:	Manage stress, emotion and time in order to be amicable in the workplace

PHONOLOGY	**6**

Introduction to Phonetics: Speech Sounds -Vowels and Consonants - Transcriptions - Use of Dictionary
Basic Rules of Word Accent: Structure of Syllables -Weak Forms and Strong Forms in Context -Minimal pairs
Indian Variants in Pronunciation: Differences in British and American Pronunciation -Professional Etiquettes - Telephone Etiquette.

TECHNICAL LANGUAGE LEARNING	**6**

Listening: Indian and Foreign Speakers – English News Channels - Listening Comprehension Tests - Speech/Audio and Video Recording for Self-Analysis
Creativity: Out of Box Thinking - Lateral Thinking.
Attitude: Factors Influencing Attitude, Challenges and Lessons from Attitude

SITUATIONAL CONVERSATION	**6**

Ice-Breaking: Activities- (Eg. Find the hidden words from the following figures, and write a paragraph.)
JAM Session: Greetings – Taking Leave – Introducing Oneself and Others.
Expressions in Various Situations: Making Requests and Seeking Permissions – Describing objects/ Places/ Persons/Situations – Story Telling - Narrating Incidents

MECHANICS OF WRITING AND GUIDANCE FOR TOEFL & IELTS	**6**

Goal Setting: Wish List - SMART Goals - Blue Print for Success - Short Term- Long Term - Life Time Goals
Techniques for Good Academic Writing: Writing Planners, Journal Articles writing - Avoiding Plagiarism - Project Proposal - Statement of Purpose.
Preparation for TOEFL and IELTS - Guidance and Practice Sessions

SELF-MANAGEMENT SKILLS	**6**

Stress Management: Causes of Stress and Its Impact - How to Manage & Distress - Circle of Control - Stress Busters**.**
Emotional Intelligence: What is Emotional Intelligence - Emotional Quotient - Emotion Scales - Managing Emotions**.**
Time management: Value of Time - Diagnosing Time Management.

Total Periods:	**30**

Text Book:

1. Academic Writing: A Practical Guide for Students, Stephen Bailey London: Routledge Falmer
2. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma, Oxford University Press, 2015
3. McCarthy, Michael and Felicity O'Dell. *English Vocabulary in Use*: advanced. Cambridge: CUP, 2002. South Asian Edition, 2008.

References:

1. PushpaLata, Sanjay Kumar, English Language and Communication Skills for Engineers, 2018.
2. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.
3. John Seely. The Oxford Guide to Effective Writing and Speaking. OUP, 2005.
4. Barron's TOEFL IBT 2016 Guide (with DVD) Pamela Sharpe, New Delhi: Galgotia,2013.
5. Professional Presentation, Malcolm Goodale, Cambridge University Press, 2005

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1					2			2	3		2			
CO2					2			2	3		2			
CO3					2			2	3		2			
CO4					2			2	3		2			
CO5					2			2	3		2		1	1
CO6					2		2	2	3		2			1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS31	TRANSFORMS AND COMPLEX ANALYSIS	L	T	P	C
		3	0	0	3

Programme:	B.E / B.Tech (Common to All Branches)	Sem:	3	Category:	BS

Prerequisites:	Matrices and Calculus

Aim:	To enable to understand the concepts of transforms their applications and to handle analytic functions on complex plane and perform complex integration

Course Outcomes: The Students will be able to

CO1:	Understand the concept of Laplace transform and its application in solving ordinary differential equations
CO2:	Use the effective mathematical tools for the solutions of difference equations by using Z – transform techniques
CO3:	Make the student for applying the Fourier transform in their domains
CO4:	Analyze functions for their continuity, differentiation and Construct an analytic function, when its real or Imaginary part is known
CO5:	Apply the techniques regarding conformal mappings to various fields
CO6:	Apply complex integration in engineering problems

UNIT I: LAPLACE TRANSFORM	**14**

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions.
Finding inverse Laplace transform by different methods, convolution theorem - solving ODEs by Laplace Transform method.

UNIT II: TRANSFORM	**14**

Z-transform - Elementary properties - Inverse Z - transform - Convolution theorem –Formation of difference equations - Solution of difference equations using Z – transform.

UNIT III: FOURIER TRANSFORM	**14**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity

UNIT IV: ANALYTIC FUNCTIONS	**14**

Functions of a complex variable – Analytic functions – Necessary and sufficient conditions (excluding proof) – Cauchy– Riemann equations (Statement only) – Properties of analytic function (Statement only) – Harmonic function – Construction of analytic function – Conformal mapping: w
= z + a, az, 1/z – Bilinear transformation

UNIT V : COMPLEX INTEGRATION	**14**

Line integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semi-circular contour with no pole on real axis

Total Periods:	**75**

Text Book:

1. Grewal B.S., "Higher Engineering Mathematics ", 44 th Edition, Khanna Publishers, New Delhi, 2018.
2. Veerarajan,T., " Engineering Mathematics" (For Semester I and II), Tata McGraw-Hill publishing New Delhi, 2013.

References:

1. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2018.
2. G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry" 9th Edition, Pearson, Reprint,2002.
3. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

4. Ramana B V, “Higher Engineering Mathematics”, 1st Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018. 5. Anita Goel and Ajay Mittal, “*Computer Fundamentals and Programming in C*”, 1/e, Pearson Education, 2013.

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	1						2			1
CO2	3	2	2	1	1						2		1	
CO3	3	3	2	1	1						2	1		2
CO4	3	2	1	1	1						1			
CO5	3	3	1	1	1						1		2	2
CO6	3	2	1	1	1						1	1		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD31	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:	3	Category:	PC
Pre-/Co-requisite:	Nil				

Aim:	To impart knowledge about networks, algorithms, and programming skills to create algorithms capable of human-like solutions.

Course Outcomes: The Students will be able to

CO1:	Explain Artificial intelligence, Agents and its environments.
CO2:	Relate different Search Strategies and constraint satisfaction problems to enable Problem solving.
CO3:	Summarize the various Knowledge Representation Logic.
CO4:	Illustrate the different forms of Learning mechanisms .
CO5:	Identify the need of Production system and Planning states.
CO6:	Apply the working principle of Expert System.

UNIT I: INTRODUCTION	**9**
Introduction to AI- Agents and Environments – concept of rationality – nature of environments problem Solving-Uninformed Search Strategies- Informed Search - Strategies- Local Search Algorithm- Heuristic search strategies – heuristic functions.	
UNIT II: KNOWLEDGE REPRESENTATION	**9**
Introduction to Game Playing- Alpha Beta Pruning - Knowledge Representation using First order logic - Knowledge Engineering in First Order Logic-Proportional vs First Order Logic - Resolution- Structured representation of Knowledge Using Scripts and Frames	
UNIT III: INFERENCE AND LEARNING	**9**
Inference - Forward and Backward Chaining-Unification-Uncertainty-– naïve Bayes models - Inference in Bayesian Network – approximate inference in BN - Learning from Observations - Forms of Learning - Inductive Learning - Neural Network - Learning Decision trees - Reinforcement Learning - Case Study - Learning examples with python.	
UNIT IV:PRODUCTION SYSTEM AND PLANNING	**9**
Introduction to Production system - control strategies - Rete Algorithm –STRIPS - Planning with state space search - Partial Order Planning - Planning Graphs - Planning & acting in the real world.	
UNIT V:EXPERT SYSTEM	**9**
Expert System - Architecture and Roles of Expert System - Typical Expert System – MYCIN - XOON - DART Case Study - Construction of simple reflex agent with sensor and actuator using Arduino.	
Total Periods:	**45**

Text Books

1. Stuart Russell, Peter Norvig, "*Artificial Intelligence – A Modern Approach*", 4th Edition, Pearson Education / Prentice Hall of India, 2022.
2. Joseph C. Giarratano , Gary D. Riley ,"*Expert Systems : Principles and Programming*",4th Edition, 2015.

References

1. Packt Publishing Limited , *"Artificial Intelligence with Python: A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers Paperback"*, 2nd Edition 2020

2. *Fundamentals of Artificial intelligence - Course (nptel.ac.in)*

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COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1			1				1	2	2	2
CO2	2	1	1	1			1				1	2	2	2
CO3	2	1	1	1							1	2	2	2
CO4	2	1	1	1		1					1	2	2	2
CO5	3	2	1	1		1					1	2	2	3
CO6	3	2	1	1							1	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD32	COMPUTER SYSTEM AND ARCHITECTURE	L	T	P	C
		3	0	0	3

Programme:	B.Tech. Artificial intelligent and Data Science	Sem:	3	Category:	PC
Prerequisite:	Nil				

Aim:	To provide an understanding and fundamental Knowledge of computer architecture.
Course Outcomes: The Students will be able to	
CO1:	Design Digital Circuits and Simplify using Boolean algebra and Karnaugh maps.
CO2:	Describe data in binary form, convert numeric data between different number systems and perform arithmetic operations in binary
CO3:	Determine various stages of instruction cycle and describe interrupts and their handling.
CO4:	Understand the basic concepts of pipelining and hazards.
CO5:	Identify the role of the control unit and complete instruction execution
CO6:	Illustrate CPU communicates with memory and I/O devices.

UNIT I:DIGITAL LOGIC CIRCUITS	**9**
Digital Logic Circuits: Logic Gates, Truth Tables, Boolean Algebra, Digital Circuits- Sequential Circuits, Combinational Circuits, Circuit Simplification using Karnaugh map, Don't Care Conditions, flip-flops, Characteristic Tables.	
UNIT II: DIGITAL COMPONENTS AND BASIC COMPUTER ARITHMETIC:	**9**
Digital Components: Half Adder, Full Adder, Encoder, Decoder, Multiplexer, De-multiplexer. Basic Computer Arithmetic: Number System, Complements, Fixed and Floating-point representation.	
UNIT III: INTRDOUCTION TO COMPUTER ARCHITECTURE	**9**
Instruction Set Architecture, Addressing Modes, Instruction Format, Instruction Cycle, RISC, CISC, Interrupts , Pipelining and its Hazards.	
UNIT IV: CENTRAL PROCESSING UNIT AND CONTROL UNIT	**9**
Fundamental Concepts ,Execution of the Complete Instruction, Hardwired Control, Performance Consideration, Microprogrammed Control	
UNIT V: MEMORY AND INPUT-OUTPUT ORGANIZATION:	**9**
Internal memory, Cache Memory, External Memory, Speed, size and cost, Performance consideration. Accessing I/O Devices, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, Standard I/O interfaces.	
Total Periods:	**45**

Text Book:

1. M.Morris Mano,"*Digital Design*", 6/e, Pearson Education, 2018.
2. Carl Hamacher, Zvonko Vranesic and SafwatZaky, "Computer Organization", McGraw-Hill Inc., 6/e, 2012.

References:

1. Charles H.Roth, Jr. "Fundamentals of Logic Design", 4th Edition, Jaico Publishing House, Cengage Earning, 5thedition, 2005.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", 3/e, Elsevier, 2005.
3. William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, 6/e, 2003.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2		1					1	3		3
CO2	3	2	2	2						1	1	3		3
CO3	2	1	1	1							1		2	2
CO4	2	1	1	1							1	2	2	2
CO5	2	1	1	1							1			2
CO6	2	2	1	1						1	1		2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD33	OBJECT ORIENTED PROGRAMMING WITH JAVA			L	T	P	C
				3	0	2	4
Programme:	B.Tech Artificial Intelligence and Data Science	**Sem:**	**3**	**Category:**		**PC**	
Prerequisites:	Nil						

Aim:	To introduce the concepts Object Oriented Programming using JAVA .

Course Outcomes: The Students will be able to

CO1:	Outline the basic Object Oriented Programming concepts and Java Fundaments.
CO2:	Demonstrate Java applications with Inheritance and Interfaces
CO3:	Infer the use of Exceptions and I/O Streams in Java applications
CO4:	Build applications using Threads and Generic Classes
CO5:	Construct interactive Java applications using swings
CO6:	Develop JDBC connectivity.

UNIT I: INTRODUCTION TO OOPS AND JAVA FUNDAMENTALS	**9**

Object Oriented Programming Concepts –. Fundamental Programming Structures in Java – Data Types, Variables, Operators, Control Flow, Arrays, Defining classes in Java – constructors, methods and Fields – Packages.

UNIT II: INHERITANCE AND POLYMORPHISM	**9**

Inheritance – Super classes & Sub classes, types of Inheritance, Abstract classes and methods – Final Classes and methods – Interfaces – Inner classes – String, Polymorphism.

UNIT III: EXCEPTIONS AND I/O	**9**

Exceptions – Exception hierarchy, Throwing & Catching exceptions, Built-in Exceptions and Creating own exceptions, Input / Output Streams Basics – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files..

UNIT IV: MULTITHREADING AND GENERIC PROGRAMMING	**9**

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, Generic Programming – Generic classes – generic methods, Type inference with var and datetime and Collection API.

UNIT V : EVENT DRIVEN PROGRAMMING	**9**

Introduction to Swing – layout management, Swing Components, Working with 2D shapes – Using color, fonts, and images – Basics of event handling – AWT event hierarchy, adapter classes & mouse events – Solid pattern in Java and JDBC.

Total Periods:	**45**

COMPONENT LAB - LIST OF EXPERIMENTS

1. Write a Program using copy constructor to copy data of an object to another object.
2. Write a java program to implement student details and calculate the total and average marks of any five students using abstract classes
3. Develop the program using Inheritance, Interfaces & Function Overloading.
4. Write a Java program that reads the file information and display it in console by Byte/Character Stream Classes.
5. 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, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
6. Design a calculator using event-driven programming paradigm of Java
7. Write a java program to connect MySQL/Oracle using JDBC

Total Periods:	**30**

Text Book:	

1. Programming with JAVA" E.Balagurusamy Tata McGraw-Hill
2. C Thomas WU, "Introduction to Object Oriented Programming WithJAVA",Fourth Edition,Tata McGraw-Hill 2006 .
3. Herbert Schildt ,"Java the Complete Reference " Eleventh Edition, TMH 2019

References:	

1. Y Daniel Liang "Introduction to JAVA Programming", 7/e, Pearson Education, 2016.
2. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Eighth Edition, Sun Microsystems Press, 2008.
3. Java for Programmers, P.J. Deitel and H.M. Deitel, Pearson education (OR) Java: How to Program P.J. Deitel and H.M. Deitel, PHI 8th Edition.

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	1		1		1	1		1	2		2
CO2	2	2	1	1		1		1	1		1	1	2	2
CO3	3	2	2	1		1		1	1		1	1		2
CO4	3	2	2	1		1		1	1		1			2
CO5	2	1	1	1		1		1	1		1	2		2
CO6	3	2	2	1		1		1	1		1	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS32	**DATA STRUCTURES** (Common to CSE&AI&DS)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Programme:	B.Tech Artificial Intelligence and Data Science	**Sem:**	**3**	**Category:**	**PC**
Prerequisites:					

Aim:	To make the student easier to study how the operations on data structure and various algorithms are performed.
Course Outcomes: The Students will be able to	
CO1:	Outline the basic data structures concepts.
CO2:	Rephrase basic data structures such as linked lists, stacks and queues.
CO3:	Apply algorithms for solving problems in sorting and searching.
CO4:	Summarize the pros and cons of hashing techniques.
CO5:	Explain the implementations and applications of advanced non-linear data structures.
CO6:	Illustrate the representation and various algorithms of graphs.

UNIT I: INTRODUCTION TO DATA STRUCTURES	**9**
Data Structures: Definition – Types – Need for Data Structures-Applications of Data Structures – Basic Terminologies: Elementary data organizations – Data structures operations.	
UNIT II: LINEAR DATA STRUCTURES	**9**
Abstract Data Types (ADTs) - List ADT - array-based implementation - linked list implementation - singly linked lists - circularly linked lists - doubly-linked lists -Stack ADT - Queue ADT - circular queue implementation - Double ended Queues - applications of queues.	
UNIT III: SORTING, SEARCHING AND HASH TECHNIQUES	**9**
Sorting algorithms: Insertion sort - Selection sort - Bubble Sort - Shell sort - Quick sort - Merge sort - Radix sort. Searching: Linear search - Binary Search. Hashing: Hash Functions.	
UNIT IV: ADVANCED NON-LINEAR DATA STRUCTURES	**9**
Binary Tree – Binary Search Tree -AVL trees - Red-Black trees - Heaps - Applications of Non- Linear Data Structures.	
UNIT V: GRAPHS	**9**
Representation of Graphs - Breadth-first search - Depth-first search - Minimum Spanning Trees - Kruskal and Prim algorithm - Shortest path algorithm - Dijkstra's algorithm - Bellman-Ford algorithm - Floyd - Warshall algorithm.	
Total Periods:	**45**

Text Book:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education, 4/e, 2014.
2. E. Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Company Ltd., 7/e, 2017.

References:

3. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "*Introductionto Algorithms*", McGraw Hill, 3/e, 2002.
4. ReemaThareja, "*Data Structures Using C*", Oxford University Press, 2/e, 2011.
5. Aho, Hopcroft and Ullman, "*Data Structures and Algorithms*", Pearson Education, 1983.
6. Michael T Goodrich, Roberto Tamassia, David Mount, "*Data Structures and Algorithms in C++*", Wiley Publishers, 7/e, 2004.

Course Outcomes	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1												
CO2	1	2	2	1	1							2	2	
CO3	2	2	2	2	3								2	
CO4	2	3	2	2	2							3	3	2
CO5	2	3	3	3	3								3	2
CO6	2	3	3	3	3							3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD34	DATA EXPLORATION AND VISUALIZATION			L	T	P	C
				3	0	2	4
Programme:	B.Tech Artificial Intelligence and Data Science	**Sem:**	**3**	**Category:**		**PC**	
Prerequisites:	Python						

Aim:	To introduce the methods for data exploration and visualization.
Course Outcomes: The Students will be able to	
CO1:	Shows the fundamentals of exploratory data analysis.
CO2:	Demonstrate real time data using R/ Python /Tableau Public/ Power BI.
CO3:	Build the data visualization using Matplotlib.
CO4:	Make Use of univariate data exploration and analysis.
CO5:	Utilize bivariate data exploration and analysis.
CO6:	Apply the Data exploration and visualization techniques for multivariate and time series data.

UNIT I: EXPLORATORY DATA ANALYSIS	**9**
EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations	
UNIT II: VISUALIZING USING MATPLOTLIB	**9**
Importing Matplotlib – Simple line plots – Simple 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.	
UNIT III: UNIVARIATE ANALYSIS	**9**
Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series	
UNIT IV: BIVARIATE ANALYSIS	**9**
Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations	
UNIT V : MULTIVARIATE AND TIME SERIES ANALYSIS	**9**
Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning –Time-based indexing – Visualizing – Grouping – Resampling	
Total Periods:	**45**

COMPONENT LAB - LIST OF EXPERIMENTS:

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.

9. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report

Total Periods:	**30**

Textbooks:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts , McGraw -Hill, 2015
2. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3. Chirag Shah, 2020, A Hands-On Introduction to Data Science, Cambridge University Press.

References:

1. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.
2. Alexis Leon and Mathews Leon, "Database Management Systems", Vikas Publishing House Private Limited, New Delhi.
3. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010.
4. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.
5. Rob Cornell, "Database Systems Design and Implementation", Cengage Learning, 2011.

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	1	1	1			1		1	2	2	2
CO2	3	3	2	2	2	1			1		1	2	2	2
CO3	3	2	1	1	2	1			1		1	2	2	3
CO4	3	2	2	1	1	1			1		1	2	2	1
CO5	3	2	2	1	1	1			1		1	2	2	1
CO6	3	2	1	1	1	1			1		1	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231HS37	ENHANCING COMMUNICATION SKILLS	L	T	P	C
		0	0	2	1

Programme:	B.Tech. Artificial intelligent and Data Science	Sem:	3	Category:	EEC
Prerequisite:	Nil				

Aim:	To provide students with necessary tools and techniques to improve their verbal, non-verbal, and written communication skills, and to help individuals express themselves more effectively and confidently in a variety of professional and personal settings

Course Outcomes: The Students will be able to

CO1:	Demonstrate the ability to communicate effectively using verbal, non-verbal, written, and visual methods, while overcoming barriers and utilizing elements such as body language, eye contact, and gestures.
CO2:	Develop and maintain positive interpersonal relationships through emotional intelligence, active listening, empathy, effective teamwork, conflict resolution, and fostering an inclusive environment.
CO3:	Apply fundamental grammar rules and construct various sentence types accurately, avoiding common mistakes and ensuring subject-verb agreement .
CO4:	Navigate and adapt to corporate culture by demonstrating ethical behavior, professional etiquette, and maintaining integrity in various professional settings.
CO5:	Plan and deliver engaging presentations by understanding the audience, structuring content effectively.
CO6:	Designing visual aids, and utilizing public speaking techniques to handle questions and feedback..

UNIT 1: COMMUNICATION SKILLS — **6**

Importance of Communication in Personal and Professional Life, 7 C's of Communication - Process & Barriers, Types of Communication: Verbal, Non-verbal, Written, and Visual, Elements of Effective Communication, Speaking Clearly and Confidently, Articulation and Pronunciation, Body Language: Understanding and Using Positive Body Language, Eye Contact and Facial Expressions, Gestures and Posture Space and Proxemics.

UNIT II: BUILDING INTERPERSONAL RELATIONSHIPS — **6**

Importance of Interpersonal Skills, Building Trust and Rapport, Emotional Intelligence - Recognizing and Managing Emotions, working in Teams: Roles and Responsibilities, Conflict Resolution: Handling Disagreements Constructively, Effective Collaboration Techniques, Developing Empathy: Understanding Others' Perspectives, Active Listening, Interpersonal Interactions, Building Inclusive and Respectful Work Environments.

UNIT III: BASIC GRAMMAR AND SENTENCE STRUCTURE — **6**

Parts of Speech: Nouns, Pronouns, Verbs, Adjectives, Adverbs, Prepositions, Conjunctions, Interjections, Sentence Types: Simple, Compound, and Complex Sentences, Common, Grammar Mistakes and How to Avoid Them, Basic Rules of Subject-Verb Agreement, Common Issues with SVA: Singular and Plural Subjects, Practice Exercises and Real-Life Examples.

UNIT IV: CORPORATE CULTURE, ETHICS, AND ETIQUETTES — **6**

Defining Corporate Culture: Values, Norms, and Practices, Adapting to a New Work Environment, Importance of Cultural Fit in Organizations, Ethical, Behavior: Principles and Examples, Handling Ethical Dilemmas, Maintaining Confidentiality and Integrity, Professional Dress Code and Grooming, Email and Phone Etiquette, Meeting Etiquette: Conducting and Participating in Meetings, Importance of Networking in Professional Growth, Building and Maintaining a Professional Network, Social Media Etiquette for Professionals.

UNIT V: PRESENTATION SKILLS — **6**

Preparing for a Presentation - Understanding Your Audience, Structuring Your Presentation: Introduction, Body, and Conclusion. Visual Aids: Designing Effective Slides, Group Presentations, Public Speaking Tips: Overcoming Stage Fright, Engaging the Audience: Using Stories and Examples, Handling Questions and Feedback.

Total Periods: **30**

Text Book:

1. Adler, Ronald B., and Jeanne Marquardt Elmhorst. Communicating at Work: Principles and

Practices for Business and the Professions. 12th ed., McGraw-Hill Education, 2020.
2. Guffey, Mary Ellen, and Dana Loewy. Business Communication: Process and Product. 11th ed., Cengage Learning, 2021.Carl Hamacher, Zvonko Vranesic and SafwatZaky, "Computer Organization", McGraw-Hill Inc., 6/e, 2012.

References:

1. Wood, Julia T. Interpersonal Communication: Everyday Encounters. 9th ed., Cengage Learning, 2020.
2. Lucas, Stephen E. The Art of Public Speaking. 13th ed., McGraw-Hill Education, 2020.
3. Markel, Mike, and Stuart A. Selber. Technical Communication. 13th ed., Bedford/St. Martin's, 2020. Knapp, Mark L., Judith A. Hall, and Terrence G. Horgan. Nonverbal Communication in Human Interaction. 8th ed., Cengage Learning, 2013.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1			1		1	2	2	2
CO2	3	3	2	2	2	1			1		1	2	2	2
CO3	3	2	1	1	2	1			1		1	2	2	3
CO4	3	2	2	1	1	1			1		1	2	2	1
CO5	3	2	2	1	1	1			1		1	2	2	1
CO6	3	2	1	1	1	1			1		1	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD37	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	3	1.5

Programme:	B.Tech. Artificial Intelligence and Data Science	Sem:	3	Category:	PC
Prerequisite:	Python				

Aim:	To introduce basic Artificial Intelligence Techniques and develop the skills in using recent machine learning software for solving practical problems in high-performance computing environment.

Course Outcomes: The Students will be able to

CO1:	Recall the uninformed and Heuristic search technologies.
CO2:	Outline the learning techniques for reasoning under uncertainty
CO3:	Compare Machine learning and supervised learning algorithms
CO4:	Summarize ensemble learning and unsupervised learning algorithms
CO5:	Build the various data clustering algorithms
CO6:	Make use of Data sets using Different Algorithm.

LIST OF EXPERIMENTS:

1. Implementation of Breath First Search and Depth First Search
2. Implementation of Tower of Hanoi using Python
3. Implementation of AO* algorithm using Python
4. Creating the Data Frame using pandas Library and Splitting of Dataset into Training and Testing Sets Using pandas and scikit-learn
5. Classification and Evaluating the data set using Decision tree Classifier
6. Implementation of Forward chaining
7. Calculating Posterior Probability Using Bayes Theorem and Gaussian Naive Bayes for Binary Classification
8. Implementation of K-Nearest Neighbor Algorithm using python
9. Clustering of Datasets using K-Means Algorithm
10. Creation of simple chat bot using python

Total Periods:	45

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1					1		1	3		
CO2	3	2	1	1					1		1	2		1
CO3	3	2	2	1			1		1		1	2	2	
CO4	3	2	2	1					1		1	3		2
CO5	3	2	2	1			1		1		1	2	2	
CO6	3	2	1	1			1		1		1	3		3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS37	DATA STRUCTURES LABORATORY (Common to CSE & AI&DS)	L	T	P	C
		0	0	3	1.5

Programme:	B.Tech. Artificial Intelligence and Data Science	Sem:	3	Category:	PC
Prerequisite:	Programming in C				

Aim:	To develop C++ programming skills in design and implementation of data structures and their applications.
Course Outcomes: The Students will be able to	
CO1:	Recall the importance and basic usability of structure and ADT in different applications.
CO2:	Compare the different algorithms based on their time complexity.
CO3:	Explain the linked implementation, and its uses both in linear and non-linear data structure.
CO4:	Illustrate the various data structure such as stacks, queues, trees, graphs, etc. to solve various computing problems.
CO5:	Apply the various kinds of searching and sorting techniques.
CO6:	Develop a suitable data structure and algorithm to solve a real world problem.

LIST OF EXPERIMENTS:

Implementation in the following topics:

1. Representation of records using Structures in C - Creation of Linked List - Manipulation of Records in a Linked List.
2. Operations on a Stack and Queue
   a. Infix to postfix
   b. Simple expression evaluation using stacks
   c. Linked Stack Implementation
   d. Linked Queue Implementation.
3. Applications of Stack and Queue.
4. Implementation of sorting algorithm.
5. Implementation of Linear search and Binary Search.
6. Implementation of Hashing Techniques.
7. Implementation of Binary Search Tree.
8. Implementation of Tree traversal Techniques.
9. Implementation of Minimum Spanning Trees.
10. Implementation of Shortest Path Algorithms.

Total Periods:	45

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1										
CO2		2	2	3						1		1		1
CO3	2	2			2					1		2		
CO4	2	2	2	2	3					2		2	3	
CO5	2	3	3	3	3					3		3	2	3
CO6		3	3	3	3					3		3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BS42	PROBABILITY AND STATISTICS	L	T	P	C
		3	0	0	3

Programme:	B.Tech. Artificial intelligent and Data Science	Sem:	4	Category:	BS
Prerequisite:	Students should have basic knowledge about measures of tendency and probability				

Aim:	The main objective of this course is to providing the required skill to apply the statistical tools in engineering problems and to acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems

Course Outcomes: The Students will be able to

CO1:	Interpret the concept of random variables
CO2:	Identify the type of statistical situation to which different distributions can be applied
CO3:	Analyze statistical date using Two Dimensional Random Variables
CO4:	Understand the concepts of correlation and regression and its applications.
CO5:	Apply statistical tests for solving engineering problems involving large sample tests
CO6:	Solving the real life problems using t, F and Chi – square test.

UNIT 1: RANDOM VARIABLES **9**

Introduction to Probability – Definition of random variable – Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating functions

UNIT II: STANDARD PROBABILITY DISTRIBUTIONS **9**

Discrete Distributions: Binomial distribution – Poisson distribution – Geometric distribution –Continuous Distribution :Uniform distribution – Exponential distribution – Normal distribution

UNIT III: TWO DIMENSIONAL RANDOM VARIBLES **9**

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem (for 2-D random variables)

UNIT IV: TEST OF SIGNIFICANCE **9**

Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single proportion and difference of two sample proportions – Z-test for single mean and difference of means

UNIT V: TESTING OF HYPOTHESIS **9**

Small sample tests: Student's t-test for testing significance of single mean and difference of means – F-test for comparison of variances – Chi-square test: Test of goodness of fit – Test of independence of attributes.

Total Periods: **45**

Text Book:

1. Grewal B.S., " **Higher Engineering Mathematics** ", 44 th Edition, Khanna Publishers, New Delhi, 2018..
2. T. Veerarajan, Probability, Statistics and Random process, Fourth Edition, Tata McGraw-Hill Education (India) Pvt. Ltd., 2016

References:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014.
2. Flynn M., Probability, Random variables and random processes, Harper & Row Publishers, New York, 1982.
3. Gupta, S.C, and Kapur, J.N., Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi, 11 th Edition., 2006.
4. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007..

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3			2						3	2	2
CO2	2	2	2			3						2		2
CO3	3		2			2						1	2	3
CO4	2	2											3	1
CO5		3	1			2							3	2
CO6	1					3						3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD41	DATA ANALYTICS	L	T	P	C
		3	0	0	3

Programme:	B.Tech. Artificial intelligent and Data Science	Sem:	4	Category:	PC
Prerequisite:	Nil				

Aim:	To understand the concepts of Data Analytics techniques

Course Outcomes: The Students will be able to

CO1:	Analyze the need of Data Analytics
CO2:	Identify the components of data warehousing architecture.
CO3:	Make use of Frequent Pattern Evaluation Methods
CO4:	Demonstrate Regression techniques with the Data Sets.
CO5:	Apply and implement enhanced classification methods and other clustering techniques
CO6:	Plan recent trends of Data mining in Business Applications.

UNIT 1: INTRODUCTION **9**

Introduction to Data Analytics Overview of Data Analytics, Need of Data Analytics, Nature of Data, Types of data and data Analytics- Characteristics of Data, Applications of Data Analytics. Business Intelligence and Analytics, Business Analytics Optimization

UNIT II: DATA WAREHOUSING **9**

Data warehousing - Data Warehousing Components — Data Warehouse Modeling — Design and implementation Mapping the Data Warehouse to Multiprocessor Architecture — Online Analytical Processing and Tools — Data Cub Technologies — Multidimensional Data Analysis — Introduction to KDD process — Knowledge discovery from databases — Data mining functionalities — Technologies used — Applications

UNIT III: FREQUENT PATTERN MINING TECHNIQUES **9**

Statistical description of data —Measuring similarity and dissimilarity —Mining frequent item sets: Apriority algorithm, FP Growth Tree — Frequent Pattern evaluation methods — Support, Confidence, Association Mining various kinds of association rules

UNIT IV: MACHINE LEARNING TECHNIQUES **9**

Regression techniques: Linear Regression: — Logistic— k Nearest Neighbour — Decision tree induction: ID3, C4.5, CART — Bayesian classification: Naïve Bayes — Model Evaluation and Selection: Accuracy, AUC, Error rate, Sensitivity, Specificity, Precision, Recall — Cross validation — Confusion Matrix-Clustering techniques: Partitioning methods — k Means — Hierarchical methods — Agglomerative Clustering – Dendrogram Evaluation of clustering algorithms — DBSCAN

UNIT V: CASE STUDY **9**

Mining Complex Data Types — Sequential pattern mining in symbolic sequences, Customer Segmentation for Retail-Data mining for intrusion detection and prevention - Data mining and Recommender systems

Total Periods: **45**

Text Book:

1. Jiawei Han, Jian Pei, Hanghang Tong, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, fourth edition, July 2,2022- eBook ISBN: 9780128117613

References:

1. Data Mining for Business Analytics: Concepts, Techniques, and Applications in R" by Galit Shmueli, Peter C. Bruce, Peter Gedeck, Nitin R. Patel (2020)
2. A"Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" (2nd Edition) by Foster Provost and Tom Fawcett (2020)
3. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" (2nd Edition) by Aurélien Géron (2022)

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1		1					1	2	1	2
CO2	2	2	1	1							1	2	2	2
CO3	2	1	1	1		1					1	2	3	2
CO4	3	2	2	1							1	2	3	2
CO5	3	2	2	1		1					1	2	3	2
CO6	2	2	1	1		1					1	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS41	DATABASE MANAGEMENT SYSTEMS (Common to CSE & AI&DS)	L	T	P	C
		3	0	0	3

Programme:	B.Tech. Artificial intelligent and Data Science	Sem:	4	Category:	PC

Prerequisite:	Nil

Aim:	To provide a strong foundation in database technology and current trends in this field..

Course Outcomes: The Students will be able to.

CO1:	Identify the basic concepts of database systems.
CO2:	Outline the basics of SQL and methods to enhance queries.
CO3:	Apply the normalization rules for optimizing the database.
CO4:	Illustrate the transactions using T-SQL.
CO5:	Summarize the fundamental concepts of transaction, concurrency and recovery processing.
CO6:	Classify the various advanced Database technologies and database security.

UNIT-I INTRODUCTION	**9**

Purpose of Database System - Views of data - Data Models - Architecture -Entity - Relationship (E-R) model - Extended E-R Features - Design of E-R database schema - Structure of Relational data model - Fundamentals of relational algebra operations

UNIT-II STRUCTURED QUERY LANGUAGE	**9**

SQL: Basic structure - Query Processing Overview -Set operations - Aggregate functions - Null Values - Nested sub queries -Data Base Languages- Keys - Embedded SQL -Dynamic SQL. Domain Constraints - Assertions - Triggers - Views.

UNIT-III DATABASE DESIGN	**9**

Functional Dependencies –Non-loss Decomposition- Normalization-First, Second, Third Normal Forms, - Boyce/Code Normal Form - Multi-valued Dependencies and Fourth Normal Form - Join Dependencies and Fifth Normal Form.

UNIT-IV TRANSACTIONS PROCESSING AND CONCURRENCY CONTROL	**9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency control –Two Phase Locking-Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm.

UNIT-V ADVANCED DATABASE SECURITY AND No-SQL	**9**

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – No-SQL MongoDB- Basic Structure – Commands – Data Base Connectivity- Database Security: Security issues –Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures.

Total Periods:	**45**

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 7th/e, Tata McGraw Hill, 2021.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th/e, Pearson, 2017.
3. Itzik Ben-Gan,"Microsoft SQL Server 2012 T-SQL Fundamentals", Microsoft Press 2nd/e, 2012.

References:

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Pearson Education, 8/e, 2006.
2. Raghu Ramakrishnan, "Database Management Systems", McGrawHill, 4/e, 2010.
3. G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	2									3	2
CO2	2	3	2	2									2	2
CO3	3	3	3	3									2	2
CO4	2	3	2	2								1	1	2
CO5	2	3	2	2									2	2
CO6	2	3	2	2								1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS42	DESIGN AND ANALYSIS ALGORITHMS (Common to CSE&AI&DS)	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and data Science	Sem:	4	Category:	PC
Pre-/Co-requisite:	Problem Solving Techniques, Data Structures				

Aim:	To learn about algorithm analysis for the run time complexities and the space requirements. And acquire knowledge of algorithms for implementing various computing system
Course Outcomes: The Students will be able to	
CO1:	Identify the time and space complexities of different algorithms.
CO2:	Solve problems using the divide and conquer paradigms.
CO3:	Utilize the greedy method to solve basic optimization problems.
CO4:	Develop algorithms that apply dynamic programming to solve various problems.
CO5:	Identify how backtracking and branch-and-bound are applied to deliver optimal solutions to various real-world problems.
CO6:	Apply theoretical knowledge of NP problems and advanced algorithms to solve real-world computational challenges.

UNIT-I INTRODUCTION TO ALGORITHMS	**9**
Role of algorithm in computing - Time and Space Complexity - Rate of Growth – Asymptotic Analysis - Recurrence Relations - The substitution method for solving recurrences.	
UNIT-II DIVIDE AND CONQUER	**9**
Merge sort - Quick sort - Finding Maximum and Minimum Elements - Strassen's Matrix Multiplication - Tiling Problem - Closest Pair Problems.	
UNIT-III GREEDY METHOD AND DYNAMIC PROGRAMMING	**9**
Greedy Method**:** Coin change problem - Scheduling Problems - Knapsack Problem - Minimum Spanning Trees - Huffman coding. Dynamic Programming: Multistage Graph Problem - Floyd-Warshall Algorithm - Bellman-Ford Algorithm	
UNIT-IV BACKTRACKING AND BRANCH-AND-BOUND	**9**
Backtracking: N Queen Problem - Sum of Subsets - Vertex Colouring Problem - Hamiltonian Circuit Problem. Branch and bound – Knapsack problem – Travelling salesman problem.	
UNIT-V NP PROBLEMS AND ADVANCED ALGORITHMS	**9**
NP-completeness - Cook's Theorem - Theory of reducibility - Circuit satisfiability - NP hard Graph Problem - Clique Decision Problem - Vertex Cover Problem - Introduction to approximation algorithms - Randomization algorithms - Parallel algorithms - Parallel Searching and Parallel Sorting.	
Total Periods:	**45**
Text Book:	
1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3/e, Pearson Education,2012.	

References:
1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3/e, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Edu, 2009.
4. Steven S. Skiena, "The Algorithm Design Manual", 2/e, Springer, 2008.
5. http://nptel.ac.in/

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2								3		
CO2	3	3	3	2							2		3	
CO3	3	3	3	2							2			3
CO4	3	3	3	2							2			
CO5	3	3	3	2							2	3		
CO6	3	3	3	2								3	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS45	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

Programme:	B.Tech Artificial Intelligence and data Science	Sem:	4	Category:	PC
Prerequisites:	191CS41 – Computer Organization and Architecture				

Aim:	To introduce the basic principles and concepts of operating systems.

Course Outcomes: The Students will be able to

CO1:	Explain the structure and functions of Operating system.
CO2:	Utilize the techniques and algorithms for process management and synchronization.
CO3:	Demonstrate various memory management schemes.
CO4:	Identify the various Process Scheduling algorithms and Page Replacement algorithms.
CO5:	Summarize various Disk scheduling algorithms, Concepts of files and I/O
CO6:	Apply administrative tasks on Linux Servers and Compare iOS and Android

UNIT-I OPERATING SYSTEM AND SERVICES **9**

Computer System Introduction-Operating system overview-structures and Operations-Types-System calls and System Programs-System Booting-Process-Concept-States-Scheduling Types-Inter Process Communication- Threads-Types and Models-Examples.

UNIT-II PROCESS MANAGEMENT **9**

Process scheduling algorithms-examples-thread scheduling- examples-process synchronization-critical sections-hardware and software solutions-semaphores- classical problems in synchronization - producer consumer problem- readers writer problem- dining philosophers problem-deadlocks-detection and avoidance algorithms-deadlock prevention techniques.

UNIT-III MEMORY MANAGEMENT **9**

Main memory and Types-Registers and Types-Cache memory and Types-Memory allocation-Paging and Segmentation-32 Bits and 64 Bits memory Systems-Virtual Memory-Demand Paging-Page Fault-Page Replacement-Allocating Kernel memory. Examples.

UNIT-IV FILE AND I/O MANAGEMENT **9**

Mass Storage-Disk Structure and Scheduling-File-File System-Directory Structure-File Allocation Methods-Free Space Management-I/O System and Components-Services.

UNIT-V CASE STUDIES AND TOOLS **9**

Linux Operating System and Services-Windows Server 2016 and Services – Memory and Process management for Intel i5 and i7 cores-Mobile OS -iOS and Android -Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System

Total Periods: **45**

COMPONENT LAB – LIST OF EXPERIMENTS:

1. Implement Process Management System Calls
2. Implement Shared memory and IPC.
3. Implement Threading Applications.
4. Implement Synchronization Applications using Semaphores.
5. Process Scheduling Algorithms (FCFS, SJF, Round Robin and Priority).
1. Page Replacement Algorithms (FIFO and LRU)

Total Periods: **30**

Text Book:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "*Operating System Concepts*", John Wiley and Sons Inc., *9/e*, 2012.

References:

1. William Stallings, "*Operating Systems – Internals and Design Principles*", Prentice Hall, *7/e*, 2011.
2. Andrew S. Tanenbaum, "*Modern Operating Systems*", Addison Wesley, *2/e*, 2001.
3. Charles Crowley, "*Operating Systems: A Design-Oriented Approach*", Tata McGraw Hill, 1996.
4. D.M.Dhamdhere, "*Operating Systems: A Concept-Based Approach*", Tata McGraw Hill,

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	2								1	3	2
CO2	3	3	3	3								1	3	3
CO3	3	3	3	3								1	3	3
CO4	3	3	3	3								1	3	3
CO5	2	3	2	2								1	3	2
CO6	3	3	3	3								1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS46	COMPUTER NETWORKS	L	T	P	C
		3	0	2	4

Programme:	B.Tech-Artificial Intelligence and Data Science	Sem:	4	Category:	PC
Pre-/Co-requisite:	Nil				

Aim:	To understand the concepts of computer networks, protocols and data communication.

Course Outcomes: The Students will be able to

CO1:	Identify the components required to build different types of networks.
CO2:	Classify the Media Access Control Protocols and different Internetworking.
CO3:	Demonstrate the various types of routing techniques
CO4:	Outline the mechanisms involved in transport layer
CO5:	Explain the different protocols used at application layer i.e. HTTP, SNMP, SMTP, FTP, TELNET And VPN.
CO6:	Construct a networking system and justify the appropriate protocols.

UNIT-I FUNDAMENTALS & LINK LAYER	**9**
Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control	
UNIT-II MEDIA ACCESS & INTERNETWORKING	**9**
Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)	
UNIT-III ROUTING	**9**
Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses –multicast routing (DVMRP, PIM)	
UNIT-IV TRANSPORT LAYER	**9**
Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements	
UNIT-V APPLICATION LAYER	**9**
Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP	
Total Periods:	**45**

LIST OF EXPERIMENTS:

1. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
2. Study of Socket Programming and Client – Server model
3. Write a code simulating ARP /RARP protocols.
4. Write a code simulating PING and TRACEROUTE commands
5. Create a socket for HTTP for web page upload and download.
6. Write a program to implement RPC (Remote Procedure Call)
7. Implementation of Subnetting.
8. Applications using TCP Sockets like
   a. Echo client and echo server
   b. Chat
   c. File Transfer
9. Applications using TCP and UDP Sockets like
   i. DNS
   ii. SNMP
   iii. File Transfer
10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS 12.
11. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
    i. Link State routing

ii. Flooding
iii. Distance vector

12. Construct a WAN using Cisco Packet Tracer Tool

Total Periods: 30

Textbooks

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.

References

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011.
4. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw – Hill, 2011.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	2								1	2	2
CO2	3	3	3	3								1	2	2
CO3	3	3	3	3								1	2	2
CO4	3	3	3	3								1	2	2
CO5	2	3	2	2								1	2	2
CO6	3	3	3	3								1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231CS47	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

Programme:	B.Tech-Artificial Intelligence and Data Science	Sem:	4	Category:	PC
Prerequisites:	191CS38 – Python Laboratory				

Aim:	To study and implement DDL, DML commands & basics of PL/SQL functions, cursors, triggers etc.

Course Outcomes: The Students will be able to

CO1:	Categorize the structured query language (SQL) for database definition and database manipulation.
CO2:	Recommend with Join and Nested Queries to perform Various Database operations.
CO3:	Analyze the PL/SQL blocks using Cursors and Triggers.
CO4:	Evaluate the normalization forms using SQL queries.
CO5:	Design the Transactions processing using T-SQL.
CO6:	Analyze the various advanced technology of Databases and No-SQL.

LIST OF EXPERIMENTS:

MICROSOFT SQL SERVER

1. Practice of Database Languages using SQL Query
2. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands
3. Set operators and Join queries and nested queries
4. PL/SQL–(Cursors, Stored procedures, stored function, Triggers)
5. Front end Connectivity
6. Normalization (1NF, 2NF and 3NF)
7. Auto Rollback - IF ELSE statement-SQL Transaction in TRY CATCH using T-SQL.

MONGODB

1. No-SQL commands
2. Recursion
3. Java Database Connectivity

Mini project :

a) Inventory Control System.
b) Hospital Management System.
c) Railway Reservation System.
d) Personal Information System.
e) Web Based User Identification System.
f) Timetable Management System.
g) Hotel Management System
h) Education Management System
i) Airline Reservation System
j) Online Voting System
k) Goods and Service Tax(GST) Management System
l) Aadhaar Management System

Total Periods:	45

COs	Program Outcomes (POs)											ProgramSpecific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	3								1	2	3
CO2	3	2	2	3								1	2	3
CO3	3	1	1	3								1	2	3
CO4	3	2	2	3								1	2	3
CO5	3	3	3	3								1	2	3
CO6	3	1	1	3								1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231HS47	ENHANCING APTITUDE AND REASONING SKILLS	L	T	P	C
		0	0	1	1*

Programme:	B.Tech Artificial Intelligence and data Science	Sem:	4	Category:	PC
Prerequisites:	Nil				

Aim:	To equip students with essential quantitative, logical, data interpretation, verbal aptitude, and general awareness skills necessary for excelling in competitive exams and real-world problem-solving scenarios, focuses on developing critical thinking and analytical abilities..

Course Outcomes: The Students will be able to

CO1:	Apply mathematical concepts and techniques to solve complex quantitative problems, demonstrating a solid understanding of number systems, arithmetic operations, and algebra
CO2:	Develop and apply logical reasoning skills to analyze patterns, sequences, and relationships, enabling effective problem-solving in various reasoning scenarios such as puzzles and seating arrangements.
CO3:	Interpret and analyze data presented in various forms, such as tables, graphs, and charts, to make informed decisions and solve problems based on quantitative data analysis
CO4:	Enhance communication skills by building a robust vocabulary, understanding grammar rules, and effectively comprehending and analyzing written texts
CO5:	Demonstrate awareness of current affairs and general knowledge across various domains, including history, geography, science, and politics, to participate in informed discussions and make educated decisions
CO6:	Develop effective test-taking strategies, including time management and analytical review of test results, to improve performance in competitive exams and enhance overall test readiness

QUANTITATIVE APTITUDE **9**

Number Systems and Simplifications - Types of Numbers: Natural, Whole, Integers, Rational, Irrational, Divisibility Rules, Simplification Techniques, HCF and LCM, Arithmetic Operations and Algebra, Basic Operations: Addition, Subtraction, Multiplication, Division, Fractions and Decimals, Percentage Calculations, Introduction to Algebra:, Variables, Expressions, and Equations, Ratio, Proportion, and Averages, Direct and Inverse Proportions, Averages: Mean, Median, and Mode, Speed, Time, and Distance - Basics of Speed, Time, and Distance, Relative Speed, Problems on Trains, Boats, and Streams.

LOGICAL REASONING **9**

Analytical Reasoning - Series Completion: Number, Alphabet, and Picture Series, Analogies and Classification, Coding-Decoding, Deductive Reasoning ***Syllogisms:*** Statements and Conclusions, Logical Deduction, Statement and Assumption, Statement and Conclusion, Puzzles and Seating Arrangements, Linear and Circular Arrangements, Complex Puzzles, Blood Relations and Family Trees.

DATA INTERPRETATION **9**

Introduction to Data Interpretation - Importance and Types of Data Interpretation, Reading and Interpreting Tables and Charts, Bar Graphs and Line Graphs, Advanced Data Interpretation, Pie Charts and Venn Diagrams, Caselets and Data Sufficiency, Practice Exercises on Data Interpretation..

VERBAL APTITUDE **9**

Vocabulary and Grammar, Building Vocabulary: Synonyms, Antonyms, and Homonyms, Common Grammar Rules, Spotting Errors and Sentence Correction, Reading Comprehension, Techniques for Efficient Reading, Types of Questions: Fact-based, Inference, and Vocabulary-based, Practice, Passages and Exercises, Verbal Reasoning, Critical Reasoning: Arguments and Conclusions, Logical Sequencing of Sentences, Para Jumbles and Sentence Rearrangement.

GENERAL AWARENESS AND PRACTICE TESTS **9**

Importance of Current Affairs - Basic General Knowledge: History, Geography, Science, and Politics, Recent Developments and News Analysis, Practice Tests and Mock Exams, Full-length Mock Tests: Quantitative Aptitude, Logical Reasoning, Data Interpretation, and Verbal Aptitude, Time Management Strategies, *Reviewing and Analyzing Test Results*

Total Periods:	**45**

Text Book:

1. Aggarwal, R.S. *Quantitative Aptitude for Competitive Examinations*. S. Chand Publishing, 2020.
2. Aggarwal, R.S. *A Modern Approach to Logical Reasoning*. S. Chand Publishing, 2019.
3. Ashisha, Ananta. *Data Interpretation & Data Sufficiency*. Arihant Publications, 2021.
4. Aggarwal, R.S. *A Modern Approach to Verbal & Non-Verbal Reasoning*. S. Chand Publishing, 2020.
5. Pandey, Manohar. *General Knowledge 2024*. Arihant Publications, 2024.

References:

1. Verma, Sarvesh K. *Quantitative Aptitude Quantum CAT*. Arihant Publications, 2022.
2. Sinha, Nishit K. *Logical Reasoning and Data Interpretation for the CAT*. Pearson, 2021.
3. Sinha, Nishit K. *The Pearson Guide to Data Interpretation and Logical Reasoning for the CAT*. Pearson, 2019.

Wren, P.C., and H. Martin. *High School English Grammar and Composition*. S. Chand Publishing, 2018.

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1							1	3		
CO2	3	2	1	1							1	3		
CO3	2	2	1	1					1		1	3		
CO4	2	1	1	1					1		1			1
CO5	2	1	1	1					1		1			
CO6	3	2	1	1					1		1			1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD51	MACHINE LEARNING ALGORITHMS	L	T	P	C
		3	0	0	3

Programme:	B.Tech. Artificial Intelligence and Data Science	Sem:	5	Category	PC
Pre-/Co-requisite:	Nil				

Aim:	To understand the basic theory underlying machine learning
Course Outcomes: The Students will be able to	
CO1:	Understand the fundamentals of Machine Learning and different learning paradigms, and recognize the role of ML in AI applications
CO2:	Apply Bayes' theorem and understand the concept of Bayesian learning and classifiers.
CO3:	Illustrate the concept of sample complexity and the theory behind finite and infinite hypothesis spaces.
CO4:	Design and implement decision trees for classification tasks and evaluate machine learning models using K-NN, Logistic Regression, and Support Vector Machines.
CO5:	Implement clustering techniques and dimensionality reduction techniques understand the concepts of ensemble learning.
CO6:	Analyze and apply advanced reinforcement learning techniques for more complex environments, including policy gradient methods and advanced learning.

UNIT I : INTRODUCTION TO MACHINE LEARNING	**9**
Introduction to Machine Learning – Learning Paradigms – PAC learning – Version Spaces – Role of Machine Learning in Artificial Intelligence applications. Types – Supervised learning, unsupervised, Reinforcement learning. Supervised Learning - Regression – Linear – Polynomial – Multiple regression.	
UNIT II : BAYESIAN AND COMPUTATIONAL LEARNING	**9**
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.	
UNIT III : DECISION TREE AND NEURAL NETWORKS	**9**
Decision Trees – ID3 –CART - K-NN classifier – Logistic regression -Support Vector Machines. Neural Network Representation – Problems – Perceptron's – Multilayer Networks and Back Propagation Algorithms -Models of Evaluation and Learning.	
UNIT IV : UNSUPERVISED LEARNING AND ENSEMBLE LEARNING	**9**
Clustering – K-means – EM -Cluster validity measures. Dimensionality Reduction - Principal components analysis (PCA) – Bias – Variance Tradeoff – Bagging and Boosting (Random forests, Adaboost, XG boost inclusive) – Metrics & Error Correction.	
UNIT V: REINFORCEMENT LEARNING AND ADVANCED LEARNING	**9**
Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning-Policy Gradient Methods-Model based method-Federated Learning – Automated Machine Learning.	
Total Periods:	**45**

Text Book:

1. Alpaydin Ethem, "Introduction to Machine Learning", Massachusetts Institute of Technology Press, 2020.
2. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto, 2018

References:	
1. "Pattern Recognition and Machine Learning" by Christopher M. Bishop,2009. 2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective‖, CRC Press, 2009.	
E-Books:	
http://pdf.th7.cn/down/files/1603/Mastering%20Machine%20Learning%20with%20scikitlearn.pdf	

COs	**Program Outcomes (POs)**											**ProgramSpecific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	1						1	3	3	
CO2	3	2	2	2							1	2		2
CO3	2	2	1								1		2	
CO4	3	2	2								1	3	1	2
CO5	3	2	2	1	1						1		2	
CO6	3	2	2								1	3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD52	INTRODUCTION TO IoT	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and data Science	Sem:	5	Category:	PC
Pre-/Co-requisite:	Data Analytics , Computer Networks				

Aim:	To understand the concepts of Data Analytics techniques

Course Outcomes: The Students will be able to

CO1:	Understand the fundamental concepts and architecture of the Internet of Things (IoT).
CO2:	Analyze the role of edge, fog, and cloud computing in enhancing IoT system performance and scalability.
CO3:	Explain common IoT networking protocols and their roles in enabling device connectivity.
CO4:	Identify and describe various sensors, actuators, and communication technologies used in IoT.
CO5:	Develop simple IoT applications using microcontrollers such as Arduino or Raspberry Pi.
CO6:	Evaluate real-world IoT applications and case studies across various domains such as smart homes, healthcare, and industry.

UNIT I-INTRODUCTION TO IoT	9
History and evolution of IoT- IoT architecture and components- Characteristics and features of IoT-Importance and applications of IoT	
UNIT II- IoT ECOSYSTEM	9
Sensors and actuators-Embedded systems and microcontrollers-Communication technologies (Wi-Fi, Bluetooth, Zigbee, LoRa, etc.)-IoT platforms and cloud services-Data processing and analytics	
UNIT III-NETWORKING AND COMMUNICATION PROTOCOLS	9
IoT network models and topologies- Protocols: MQTT, CoAP, HTTP, HTTPS- IPv4 vs IPv6 in IoT- Wireless communication technologies in IoT-Edge, Fog, and Cloud computing in IoT-	
UNIT IV-IoT HARDWARE AND SOFTWARE	9
Microcontrollers: Arduino, Raspberry Pi, ESP8266/ESP32-Sensors: Temperature, humidity, motion, etc.-Actuators and motors-IoT device interfacing and control-IoT programming basics (C, Python, JavaScript)-IoT development environments and tools-Data acquisition and processing-Cloud integration (AWS IoT, Microsoft Azure, Google Cloud IoT)	
UNIT V- IoT APPLICATION AND CASE STUDIES	9
Smart homes and buildings-Healthcare and wearable devices-Industrial IoT (IIoT) and smart manufacturing-Smart cities and transportation-Agriculture and environmental monitoring	
Total Periods:	**45**

Textbooks:

1. "Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti(2014)

References:

1. **"Internet of Things: Principles and Paradigms"**— Edited by Rajkumar Buyya, Amir Vahid Dastjerdi.
2. **"Building Internet of Things with the Arduino"**— by Charalampos Doukas

"Internet of Things: Architecture and Design Principles"— by Rajkumar Buyya, Amir Vahid Dastjerdi

Course Outcomes	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1		1					1	2	2	2
CO2	2	2	1	2							1	2	2	2
CO3	2	1	1	1		1					1	2	2	2
CO4	3	2	2	2							1	2	2	2
CO5	3	3	2	1		1					1	2	3	2
CO6	2	2	1	1		1					1	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD53	COMPUTER VISION AND IMAGE PROCESSING	L	T	P	C
		3	0	2	4

Programme:	B.Tech Artificial Intelligence and data Science	Sem:	5	Category:	PC
Pre-/Co-requisite:	Nil				

Aim:	To Understand the concept of computer vision and image processing techniques, focusing on both traditional methods and deep learning-based approaches.

Course Outcomes: The Students will be able to

CO1:	Apply foundational image processing techniques.
CO2:	Explain various feature extraction techniques.
CO3:	Interpret advanced computer vision algorithms such as object detection, image segmentation, and motion analysis
CO4:	Demonstrate the use of object detection platforms
CO5:	Create vision-based solutions for autonomous systems.
CO6:	Develop advanced computer vision systems by integrating techniques

UNIT I –FOUNDATIONS OF VISION SYSTEMS AND IMAGE MANIPULATION	**9**
Fundamentals of Computer Vision: Concepts, history, and importance-Digital Image Processing Techniques: Filtering, transformation, enhancement-Image Representation: Pixels, color models, and formats-Basic Image Manipulation: Cropping, resizing, color space conversion.	
UNIT-II FEATURE DISCOVERY AND KEYPOINT ANALYSIS	**9**
Feature Detection Techniques: Edges, corners, blobs-Feature Description: SIFT, SURF, ORB-Keypoint Matching: Brute-force, FLANN-based, and descriptor matching-Feature-based Image Alignment and Stitching-Use Cases: Panorama creation, object tracking, and 3D reconstruction	
UNIT-III IMAGE PARTITIONING AND VISUAL CLUSTERING	9
Introduction to Image Segmentation: Concepts and significance-Semantic vs. Instance Segmentation: Key differences and use cases-Segmentation Algorithms: Thresholding, region growing, watershed, GrabCut-Clustering in Image Processing: K-Means, Mean Shift, and DBSCAN-;	
UNIT-IV INTELLIGENT OBJECT ANALYSIS AND DETECTION TECHNIQUES	**9**
Object Recognition: Concepts, categories, and challenges-Detection Techniques: Sliding window, selective search, region proposal networks-Deep Learning for Detection: CNN-based models (YOLO, SSD, Faster R-CNN)- Tools and Platforms: Introduction to Roboflow, Landing AI, and other annotation tools	
UNIT-V VISION IN MOTION AND INTELLIGENT SYSTEMS	**9**
Motion Analysis: Optical flow, background subtraction, and tracking methods -Kalman filter, Mean Shift-Multi-view Geometry: Depth estimation, stereo vision, and 3D reconstruction-Vision for Robotics: Visual servoing, SLAM (Simultaneous Localization and Mapping)- Autonomous Systems: Role of vision in self-driving cars and drones.	
Total Periods:	**45**

LIST OF EXPERIMENTS:	
1. To load and display an image, and perform basic image manipulations. 2. Implement key feature extraction techniques such as Harris Corner Detector, SIFT, and SURF using OpenCV, and explore feature matching between images. 3. Implementing object tracking techniques such as KCF and MOSSE using OpenCV. 4. To explore different color spaces and convert between them. 5. To apply simple thresholding techniques to segment images ss6. To detect objects such as faces using pre-trained classifiers. 7. Implementing optical flow algorithms such as Lucas-Kanade . 8. Implementing image segmentation using semantic and instance segmentation.	

Total Periods:	**30**

Textbooks:	
1. Computer Vision: Algorithms and Applications" by Richard Szeliski, 2021. 2. Deep Learning for Computer Vision with Python" by Adrian Rosebrock,2020	
References:	
1. Computer Vision: A Modern Approach" by David A. Forsyth and Jean Ponce,2011 2. Computer Vision with TensorFlow 2: Develop Object Detection Systems with TensorFlow and Keras" by Benjamin Planche and Eliot Andres,2020.	

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	1	1					1	3	3	2
CO2	3	2	1	1	1	1					1	3	3	
CO3	3	2	1	1	1	1					1	3	3	3
CO4	3	2	1	1	1	1					1	3	3	
CO5	3	2	2	1	1	1	1				1	3	3	3
CO6	3	2	1	1	1	1					1	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD57	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	3	1.5

Programme:	B.Tech. Artificial Intelligence and Data Science	Sem:	5	Category:	PC
Prerequisites:	Artificial Intelligence				

Aim: Implement the machine learning concepts and algorithms using various tools.

Course Outcomes: The Students will be able to

CO1:	Recall the simple commands using machine learning library .
CO2:	Outline the regression Model using python .
CO3:	Develop the Decision tree using different examples.
CO4:	Explain the different clustering techniques
CO5:	Implement the Principal Component Analysis using Machine learning tools
CO6:	Apply the SVM concepts in the various dataset.

LIST OF EXPERIMENTS:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. 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.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same Using Appropirate DataSet
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Total Periods: 45

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2			2		1				1	3	2	
CO2	3			2							1	3		2
CO3	3	2				1					1		2	
CO4	3										1	3	3	2
CO5	3				2		2				1		2	
CO6	3		2			1					1	3		3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD61	DEEP LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

Programme:	B.Tech. Artificial Intelligence and Data Science	Sem:	6	Category:	PC

Prerequisites:	231AD51 - Machine Learning Algorithms

Aim:	To understand and need and principles of deep neural networks

Course Outcomes: The Students will be able to

CO1:	Infer basics in deep neural networks
CO2:	Summarize Convolution Neural Network for image processing
CO3:	Outline Recurrent Neural Network and its variants for text analysis
CO4:	Apply model evaluation for various applications
CO5:	Demonstrate various Autoencoders and related applications
CO6:	Develope generative models for suitable applications

UNIT I DEEP NETWORKS BASICS	**9**

Learning Algorithms – Capacity, Overfitting and Underfitting – Hyperparameters and Validation Sets – Estimators, Bias and Variance – Maximum Likelihood Estimation – Bayesian Statistics – Learning Algorithms – Stochastic Gradient Descent– Challenges Motivating Deep Learning

UNIT II DEEP FEEDFORWARD NETWORKS AND REGULARIZATION	**9**

Deep Feedforward Networks – Learning XOR – Gradient Based Learning – Activation Functions and Loss Functions – Hidden Units – Neural Network architecture Design and considerations – Backpropagation and Optimization-Regularization -Ridge, Lasso, Dropout, Batch Normalization.

UNIT III CONVOLUTIONAL NETWORKS	**9**

CNN Architectures – Convolution – Pooling Layers **–** Residual Learning and ResNet-Transfer Learning and fine tuning Using Pre-trained ResNet Models – Recurrent and Recursive Nets – Recurrent Neural Networks – Deep Recurrent Networks – Recursive Neural Networks-Applications

UNIT IV DEEP LEARNING ARCHITECTURE	**9**

Long Short-Term Memory (LSTM) Networks – Sequence Prediction – Gated Recurrent – Encoder/Decoder Architectures – Autoencoders – Standard – Sparse – Denoising – Contractive – Variational Autoencoders – Applications of Autoencoders

UNIT V ADVANCED DEEP LEARNING TECHNIQUES	**9**

Deep Belief Networks – Deep Boltzman Machine – Generative Neural Networks – GAN and its variants – Transfer Learning – BERT – GPT – XLNet – T5 – Deep fake Technology – Applications-Images segmentation – Object Detection – Automatic Image Captioning.

Total Periods:	**45**

Text Book:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning", MIT Press, 2016.
2. **"Neural Networks and Deep Learning"** by Michael Nielsen 2015
3. **"Convolutional Neural Networks for Visual Recognition"** by Fei-Fei Li, Andrej Karpathy, and Justin Johnson 2016

References:

1. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, ``A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.
2. Yoav Goldberg, ``Neural Network Methods for Natural Language Processing' 'Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3. Francois Chollet, ``Deep Learning with Python", Manning Publications Co, 2018.
4. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.
5. **Understanding the Difficulty of Training Deep Feedforward Neural Networks"** Xavier Glorot, Yoshua Bengio, *Proceedings of the 13th International Conference on Artificial Intelligence and Statistics*, 2010

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1							1	2		1
CO2	3				2							2	1	
CO3	3		2								1		2	1
CO4	3	1	1									3	2	
CO5		2	2		2								2	
CO6	3	2	2								1	3		1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD62	DATA AND INFORMATION SECURITY	L	T	P	C
		3	0	0	3

Programme:	B.Tech. Artificial Intelligence and Data Science	Sem:	6	Category:	PC

Prerequisites:	231CS46 - Computer Networks

Aim:	To enable the students to understand security principles, policies, and techniques, emphasizing practical applications in securing digital Systems.

Course Outcomes: The students will be able to

CO1:	Recall the history and basic definitions of information security
CO2:	Summarize key security policies such as confidentiality and integrity policies.
CO3:	Identify authentication protocols such as Kerberos and X.509 Directory Services.
CO4:	Outline the Implementation of PGP for secure email communication.
CO5:	Infer the components and protocols involved in SSL and SET (Secure Electronic Transaction).
CO6:	Apply SSL and TLS in securing web applications, ensuring data confidentiality and integrity.

UNIT I INTRODUCTION	**9**
Information Security - History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC	

UNIT II SECURITY INVESTIGATION	**9**
Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies	

UNIT III DIGITAL SIGNATURE AND AUTHENTICATION	**9**
Digital Signature and Authentication Schemes: Digital Signature-Digital Signature Schemes and their Variants- Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos -X.509 Directory Services	

UNIT IV E-MAIL AND IP SECURITY	**9**
E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management	

UNIT V WEB SECURITY	**9**
Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL Secure Communication- Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification	
Total Periods:	**45**

Text Book:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security, Course Technology, 7th Edition, 2021.
2. Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2020

References:

1. Harold F. Tipton, Micki Krause Nozaki, "Information Security Management Handbook, Volume6, 6th Edition, 2016.
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", McGraw- Hill, Seventh Edition, 2012.
3. Matt Bishop, "Computer Security Art and Science, Addison Wesley Reprint Edition, 2015
4. Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography And network security, 3rd Edition, McGraw-Hill Education, 2015.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1							1	1		1
CO2	2	1	1	1				1			1	1	2	1
CO3	3	2	2	1						1	1	1		2
CO4	3	2	2	1						1	1	1		2
CO5	2	1	1	1							1	1	2	2
CO6	3	2	2	1				1			1	1		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD63	BIG DATA FRAMEWORKS	L	T	P	C
		3	0	0	3

Programme:	B.Tech. Artificial Intelligence and Data Science	Sem:	6	Category:	PC

Prerequisite: 231AD41 - Data Analytics

Aim: To introduce the concepts and principle of Big Data

Course Outcomes: The students will be able to.

CO1:	Compare the types of Digital Data
CO2:	Apply CRUD operations on Data
CO3:	Summarize the design concepts of HDFS
CO4:	Make Use of Pig for Data Analytics
CO5:	Develop and Test Pig Latin Scripts
CO6:	Interpret Hive for Data Manipulation

UNIT I: INTRODUCTION TO BIG DATA — **9**

Introduction - Types of Digital Data - Characteristics of Big Data - 3Vs of Big Data - Evolution of Big Data - Architecture of Big Data systems - Advantages of Big Data - Challenges with Big Data - Big Data Use Cases -Analytics - Descriptive Analytics - Diagnostic Analytics - Predictive Analytics - Prescriptive Analytics.

UNIT II : BIG DATA PATTERNS & NOSQL — **9**

No SQL databases: Mongo DB: Introduction – Features – Data types – Mongo DB Query language – CRUD operations – Arrays – Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cursors – Indexes – Mongo Import – Mongo Export. Cassandra: Introduction – Features – Data types – CQLSH – Key spaces – CRUD operations – Collections – Counter – TTL – Alter commands – Import and Export – Querying System tables.

UNIT III : BIG DATA STORAGE AND ANALYSIS — **9**

Design of HDFS- HDFS Concepts - Command Line Interface - Hadoop file system Interfaces-Data flow-Hadoop I/O: Compression, Serialization, Avro-File- Based Data structure, Map reduce Model with example –Hadoop YARN-Hadoop Schedulers.

UNIT IV : DATA ANALYTICS USING PIG — **9**

Introduction - Installation and Execution - Pig Data Model - Pig Latin - Input, Output Relational Operators - User Defined Functions - Join Implementations - Integrating Pig with Legacy Code and Map Reduce - Developing and Testing Pig Latin Scripts

UNIT V : DATA ANALYTICS USING HIVE — **9**

Introduction - Data Types and File Formats - Databases in Hive – HiveQL - Data Definition - Data Manipulation - Queries - Views - Indexes - Schema Design

Total Periods: 45

Text Books:

1. **"Big Data: Principles and Paradigms"** by Rajendra Akerkar, 2014
2. **"MongoDB: The Definitive Guide"** by Kristina Chodorow and Michael Dirolf, 2021 (3rd Edition)
3. Alan Gates and Daniel Dai, Pig: Data flow Scripting with Hadoop, O'Reilly Media, 2016
4. Jason Rutherglen, Dean Wampler and Edward Capriolo, Programming Hive, 1 st Edition, O'Reilly Media, 2012

Reference s:

1.Seema Acharya, SubhashiniChellappan, "Big Data and Analytics", Wiley Publications, First Edition, 2015

2.E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012

3.Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010

4.https://archive.nptel.ac.in/courses/106/104/106104189/

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2		1							1	2		1
CO2	3		2									2	1	
CO3	3				2					1	1		2	1
CO4	3	1	2							1		3	2	
CO5		2	1										2	
CO6	3		2		2						1	3		1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD67	BIG DATA FRAMEWORKS LABORATORY				L	T	P	C
					0	0	3	1.5
Programme:	B.Tech. Artificial Intelligence and Data Science	**Sem:**	**6**	**Category:**	**PC**			
Prerequisites:	**231AD34 – Data Exploration and Visualization**							

Aim:	To study and implement MapReduce Program, Pig, Hive
Course Outcomes: The students will be able to	
CO1:	Demonstrate Hadoop implementation of File Management.
CO2:	Construct a Map reduce program to understand MapReduce Paradigm.
CO3:	Apply Hadoop MapReduce for Matrix Multiplication.
CO4:	Develop Pig Latin Scripts to Sort, Group etc.
CO5:	Interpret with importing and exporting data from database
CO6:	Implement Hive to Practice examples.

LIST OF EXPERIMENTS:

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration Files
2. Hadoop Implementation of file Management tasks, such as adding files and directories, retrieving files and Deleting Files.
3. Implement of Matrix Multiplication using Hadoop Map reduce.
4. Run a Basic word count Map reduce program to understand Map reduce paradigm
5. Installation of Hive Along with Practice examples.
6. Installation of Pig on Hadoop
7. Development of pig Latin scripts to sort, group, join, project and filter data
8. Practice importing and exporting data form various database.

Total Periods:	**45**

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2			2		1					3	2	
CO2	3			2								3		2
CO3	3	2				1							2	
CO4	3											3	3	2
CO5	3				2		2						2	
CO6	3		2			1						3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD68	DEEP LEARNING TECHNIQUES LABORATORY	L	T	P	C
		0	0	3	1.5

Programme:	B.Tech. Artificial Intelligence and Data Science	Sem:	6	Category:	PC
Pre-/Co-requisite:	231 AD57 - Machine Learning Laboratory				

Aim:	To understand the tools and techniques to implement deep neural networks.
Course Outcomes: The students will be able to	
CO1:	Apply deep neural network for simple problems
CO2:	Outline the Convolution Neural Network for image processing
CO3:	Construct Recurrent Neural Network and its variants for text analysis
CO4:	Demonstrate generative models for data augmentation
CO5:	Develop real-world solutions using suitable deep neural networks
CO6:	Summarize the machine translation methods.

LIST OF EXPERIMENTS

1.	Solving XOR problem using DNN
2.	Character recognition using CNN
3.	Face recognition using CNN
4.	Language modeling using RNN
5.	Sentiment analysis using LSTM
6.	Parts of speech tagging using Sequence to Sequence architecture
7.	Machine Translation using Encoder-Decoder model
8.	Image augmentation using GANs
9.	Mini-project on real world applications

Total Periods:	45

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	1					1		3	2
CO2	3	3	2	2	2	2						2	2	2
CO3	2	2	2	2	2	2				1	1		3	2
CO4	3	3	2	2	2	2				1		2	2	2
CO5	3	3	2	2	2	2						2	2	2
CO6	3	3	2	2	2	2					1	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD69	Mini Project				L	T	P	C
					0	0	2	1
Programme:	B.Tech. Artificial Intelligence and Data Science	**Sem:**	**6**	**Category:**			**EEC**	
Pre-/Co-requisite:								
Aim:	To develop students' knowledge for solving technical problems through structured project research study in order to produce competent and sound engineers							
Course Outcomes: The Students will be able to								
CO1:	Relate the programming language concepts and basics of Software Development Life Cycle model for the implementation of the project.							
CO2:	Practice acquired knowledge within the chosen area of technology for project development							
CO3:	Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.							
CO4:	Develop solution using appropriate methodology for challenging real world problems							
CO5:	Motivate on getting a project done within a stipulated period of time.							
CO6:	Communicate and report effectively project related activities and findings							

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2			2	3	2	3	2	2	2	3
CO2	3	3	2	2				3	2	3	2	3	2	2
CO3	3	3	3	3	3	3		3	3	3	3	3	3	3
CO4	2	2	2	2		3		3	2	3	3	2	2	2
CO5	2	2	2	2		3		2	2	3	2	3	2	2
CO6	2	2	3	3	3	2		3	3	3	3	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD71	AI BASED DIAGNOSTICS TOOLS	L	T	P	C
		3	0	2	4

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:	7	Category:	PC
Prerequisite:	Artificial Intelligence & Machine Learning				

Aim:	To equip students with the knowledge and skills to design, develop, and evaluate AI-driven diagnostic tools for healthcare applications, emphasizing data handling, model building, and ethical deployment.

Course Outcomes: The students will be able to

CO1:	Understand the role and challenges of AI in medical diagnostics and healthcare systems.
CO2:	Infer skills to preprocess and manage various types of medical data, including images and bio signals.
CO3:	Apply machine learning and deep learning algorithms to develop diagnostic models.
CO4:	Implement advanced AI techniques such as image segmentation and explainable AI in medical diagnostics.
CO5:	Demonstrate the performance and reliability of AI diagnostic tools using appropriate metrics.
CO6:	Identify regulatory, and deployment considerations in the development of AI-based diagnostic systems.

UNIT I: Introduction to AI in Medical Diagnostics — 9

Role of AI in healthcare diagnostics-Overview of diagnostic systems and clinical decision support-Types of medical data: images, signals, Electronic Health Records -Challenges: data quality, interpretability, ethics, privacy

UNIT II: Medical Data Acquisition and Preprocessing — 9

Data sources: Imaging modalities -X-ray, MRI, CT, biosignals, text-Data annotation and labeling techniques -Data preprocessing: normalization, augmentation, noise reduction -Handling imbalanced and missing data.

UNIT III: Machine Learning Techniques for Diagnostics — 9

Supervised learning algorithms: decision trees, SVM, k-NN, ensemble methods-Deep learning basics: CNNs for image analysis, RNNs for sequential data-Transfer learning and fine-tuning for medical datasets-Model evaluation: sensitivity, specificity, ROC, AUC

UNIT IV: Advanced AI Techniques and Applications — 9

Image segmentation and object detection -U-Net, YOLO-Explainable AI in diagnostics -AI for wearable sensor data and IoT health monitoring -Federated learning and privacy-preserving AI

UNIT V: Deployment, Ethics, and Future Trends — 9

Integration of AI diagnostic tools in clinical workflows -Regulatory considerations -FDA, CE and validation protocols -Ethical issues: bias, accountability, transparency -Emerging trends: multimodal AI, generative models, personalized diagnostics

Total Periods: 45

LIST OF EXPERIMENTS

1. Preprocessing and exploratory data analysis on diagnostic datasets
2. Training and evaluating ML models for classification tasks
3. Building CNN models for image-based diagnostics
4. Hands-on with data annotation and labeling tools
5. Model explainability exercises using SHAP, LIME, or Grad-CAM
6. Mini projects simulating real-world diagnostic challenges

Total Periods: 30

Text Book:

1. "Deep Learning for Medical Image Analysis" S. Kevin Zhou, Hayit Greenspan, Dinggang Shen,2023

2. "Artificial Intelligence in Healthcare", Adam Bohr, Kaveh Memarzadeh,2020 **3. "Medical Image Analysis",** Atam P. Dhawan,2011
References:
1. "Pattern Recognition and Machine Learning", Christopher M. Bishop,2009 **2. "Explainable AI in Healthcare"** Lei Xing, Jiawei Han

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	1	1					1		3	2
CO2	3	2	1	1	1	1						2	3	3
CO3	3	2	2	2	1	1					1		3	2
CO4	3	3	2	2	1	1						2	3	3
CO5	3	3	2	2	1	1						2	3	3
CO6	3	3	2	2	2	1					1	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD72	LINGUISTICS AND LANGUAGE THEORY	L	T	P	C
		3	0	2	4

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:	7	Category:	PC
Prerequisite:	Artificial Intelligence & Machine Learning				

Aim:	To develop students' understanding of the structure and function of human language through linguistic theory and analysis.

Course Outcomes: The Students will be able to

CO1:	Infer the core components of language, phonetics, phonology,morphology, syntax, semantics, and pragmatics.
CO2:	Analyze speech sounds using phonetic transcription and apply phonological rules to different language data.
CO3:	Identify morphemes and apply morphological rules to form and analyze words.
CO4:	Interpret syntactic structures using phrase structure and dependency grammar.
CO5:	Apply semantic and pragmatic principles to understand meaning in language use.
CO6:	Develop linguistic data and use basic tools for linguistic research.

UNIT I: Introduction to Linguistics and Language — 9

Nature and origin of language- Characteristics of human language- Linguistic competence vs performance- Levels of linguistic analysis: phonetics, phonology, morphology, syntax, semantics, pragmatics -Overview of linguistic typology and language families.

UNIT II: Phonetics and Phonology — 9

Articulatory phonetics: vowels, consonants, IPA -Acoustic and auditory phonetics -Phonemes, allophones, minimal pairs -Phonological rules and representations -Suprasegmentals: stress, tone, intonation.

UNIT III: Morphology — 9

Morphemes: free vs bound, root, stem, affix -Inflectional vs derivational morphology -Word formation processes: compounding, blending, clipping -Morphological typology: analytic, agglutinative, fusional, polysynthetic languages -Morphological analysis and parsing.

UNIT IV: Syntax and Grammatical Theories — 9

Phrase structure rules and syntactic categories -Constituency tests and tree diagrams -Transformational-generative grammar -Dependency grammar and word order typology-Universal Grammar and cross-linguistic structures.

UNIT V: Semantics and Pragmatics — 9

Lexical semantics: sense, reference, synonymy, antonymy -Compositional semantics: truth conditions, scope -Pragmatics: deixis, implicature, presupposition, speech acts -Discourse analysis and conversation structure -Semantic change and metaphor

Total Periods: 45

LIST OF EXPERIMENTS:

1: Phonetic Transcription Using IPA (Transcribe English and non-English words phonetically using the International Phonetic Alphabet (IPA))
2: Phonological Rule Identification (Analyze sound patterns in a language to identify phonological rules (e.g., assimilation, deletion).)
3: Morphological Segmentation (Break down complex words into morphemes and classify them (prefix, root, suffix).
4: Syntax Tree Construction (Create phrase structure trees for simple and complex English sentences)
5: Semantic Role Labeling (Identify semantic roles (agent, theme, experiencer, etc.) in given sentences.)
6: Speech Act and Pragmatic Analysis (Analyze a short dialogue and classify utterances as assertives, directives, commissives, etc.)

Total Periods: 30

Text Book:	
1. **"Beginning Syntax: An Introduction to Syntactic Analysis"**, Ian Roberts, **2023**. 2. **"Essentials of Linguistics", 2nd Edition,** Catherine Anderson, Bronwyn Bjorkman, Derek Denis, **2022**.	
References:	
1. "**Morphology: A Distributed Morphology Introduction** "Jeffrey P. Punske, **2023**. 2. "**Meaning: Semantics, Pragmatics, Cognition** ", Betty J. Birner, **2023**. 3. **"Semantics**", John I. Saeed, **5th Edition, 2023**	

Cos	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	1	1					1		3	2
CO2	3	3	2	2	1	1						2	2	3
CO3	3	2	2	1	1	1					1		2	2
CO4	3	3	2	2	1	1						2	3	3
CO5	3	3	2	2	1	1						2	3	3
CO6	3	3	2	2	1	1					1	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD70	INTERNSHIP / FIELD PROJECT		L	T	P	C
			0	0	1	1
Programme:	B. Tech – Artificial Intelligence and Data Science	**Sem:**	7	**Category:**		EEC

Aim: To expose students to use the AI and Data Science Algorithms with the industrial environment and enhance the Employability skills.

Course Outcomes:

CO1: Develop professional skills and ethics based on industrial problems and effectively plan to execute the work within a definite time frame and present a report.
CO2: Design efficient technical solutions to industrial problems
CO3: Find a solution related to project and finance management.
CO4: Identify the possible approach for the solution and fix the methodology to be used.
CO5: Compare the results with alternate study.
CO6: Outline scope of the project work and conclusion.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	2				2	2	3	3
CO2	2	2	2	1	1	1	1				1	2	1	1
CO3	2	2	1	1	1	1	1				1	1	2	1
CO4	3	3	2	2	2	2	2				2	2	3	3
CO5	3	2	2	2	2	2	2				2	1	3	2
CO6	3	2	2	2	2	2	2				2	1	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD79	PROJECT-I				L	T	P	C
					0	0	4	1
Programme:	B.Tech.AI&DS	**Sem:**	**7**	**Category:**			**EEC**	
Pre-/Co-requisite:								
Aim:	To develop students' knowledge for solving technical problems through structured project research study in order to produce competent and sound engineers.							
Course Outcomes: The Students will be able to								
CO1:	Identify and formulate research problem statements with surveying variety of domains							
CO2:	Analyze and collect meaningful information using relevant tools for the problems.							
CO3:	Develop and propose an optimized solution among the existing solutions for the problems.							
CO4:	Work with team mates, implement and execute the problem solutions in ethically manner.							
CO5:	Write effective technical report and demonstrate through presentation.							
CO6:	Apply the basic entrepreneurship skills in project management.							

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2			2			3	2	2	2	3
CO2	3	3	2	2						3	2	3	2	2
CO3	3	3	3	3	3	2				3	3	3	3	3
CO4	3	2	2	2		2				3	3	2	2	2
CO5	3	2	2	2						3	2	3	2	2
CO6	3	3	3	3	3	2				3	3	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231AD89	PROJECT-II				L	T	P	C
					0	0	16	8
Programme:	B.Tech. Artificial Intelligence and Data Science	**Sem:**	**8**	**Category:**			**EEC**	
Pre-/Co-requisite:								
Aim:	To develop students' knowledge for solving technical problems through structured project research study in order to produce competent and sound engineers.							
Course Outcomes: The Students will be able to								
CO1:	Identify and describe the problem and scope of project clearly							
CO2:	Develop a proper methodology in problem solving							
CO3:	Demonstrate a strong working knowledge of ethics and professional responsibility.							
CO4:	Apply new technologies and design techniques concerned for devising a solution for a given problem statement.							
CO5:	Write effective technical report and demonstrate through presentation.							
CO6:	Apply the basic entrepreneurship skills in project management.							

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2			2			2	2	2	2	3
CO2	3	3	2	2						2	2	3	2	2
CO3	3	3	3	3	2	2				3	3	3	3	3
CO4	3	2	2	2		1				3	3	2	2	3
CO5	3	2	2	2		2				3	2	3	2	3
CO6	3	2	1	1	1	1				3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV51	PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD51-Machine Learning				

Aim:	To equip students with the theoretical knowledge and practical skills required to design, analyze, and implement pattern recognition systems for diverse real-world applications.

Course Outcomes: The students will be able to

CO1:	Understand fundamental concepts and types of pattern recognition systems.
CO2:	Use Bayesian decision theory and statistical methods for classification problems.
CO3:	Infer feature extraction and dimensionality reduction techniques like PCA and LDA.
CO4:	Implement clustering algorithms for unsupervised learning.
CO5:	Apply neural networks, SVMs, and HMMs for pattern recognition tasks.
CO6:	Construct pattern recognition techniques to real-world problems in image, speech, biometrics.

UNIT I: Introduction to Pattern Recognition	**9**
Overview and applications of pattern recognition- supervised, unsupervised, and reinforcement learning-Pattern classes, features, and decision regions, Basics of Bayesian decision theory.	
UNIT II: Statistical Pattern Recognition	**9**
Probability density functions and parameter estimation-Maximum likelihood and Bayesian parameter estimation, Discriminant functions and classifiers- Performance evaluation: error rates, ROC curves.	
UNIT III: Feature Extraction and Dimensionality Reduction	**9**
Feature selection and transformation methods-Principal Component Analysis , Linear Discriminant Analysis, Nonlinear methods- Kernel PCA, manifold learning.	
UNIT IV: Unsupervised Learning and Clustering	**9**
Clustering concepts and algorithms: k-means, hierarchical, DBSCAN-Gaussian Mixture Models and EM algorithm- Self-Organizing Maps, Evaluation of clustering	
UNIT V: Advanced Topics and Applications	**9**
Neural networks and deep learning for pattern recognition-Support Vector Machines -Hidden Markov Models -Applications in image, speech, and biometric recognition.	
Total Periods:	**45**

Text Book:

1. **An Introduction to Pattern Recognition and Machine Learning — Paul Fieguth (Springer, 2022)**
2. **Probabilistic Machine Learning: An Introduction** — Kevin P. Murphy (MIT Press, 2022)

References:

1. **Sergios Theodoridis and Konstantinos Koutroumbas**, *Pattern Recognition*, 4th Edition, Academic Press, 2009.
2. **Richard O. Duda, Peter E. Hart, and David G. Stork**, *Pattern Classification*, 2nd Edition, Wiley, 2000.
3. **Anil K. Jain, Robert P.W. Duin, and Jianchang Mao**, "Statistical Pattern Recognition: A Review," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2000.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1								1	1	2	3
CO2	3	2	2										2	
CO3	3	3	2								1	1	1	3
CO4	3	2	1										2	
CO5	3	2	2	1							1		2	3
CO6	3	2		1								1	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV52	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Artificial Intelligence & Machine Learning				

Aim:	To study the skills to analyze and process human language in both text and speech using modern AI techniques.

Course Outcomes: The students will be able to

CO1:	Understand the fundamentals of Natural Language Processing, including text preprocessing and linguistic structures.
CO2:	Apply traditional and modern text representation techniques for classification and summarization tasks.
CO3:	Develop and evaluate question answering systems and conversational agents using NLP techniques.
CO4:	Outline the architecture and working of classical and neural Text-to-Speech systems.
CO5:	Analyze speech signals and implement core techniques in Automatic Speech Recognition.
CO6:	Integrate text and speech analysis methods to build real-world AI applications such as chatbots, virtual assistants, and voice interfaces.

UNIT I: FUNDAMENTALS OF TEXT ANALYSIS	**9**
Introduction to NLP and its applications-Linguistic basics: syntax, semantics, morphology, pragmatics - Text preprocessing- tokenization, stopword removal, stemming, lemmatization, Feature extraction: N-grams, POS tagging, Named Entity Recognition -Text representation: BoW, TF-IDF, BM25	
UNIT II: MODERN TEXT REPRESENTATION & CLASSIFICATION	**9**
Word embeddings: Word2Vec, GloVe, FastText-Contextual models: BERT, ELMo- Sentence and document embeddings-Machine learning models: Naive Bayes, SVM, Logistic Regression- Deep learning for text classification - Text summarization techniques	
UNIT III: QUESTION ANSWERING & CONVERSATIONAL AI	**9**
Information retrieval and knowledge-based QA- Language models for QA BERT, GPT - Classic QA systems and modern pipelines - Chatbots and dialogue system design - Evaluation of QA and dialogue systems.	
UNIT IV: TEXT-TO-SPEECH SYSTEMS	**9**
Overview of TTS and its components-Text normalization and Grapheme-to-Phoneme conversion - Classical TTS methods: concatenative, parametric-Neural TTS: Tacotron, FastSpeech -Vocoders: WaveNet, HiFi-GAN, WaveGlow -Applications: assistive tech, virtual assistants, dubbing	
UNIT V: AUTOMATIC SPEECH RECOGNITION	**9**
Introduction to ASR and its challenges- Speech processing: sampling, framing, windowing -Feature extraction: MFCC, Mel spectrogram, PLP -Traditional ASR: HMM, GMM-HMM- Deep learning in ASR: LSTM, CNN, TDNN- End-to-End ASR: DeepSpeech, RNN-T, Conformer	
Total Periods:	**45**

Text Book:

1. **Daniel Jurafsky & James H. Martin**, *Speech and Language Processing*, 3rd Edition (Draft), Prentice Hall, 2023.

References:

1. **Yoav Goldberg**, *Neural Network Methods for Natural Language Processing*, Morgan & Claypool, 2017.
2. **Ben Gold and Nelson Morgan**, *Speech and Audio Signal Processing*, Wiley, 2011.
3. **Steven Bird, Ewan Klein, and Edward Loper**, *Natural Language Processing with Python*, O'Reilly Media, 2009.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1									1	2	3
CO2	2	2	1	1									2	
CO3	3	2	2	2	1						1	1	1	3
CO4	3	2	1								1			
CO5	3	3	2	1									2	3
CO6	3	2									1		2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV53	PROMPT ENGINEERING	L	T	P	C
		3	0	0	3

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD31-Artificial Intelligence				

Aim:	To equip students with the skills and knowledge to design, optimize, and deploy effective prompts for large language models, enabling enhanced AI-driven applications.

Course Outcomes: The Students will be able to

CO1:	Recall the fundamentals and significance of prompt engineering in generative AI and large language models.
CO2:	Demonstrate the ability to design effective prompts using various patterns such as zero-shot, one-shot, and few-shot techniques.
CO3:	Illustrate advanced prompting methods including Chain-of-Thought and Tree-of-Thought approaches for improved model responses..
CO4:	Outline the effectiveness of prompts using appropriate metrics and optimize them through iterative refinement
CO5:	Utilize popular tools and platforms to develop, test, and deploy prompt-based applications across different AI modalities.
CO6:	Apply the fundamentals and significance of prompt engineering in generative AI and large language models.

UNIT I: INTRODUCTION	**9**
Overview of Prompt Engineering-Importance in Generative AI and Large Language Models (LLMs)-History and evolution of prompt-based interaction- Types of prompts: Text, code, multi-modal inputs-Use cases and applications	
UNIT II: BASICS OF PROMPT DESIGN	**9**
Structure and components of effective prompts-Principles of prompt clarity, specificity, and context-Common prompt patterns: Zero-shot, one-shot, few-shot learning-Role of context and instructions in prompt quality- Limitations and challenges in prompt design.	
UNIT III: ADVANCED PROMPTING TECHNIQUES	**9**
Chain-of-Thought prompting-Tree-of-Thought prompting- Iterative prompting and refinement-Prompt tuning and template design-Prompt ensembling and prompt chaining	
UNIT IV: EVALUATION AND OPTIMIZATION	**9**
Metrics for prompt effectiveness -accuracy, coherence, relevance-Testing and debugging prompts-Human-in-the-loop feedback for prompt improvement-Automating prompt optimization with reinforcement learning-Ethical considerations in prompt engineering.	
UNIT V: TOOLS AND PLATFORMS FOR PROMPT ENGINEERING	**9**
Platforms supporting prompt design -OpenAI Playground, Hugging Face, AI21 Studio- Integrating prompts with APIs and frameworks-Prompt engineering for text, code, image, and audio generation-Case studies: Chatbots, code generation, content creation-Future trends and research directions.	
Total Periods:	**45**

Text Book:

1. Prompt Engineering for Generative AI,by James Phoenix, Mike Taylor, 2024.
2. "*ChatGPT Prompt Engineering for Developers*, DeepLearning.AI, Isa Fulford & Andrew Ng 2023.

References:

1. Natural Language Processing with Transformers: Building Language Applications with Huggi Face,Lewis Tunstall, Leandro von Werra, Thomas Wolf, 2022.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1		1					1	1	3	
CO2	3	3	2	1							1	2	3	
CO3	3	2	1	1							1	2	3	3
CO4	3	2	1	1							1	2	3	
CO5	3	3	2	2		1					1	1	3	3
CO6	3	2	1	1		1					1	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV54	MEDICAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD51-Machine Learning				

Aim:	To provide students with knowledge and skills to analyze, process, and interpret medical images using advanced techniques for improved healthcare diagnosis and treatment.

Course Outcomes: The students will be able to

CO1:	Understand the fundamentals of medical imaging modalities and image acquisition techniques.
CO2:	Recall preprocessing and enhancement techniques to improve medical image quality.
CO3:	Implement various image segmentation methods for extracting regions of interest.
CO4:	Analyze features from medical images for clinical interpretation.
CO5:	Apply image registration and visualization for multi-modal and 3D medical data.
CO6:	Demonstrate AI-driven solutions for medical image analysis while considering ethical and privacy issues.

UNIT I: INTRODUCTION TO MEDICAL IMAGE PROCESSING — **9**

Overview of medical imaging modalities -X-ray, CT, MRI, Ultrasound, PET- Digital image fundamentals and medical image formats - Image acquisition and reconstruction techniques - Image enhancement and preprocessing in medical images

UNIT II: IMAGE SEGMENTATION TECHNIQUES — **9**

Thresholding and region-based segmentation- Edge detection and active contours - Clustering methods for segmentation -k-means, fuzzy c-means -Segmentation using deep learning -U-Net, CNNs

UNIT III: FEATURE EXTRACTION AND REPRESENTATION — **9**

Texture analysis and morphological operations- Shape analysis and descriptors -Feature selection and dimensionality reduction -Representation of medical image features for diagnosis.

UNIT IV: MEDICAL IMAGE REGISTRATION AND VISUALIZATION — **9**

Concepts of image registration and alignment - Rigid and non-rigid registration techniques - Multi-modal image registration - 3D visualization and volume rendering techniques

UNIT V: APPLICATIONS AND ADVANCED TOPICS — **9**

Computer-aided diagnosis systems -Disease detection and classification using medical images -Recent trends: AI and deep learning in medical imaging -Ethical, legal, and privacy issues in medical image processing

Total Periods: 45

Text Book:

1. **Rangaraj M. Rangayyan**, *Biomedical Image Analysis*, CRC Press, 2022
2. **Rafael C. Gonzalez and Richard E. Woods**, *Digital Image Processing*, 4th Edition, Pearson, 2018.
3. **K. Sundeep Babu & R. Somanath, Medical Image Processing, McGraw Hill, 2021.J. Michael Fitzpatrick and Milan Sonka (Editors)**, *Handbook of Medical Imaging*, SPIE Press, 2000.

References:

1. **Dimitris Metaxas et al.**, *Medical Image Analysis*, Wiley, 2000.
2. **Paul Suetens**, *Fundamentals of Medical Imaging*, 2nd Edition, Cambridge University Press, 2009.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2									1	2	3
CO2	2	2	3										2	
CO3	2	3	3									1	1	3
CO4	2	2	2										2	
CO5	2	3	3										2	3
CO6	1	2	3									1	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV55	APPLIED GenAI SYSTEMS	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Artificial Intelligence & Machine Learning				

Aim:	To help students understand Generative AI concepts, tools, and platforms, and enable them to apply generative techniques responsibly in real-world situations.

Course Outcomes: The Students will be able to

CO1:	Understand the foundational concepts and generative models of AI
CO2:	Interpret real-world applications of Generative AI tools and models.
CO3:	Compare Generative AI platforms, pre-trained models
CO4:	Apply generative workflows to solve practical problems.
CO5:	Analyze the limitations, risks and ethical considerations associated with Generative AI systems
CO6:	Identify the future trends and Opportunities in GenAI

UNIT I FOUNDATIONS OF GENERATIVE AI	9
Introduction to Generative AI-Core Concepts and Capabilities-History and Evolution of Generative AI-Benefits and Opportunities-Key Challenges in Generative AI-Overview of Generative Models -GANs, VAEs, Diffusion Models, LLMs.	
UNIT II GENERATIVE AI APPLICATIONS AND TOOLS	**9**
Applications across Domains: Text, Image, Audio, Video, and Code -Tools for Text Generation -LLMs, ChatGPT-like models-Tools for Image Generation -Stable Diffusion, Midjourney, DALL·E-Tools for Code Generation -Copilot, Code LLMs-Tools for Audio & Video Generation.	
UNIT III GENAI PLATFORMS AND PRE-TRAINED MODELS	**9**
Introduction to Generative AI Platforms-Features, Capabilities, and Architecture of GenAI Platforms-Cloud Platforms for GenAI: HuggingFace, OpenAI, Google, AWS, Meta Models-Pre-trained Models: Structure and Functionality-Platform-Specific Challenges and Limitations.	
UNIT IV GENERATIVE WORKFLOWS AND TECHNIQUES	**9**
Text-to-Text Generation Techniques-Text-to-Image Generation: Prompting & Workflows-Text-to-Code Generation Workflows-Working with Multimodal Generation	
UNIT V LIMITATIONS, ETHICS & FUTURE OF GENAI	**9**
Technical Limitations of Generative AI-Issues: Bias, Hallucination, Data Privacy, Copyright, Misinformation-Responsible and Ethical Generative AI-Socio-Economic Implications of GenAI-Regulatory and Policy Considerations-Future Trends and Professional Opportunities in GenAI	
Total Periods:	**45**

Text Book:

1.**"Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play"** *David Foster, O'Reilly Media, 2nd Edition, 2023.*

2. **"Deep Learning with Python"***François Chollet, Manning Publications, 2nd Edition, 2021.*

References:

1.**"Hands-On Generative AI with Python: Train, Fine-Tune, and Deploy State-of-the-Art Models"** *Rishal Hurbans, Packt Publishing, 2024.*

2.**"Transformers for Natural Language Processing"***Denis Rothman, Packt Publishing, 2nd Edition, 2022.*

3. **"Machine Learning: A Probabilistic Perspective"***Kevin P. Murphy, MIT Press, 2012.*

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1				1				1	3	3	2
CO2	3	2	2	1			1				1		3	1
CO3	3	2	1				1				1		3	1
CO4	3	2	1	1			1				1		3	3
CO5	3	3	2	1			1				1	1	3	1
CO6	3	2	1	1			1				1	2	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV56	RECOMMENDER SYSTEM	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD51-Machine Learning				

Aim:	To design, develop, and evaluate recommender systems that deliver personalized and ethical recommendations across various applications.

Course Outcomes: The students will be able to

CO1:	Understand the basic concepts and types of recommender systems.
CO2:	Summarize content-based filtering techniques for personalized recommendations.
CO3:	Apply collaborative filtering methods, including matrix factorization, for effective recommendation.
CO4:	Develop hybrid recommender systems combining multiple approaches to improve performance.
CO5:	Interpret recommender systems with appropriate metrics and address challenges
CO6:	Analyze ethical considerations such as privacy, bias, and fairness in recommendation systems.

UNIT I: INTRODUCTION TO RECOMMENDER SYSTEMS	**9**
Overview and importance of recommender systems - Types of recommendation: content-based, collaborative filtering, hybrid methods - Evaluation metrics: precision, recall, F1-score, RMSE, MAE	
UNIT II: CONTENT-BASED FILTERING	**9**
Feature representation and user profiling-Similarity measures: cosine similarity, Pearson correlation - Building content-based recommenders -Advantages and limitations	
UNIT III: COLLABORATIVE FILTERING	**9**
User-based and item-based collaborative filtering -Matrix factorization techniques -SVD, PCA - Neighborhood models and latent factor models -Scalability and sparsity challenges	
UNIT IV: HYBRID RECOMMENDER SYSTEMS AND ADVANCED METHODS	**9**
Hybrid recommendation techniques -Context-aware and session-based recommendation -Deep learning approaches for recommender systems -Incorporating side information and knowledge graphs	
UNIT V: EVALUATION AND APPLICATIONS	**9**
Offline and online evaluation techniques -Cold-start problem and solutions -Real-world applications: e-commerce, streaming services, social media -Ethical issues: privacy, bias, and fairness	
Total Periods:	**45**

Text Book:

1. **Francesco Ricci, Lior Rokach, and Bracha Shapira**, *Recommender Systems Handbook*, 3rd Edition, Springer, 2022.
2. **Charu C. Aggarwal**, *Recommender Systems: The Textbook*, Springer, 2016.

References:

1. **Jannach, Dietmar, et al.**, *Recommender Systems: An Introduction*, Cambridge University Press, 2011.
2. **Bobadilla, Jesús, et al.**, "Recommender Systems Survey," *Knowledge-Based Systems*, 2013.

Cos	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1							1	1	2	3
CO2	3	2	1								1		2	
CO3	3	3	2	2							1	1	1	3
CO4	3	2	2	1							1		2	
CO5	3	2	1								1		2	3
CO6	3	2	1	1							1	1	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV57	ETHICS AND AI	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD31-Artificial Intelligence				

Aim:	To equip students with the understanding and skills to identify, analyze, and address ethical issues in AI development and deployment, fostering responsible and fair AI practices

Course Outcomes: The students will be able to

CO1:	Understand fundamental ethical theories and their relevance to AI technologies.
CO2:	Identify ethical challenges such as bias, fairness, and privacy in AI systems.
CO3:	Infer legal and regulatory frameworks governing AI development and deployment.
CO4:	Apply principles of responsible AI design, including explainability and transparency.
CO5:	Outline the societal impacts of AI, including effects on employment and autonomous systems.
CO6:	Develop ethical practices and governance in AI research and applications.

UNIT I: INTRODUCTION TO ETHICS AND AI	**9**
Basics of ethics and moral philosophy - Overview of AI technologies and their societal impact - Importance of ethics in AI development and deployment.	
UNIT II: ETHICAL CHALLENGES IN AI	**9**
Bias, fairness, and discrimination in AI systems - Privacy and data protection concerns - Transparency and accountability in AI algorithms	
UNIT III: LEGAL AND REGULATORY FRAMEWORKS	**9**
AI-related laws and regulations globally - Intellectual property and AI-generated content - Compliance and governance in AI systems	
UNIT IV: RESPONSIBLE AI DESIGN AND IMPLEMENTATION	**9**
Principles of responsible AI development - Explainability and interpretability - Human-AI collaboration and decision-making.	
UNIT V: SOCIETAL IMPACT AND FUTURE DIRECTIONS	**9**
AI and employment, automation effects - Ethical considerations in autonomous systems : self-driving cars, drones- Emerging trends and the future of ethical AI	
Total Periods:	**45**

Text Book:

1. ***"AI Ethics: A Textbook "*,** *Paula Boddington* Springer, 2023
2. ***"Ethics in Artificial Intelligence: Bias, Fairness and Beyond"*,** Animesh Mukherjee, Juhi Kulshrestha, Abhijnan Chakraborty & Srijan Kumar -Springer, 2023

References:

1.Virginia Dignum, *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*, Springer, 2019.

2.Jobin, Anna, Marcello Ienca, and Effy Vayena, "The global landscape of AI ethics guidelines," *Nature Machine Intelligence*, 2019.

Cos	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1			1				1	1	2	3
CO2	3	2	1	1			1				1		2	2
CO3	3	3	2				1				1	1	1	3
CO4	3	2	2	1			1				1		1	2
CO5	3	3	2	1			1				1		1	3
CO6	3	2	2	1			1				1	1	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV58	PRIVACY AND SECURITY IN AI	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD31-Artificial Intelligence				

Aim:	To equip students with the knowledge and skills to identify, analyze, and mitigate privacy and security risks in AI systems, ensuring ethical and secure AI deployment.

Course Outcomes: The Students will be able to

CO1:	Understand key privacy and security concepts relevant to AI systems.
CO2:	Identify privacy risks and challenges associated with AI data handling and processing.
CO3:	Apply various security threats and adversarial attacks targeting AI models.
CO4:	Interpret privacy-preserving techniques such as differential privacy and federated learning.
CO5:	Analyze security measures to safeguard AI models and ensure robust deployment.
CO6:	Summarize legal, ethical, and regulatory aspects related to privacy and security in AI.

UNIT I: INTRODUCTION TO PRIVACY AND SECURITY IN AI	**9**
Overview of AI systems and their privacy/security concerns - Key concepts: data privacy, confidentiality, integrity, and availability - Threat landscape in AI applications	
UNIT II: PRIVACY CHALLENGES IN AI	**9**
Data collection, storage, and sharing issues -Privacy risks: data leaks, re-identification, and surveillance - Differential privacy and anonymization techniques.	
UNIT III: SECURITY THREATS IN AI SYSTEMS	**9**
Adversarial attacks on AI models :evasion, poisoning, model extraction-Robustness and defense mechanisms -Secure AI model deployment and monitoring	
UNIT IV: TECHNIQUES FOR PRIVACY PRESERVATION AND SECURITY	**9**
Federated learning and secure multi-party computation - Encryption methods and homomorphic encryption -Blockchain for secure AI data management	
UNIT V: LEGAL, ETHICAL, AND PRACTICAL CONSIDERATIONS	**9**
Regulatory frameworks -GDPR, HIPAA and compliance - Ethical implications of privacy and security in AI - Best practices and future trends in AI privacy and security	
Total Periods:	**45**

Text Book:

1. **Nirvana Meratnia, et al.**, *Privacy and Security in Artificial Intelligence and Machine Learning*, Springer, 2022.
2. **Kevin R. B. Butler**, *Security and Privacy in Artificial Intelligence Systems*, Wiley, 2021.
3. **Shai Halevi and Daniel Hsu**, *Differential Privacy: Theory and Practice*, CRC Press, 2020.

References:

1. **Cynthia Dwork and Aaron Roth**, *The Algorithmic Foundations of Differential Privacy*, 2014.
2. **Ian Goodfellow, Yoshua Bengio, and Aaron Courville**, *Deep Learning*, MIT Press, 2016.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1							1	1	2	3
CO2	3	2	2	1							1		1	
CO3	3	3	2	2	1						1	1	1	3
CO4	3	2	2	1							1			2
CO5	3	3	2	1	1						1			3
CO6	3	2	1								1	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV61	DATA SCIENCE USING R	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD51- Machine Learning				

Aim:	To equip students with the skills to analyze, visualize, and model data effectively using R programming for solving real-world problems.

Course Outcomes: The Students will be able to

CO1:	Understand the fundamentals of Data Science and perform basic R programming operations including data types, data structures, and file handling.
CO2:	Interpret data cleaning, manipulation, and visualization using popular R packages
CO3:	Develop, document, and test custom R packages using tools such as Roxygen2.
CO4:	Infer solutions for handling large-scale data using R with Hadoop and MapReduce frameworks.
CO5:	Apply R techniques for time series forecasting, text mining, and building interactive dashboards with Shiny.
CO6:	Design an end-to-end data science project using real-world data and R-based tools

UNIT I: INTRODUCTION TO DATA SCIENCE AND R PROGRAMMING	**9**
Overview of Data Science and its applications- Introduction to R: Environment, IDE- RStudio- Basic R programming: data types, variables, operators-Data structures in R: vectors, lists, matrices, data frames -Reading and writing data	
UNIT II: DATA MANIPULATION AND VISUALIZATION	**9**
Data cleaning and transformation using dplyr and tidyr -Handling missing data and outliers -Data aggregation and summarization -Visualization using ggplot2: scatter plots, histograms, bar charts, box plots -Customizing plots and themes	
UNIT III: BUILDING AND TESTING R PACKAGE	**9**
Building an R Package- Creating an R Package- Roxygen- Adding Data to Your Package- Testing and Package Checking.	
UNIT IV: BIG DATA IN R	**9**
Handling Big Data in R- Hadoop and R – New frameworks- Map reduce with R- Organizing Data Sources	
UNIT V: ADVANCED TOPICS IN R	**9**
Time series analysis and forecasting basics- Text mining and sentiment analysis in R- Introduction to R Shiny for interactive dashboards -Working with APIs and real-world datasets -Final project: end-to-end data science workflow	
Total Periods:	**45**

Text Book:

1. **R for Data Science, 2nd Ed., 2023 – Wickham**
2. **Big Data Analytics with R and Hadoop, 2022,BPB**
3. **"Text Mining with R",** 2nd Ed., 2022 ,Silge & Robinson

References:

1. **Advanced R** *Hadley Wickham* **Publisher:** Chapman and Hall, 2019 (2nd Edition)
2. **Data Science from Scratch: First Principles with Python** *Joel Grus*, O'Reilly Media, 2019
3. **"The Art of R Programming: A Tour of Statistical Software Design"** *Norman Matloff,* 2011

Cos	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1						1	1	1	3
CO2	3	2	1	1							1		1	3
CO3	3	3	2	1								1		3
CO4	2	2	1								1		2	3
CO5	3	3	2	1	1						1		2	3
CO6	3	2	2	1	1						1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV62	COMPUTATIONAL SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Computer Networks & Machine Learning				

Aim:	To analyze, model, and interpret social networks, enabling them to solve real-world problems using network theory and computational tools.

Course Outcomes: The students will be able to

CO1:	Understand fundamental concepts and terminology of social networks and graph theory.
CO2:	Interpret key network metrics and centrality measures.
CO3:	Summarize social networks visualization using popular tools and software.
CO4:	Identify different network models including random, small-world, and scale-free networks.
CO5:	Outline dynamic networks, influence propagation, and multilayer networks.
CO6:	Apply social network analysis techniques to real-world datasets and problems across various domains.

UNIT I: INTRODUCTION TO SOCIAL NETWORK ANALYSIS	**9**
Basics of social networks and graph theory-Types of networks: directed, undirected, weighted, bipartite-Key concepts: nodes, edges, degree, paths, components-Applications in real-world scenarios	
UNIT II: NETWORK METRICS AND CENTRALITY MEASURES	**9**
Degree centrality, closeness centrality, betweenness centrality -Eigenvector centrality and PageRank -Network density, clustering coefficient, and connectivity -Community detection basics	
UNIT III: NETWORK MODELS AND VISUALIZATION	**9**
Random graph models: Erdős-Rényi model -Small-world networks and scale-free networks -Barabási-Albert model -Visualization techniques and tools -Gephi, NetworkX -Practical network visualization and interpretation	
UNIT IV: ADVANCED TOPICS IN SOCIAL NETWORK ANALYSIS	**9**
Dynamic and temporal networks -Influence propagation and diffusion models -Social network sampling and data collection methods -Multiplex and multilayer networks	
UNIT V: APPLICATIONS AND CASE STUDIES	**9**
Social media analysis and opinion mining -Network analysis in marketing, epidemiology, and security -Using Python/R tools for SNA - NetworkX, igraph -Project work: analyzing a real-world social network dataset	
Total Periods:	**45**

Text Book:

1. "**Network Analysis: Integrating Social Network Theory, Method, and Application with R",** Craig M. Rawlings, Jeffrey A. Smith, James Moody & Daniel A. McFarland", Cambridge University Press (2023)

2. "**Social Network Computing",** Jiang Wu, Springer 2024

References:

1. **Ulrik Brandes & Thomas Erlebach (Editors)**, *Network Analysis: Methodological Foundations*, Springer, 2005.
2. **Linton C. Freeman**, *The Development of Social Network Analysis: A Study in the Sociology of Science*, Empirical Press, 2004.
3. **Wouter de Nooy, Andrej Mrvar, Vladimir Batagelj**, *Exploratory Social Network Analysis with Pajek*, Cambridge University Press, 2011.
4. **John Scott**, *Social Network Analysis*, 4th Edition, Sage Publications, 2017.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1							1	1	1	3
CO2	3	2	2	1	1						1	1	1	2
CO3	3	3	2	1	1						1		1	3
CO4	3	2	1	1							1	1	2	3
CO5	3	3	3	2	1	1					1		2	3
CO6	3	2	2	1	1						1	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV63	IMAGE AND VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Artificial Intelligence & Machine Learning				

Aim:	To equip students with the knowledge and skills to process, analyze, and interpret images and videos using traditional and modern AI techniques for practical applications.

Course Outcomes: The Students will be able to

CO1:	Understand fundamental concepts of digital images, videos, and their representations.
CO2:	Apply image processing techniques for enhancement, filtering, and segmentation.
CO3:	Analyze video data using motion detection, tracking, and background subtraction methods.
CO4:	Interpret machine learning and deep learning models for image and video classification and object detection.
CO5:	Infer facial recognition, video summarization, and 3D reconstruction.
CO6:	Develop real-time image and video analytics applications for various domains.

UNIT I: INTRODUCTION TO IMAGE AND VIDEO ANALYTICS	**9**
Basics of digital images and videos: pixels, color models, formats -Fundamentals of image processing: filtering, enhancement, transformations -Video fundamentals: frames, frame rates, compression -Applications of image and video analytics.	
UNIT II: IMAGE PROCESSING TECHNIQUES	**9**
Image filtering: smoothing, sharpening, edge detection -Morphological operations: dilation, erosion, opening, closing -Image segmentation: thresholding, clustering, region-based methods -Feature extraction: corners, blobs, contours	
UNIT III: VIDEO ANALYTICS AND MOTION ANALYSIS	**9**
Motion detection and tracking techniques -Optical flow estimation -Background subtraction methods -Activity and event recognition in videos	
UNIT IV: MACHINE LEARNING FOR IMAGE AND VIDEO ANALYSIS	**9**
Classical methods: SVM, k-NN for image classification -Introduction to deep learning: CNN architectures -LeNet, AlexNet, VGG -Object detection: R-CNN, YOLO, SSD -Video classification and captioning basics	
UNIT V: RECENT TRENDS AND APPLICATIONS	**9**
Facial recognition and biometrics -Image and video summarization- 3D reconstruction and depth estimation-Real-time analytics and applications in surveillance, healthcare, and entertainment	
Total Periods:	**45**

Text Book:

1. **"Deep Learning in Image Processing and Pattern",** Yuji Iwahori et al., MDPI, 2025
2. **"Computer Vision: Algorithms and Applications"** , Szeliski ,2nd ed., 2022

References:

1. ***Deep Learning for Vision Systems* – Elgendy (2020)**
2. **Rafael C. Gonzalez & Richard E. Woods**, *Digital Image Processing*, 4th Edition, Pearson, 2017.
3. **Simon J. D. Prince**, *Computer Vision: Models, Learning, and Inference*, Cambridge University Press, 2012.
4. **Ian Goodfellow, Yoshua Bengio, Aaron Courville**, *Deep Learning*, MIT Press, 2016.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	1						1	1	2	3
CO2	3	2	2	1							1		1	3
CO3	3	3	2	2	1	1					1	1	1	3
CO4	3	2	2	1							1		2	3
CO5	3	3	2	2	1						1		1	3
CO6	3	2	2	1							1	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV64	HEALTH CARE DATA ANALYTICS	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Data Analytics & Machine Learning				

Aim:	To analyze complex health care data and develop data-driven solutions for improving patient care and health system management.

Course Outcomes: The students will be able to

CO1:	Understand the types and sources of health care data and the challenges involved in health data analytics.
CO2:	Recall data preprocessing, cleaning, and integration on complex health care datasets.
CO3:	Apply statistical methods and visualization techniques to analyze and interpret health data.
CO4:	Develop and evaluate machine learning models for predictive analytics in health care.
CO5:	Construct advanced analytics applications in medical imaging, genomics, and sensor data.
CO6:	Interpret data-driven solutions for clinical decision support, patient outcome prediction, and operational improvements.

UNIT I: INTRODUCTION TO HEALTH CARE DATA ANALYTICS	**9**
Overview of health care systems and data types -Sources of health data: EHR, claims, wearable devices, public datasets-Data privacy, security, and regulatory issues -HIPAA, GDPR-Challenges in health care data analytics	
UNIT II: HEALTH DATA PREPROCESSING AND MANAGEMENT	**9**
Data cleaning, integration, and transformation-Handling missing and imbalanced data-Health data standards and interoperability -HL7, FHIR-Database systems and big data platforms in health care	
UNIT III: STATISTICAL ANALYSIS AND VISUALIZATION IN HEALTH CARE	**9**
Descriptive and inferential statistics for clinical data-Survival analysis and time-to-event data-Visualization techniques for health data -dashboards, charts - Tools for health data visualization-Tableau, R, Python	
UNIT IV: MACHINE LEARNING AND PREDICTIVE MODELING IN HEALTH CARE	**9**
Supervised learning: diagnosis, risk prediction models - Unsupervised learning: patient segmentation, anomaly detection - Deep learning applications: medical imaging, genomics -Model evaluation, validation, and interpretability	
UNIT V: APPLICATIONS AND CASE STUDIES	**9**
Clinical decision support systems -Predictive analytics for patient outcomes and hospital management - Wearable and sensor data analytics - Health care fraud detection and operational analytics on real-world health care datasets.	
Total Periods:	**45**

Text Book:

1. ***"Medical Analytics for Clinical and Healthcare Applications"*****,** Kanak Kalita, Divya Zindani, Narayanan Ganesh, Xiao-Zhi Gao,Wiley, 2025.

2. "**Artificial Intelligence and Machine Learning in Health Care and Medical Sciences: Best Practices and Pitfalls", Gyorgy** J. Simon, Constantin Aliferis ,Springer, 2024

References:

1. ***Trends of Artificial Intelligence and Big Data for E-Health*****, Houneida Sakly, Kristen Yeom, Safwan Halabi, Mourad Said,Springer, 2022**
2. **Thomas H. Davenport and John Glaser**, *The Rise of Big Data in Health Care*, Harvard Business Review, 2012.
3. **Kumar Sarvotham**, *Healthcare Analytics for Quality and Performance Improvement*, Wiley, 2016.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1						1	1	2	3
CO2	3	3	2	1	1						1		2	
CO3	3	2	2	1							1	1	1	3
CO4	3	3	2	2	1						1		1	3
CO5	3	3	2	1							1		1	3
CO6	3	3	3	2	1	1					1	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV65	PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Artificial Intelligence & Machine Learning				

Aim:	To build, evaluate, and deploy predictive models that support data-driven decision-making in diverse fields.

Course Outcomes: The Students will be able to

CO1:	Understand the fundamentals and significance of predictive analytics in various domains.
CO2:	Summarize data preprocessing and feature engineering to prepare datasets for modeling.
CO3:	Develop predictive models using regression, classification, and clustering techniques.
CO4:	Apply advanced methods like ensemble learning and time series forecasting for improved predictions.
CO5:	Interpret predictive models to ensure transparency and trustworthiness.
CO6:	Construct predictive analytics projects addressing real-world problems across different industries.

UNIT I: Introduction to Predictive Analytics	**9**
Overview and importance of predictive analytics -Types of predictive models: regression, classification, clustering -Data collection and preparation -Introduction to analytics tools -R, Python, SAS	
UNIT II: Data Preprocessing and Feature Engineering	**9**
Data cleaning and transformation -Handling missing data and outliers -Feature selection and extraction techniques -Dimensionality reduction methods -PCA, t-SNE	
UNIT III: Predictive Modeling Techniques	**9**
Regression models: linear, logistic regression -Classification models: decision trees, random forests, SVM -Clustering techniques: k-means, hierarchical clustering -Model training, validation, and evaluation metrics	
UNIT IV: Advanced Predictive Analytics Methods	**9**
Ensemble methods: boosting, bagging, stacking -Time series forecasting and analysis -Introduction to neural networks and deep learning for prediction -Model interpretability and explainability	
UNIT V: Deployment and Privacy	**9**
Predictive analytics in marketing, finance, healthcare, and operations -Deployment of predictive models in real-world systems -Ethical considerations and data privacy -Capstone project on end-to-end predictive analytics workflow	
Total Periods:	**45**

Text Book:

1. P**redictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die",** Eric Siegel, Wiley,2023
2. "**Applied Predictive Modeling**", Max Kuhn & Kjell Johnson, Springer, 2018.

References:

1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", Aurélien Géron,3rd Edition, 2023, O'Reilly
2. Marco Tulio Ribeiro, Sameer Singh, and Carlos Guestrin, "Why Should I Trust You?" Explaining the Predictions of Any Classifier," *KDD*, 2016. (LIME paper)
3. Scott Lundberg and Su-In Lee, "A Unified Approach to Interpreting Model Predictions," *NIPS*, 2017. (SHAP paper)

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1							1	1	2	3
CO2	3	2	2								1		1	1
CO3	3	3	2	2	1						1	1	1	3
CO4	3	2	2	1							1		2	3
CO5	3	3	2	2							1		2	3
CO6	3	2	1								1	1	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV66	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231 AD51- Machine Learning				

Aim:	To provide students with a multidisciplinary understanding of how the mind processes information, learns, perceives, and interacts with the world through cognitive and computational models.

Course Outcomes: The Students will be able to

CO1:	Understand the interdisciplinary nature and foundational concepts of cognitive science.
CO2:	Summarize human perception and attention mechanisms from psychological and neuroscientific perspectives.
CO3:	Infer different types of memory and learning processes and their cognitive models.
CO4:	Recall language structure, processing, and its role in cognition.
CO5:	Analyze computational models and AI techniques used to simulate cognitive functions.
CO6:	Apply cognitive science principles to practical problems in AI, linguistics, and human-computer interaction.

UNIT I: Introduction to Cognitive Science	**9**
Definition, history, and interdisciplinary nature -Key questions and approaches-Overview of major fields: psychology, neuroscience, linguistics, AI, philosophy	
UNIT II: Perception and Attention	**9**
Sensory systems and perception processes -Visual and auditory perception -Attention mechanisms and models -Cognitive neuroscience methods	
UNIT III: Memory and Learning	**9**
Types of memory: sensory, short-term, long-term -Models of memory and encoding -Learning theories and neural basis-Cognitive development and plasticity	
UNIT IV: Language and Cognition	**9**
Language structure and processing -Psycholinguistics and language acquisition -Thought, reasoning, and problem solving -Cognitive models of language understanding	
UNIT V: Computational and AI Approaches	**9**
Symbolic and connectionist models -Cognitive architectures -ACT-R, SOAR -Neural networks and deep learning in cognition -Applications in robotics, NLP, and human-computer interaction	
Total Periods:	**45**

Text Book:

1. "**Cognitive Science: An Introduction to the Science of the Mind",** José Luis Bermúdez,3rd Edition, 2022, Cambridge University Press
2. "**Cognitive Psychology: A Student's Handbook",** Michael Eysenck & Mark Keane,8th Edition, 2020, Psychology Press

References:

1. ***"Mind: Introduction to Cognitive Science*", Paul Thagard, 3rd Edition, 2019, MIT Press**
2. **E. Bruce Goldstein**, *Cognitive Psychology: Connecting Mind, Research, and Everyday Experience*, Cengage Learning, 2014.
3. **Patricia A. Reuter-Lorenz & Robert J. Davidson (Editors)**, *The Cognitive Neurosciences*, MIT Press, 2014.
4. **Russell & Norvig**, *Artificial Intelligence: A Modern Approach*, Pearson, 2020.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1							1	1	1	3
CO2	3	3	2	2	1						1		1	3
CO3	3	3	2	2	1						1	1	1	3
CO4	3	2	2	1							1		2	3
CO5	3	2	2	1							1		2	3
CO6	3	2	2	1							1	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV67	STREAM PROCESSING	L	T	P	C
		3	0	0	3

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Nil				

Aim:	To provide students with the knowledge and skills to design, implement, and optimize real-time stream processing systems for handling continuous data flows efficiently.

Course Outcomes: The students will be able to

CO1:	Understand the fundamentals and importance of stream processing in real-time data analytics.
CO2:	Outline various stream processing architectures and frameworks.
CO3:	Summarize continuous queries using windowing and time semantics.
CO4:	Interpret fault tolerance and state management techniques in stream processing systems.
CO5:	Apply stream processing applications for high throughput and low latency.
CO6:	Develop practical applications of stream processing in areas like event detection and real-time monitoring.

UNIT I: INTRODUCTION TO STREAM PROCESSING — **9**

Definition and importance of stream processing- Differences between batch and stream processing - Applications: real-time analytics, IoT, fraud detection -Challenges: latency, scalability, fault tolerance

UNIT II: STREAM PROCESSING ARCHITECTURES — **9**

Key components: sources, operators, sinks -Stream processing models: record-at-a-time vs micro-batching -Distributed stream processing frameworks overview (Apache Kafka, Apache Flink, Apache Storm, Spark Streaming) -Dataflow programming concepts

UNIT III: DATA STREAM MANAGEMENT AND QUERYING — **9**

Continuous queries and windowing techniques (tumbling, sliding, session windows) -Event time vs processing time -Stateful vs stateless operations -Handling out-of-order and late data

UNIT IV: FAULT TOLERANCE AND SCALABILITY — **9**

Check pointing and state management -Exactly-once, at-least-once, and at-most-once processing semantics -Scaling stream processing systems: partitioning and parallelism -Backpressure and flow control

UNIT V: ADVANCED TOPICS AND APPLICATIONS — **9**

Complex event processing -Integration with machine learning and real-time analytics -Use cases: real-time monitoring, anomaly detection, recommendation systems -Hands-on with a stream processing framework -Apache Flink / Kafka Streams

Total Periods: 45

Text Book:

1. **"Streaming Systems: The What, Where, When, and How of Large-Scale Data Processing***"*, Tyler Akidau, Slava Chernyak, Reuven Lax, O'Reilly Media, 2018.
2. **"Stream Processing with Apache Flink: Fundamentals, Implementation, and Operation**,Fabian Hueske & Vasiliki Kalavri, 1st Edition, 2019 ,O'Reilly

References:

1. **Dean Wampler**, *Apache Kafka 1.0 Cookbook*, Packt Publishing, 2017.
2. **Stefan Bocutiu & Ioana Bocutiu**, *Real-Time Big Data Analytics*, Springer, 2017.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1							1	1	1	3
CO2	3	2	2	1							1		2	3
CO3	3	3	1	1							1	1	1	3
CO4	3	3	2	2	1						1		2	3
CO5	3	3	2	1	1						1		1	3
CO6	3	2	2	1	1						1	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADV68	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD31-Artificial Intelligence				

Aim:	To equip students with the principles and techniques of knowledge representation, acquisition, and reasoning for building intelligent systems and expert applications.

Course Outcomes: The Students will be able to

CO1:	Understand the fundamental concepts and scope of knowledge engineering and its role in AI.
CO2:	Interpret various knowledge representation techniques such as logic, semantic networks, and ontologies.
CO3:	Demonstrate methods for knowledge acquisition and effective management of knowledge bases.
CO4:	Apply inference and reasoning techniques including deduction, induction, and handling uncertainty.
CO5:	Design and develop expert systems and knowledge-based decision support systems.
CO6:	Utilize knowledge engineering tools and platforms for building real-world applications.

UNIT I: INTRODUCTION TO KNOWLEDGE ENGINEERING	**9**
Definition, scope, and objectives -Types of knowledge: declarative, procedural, tacit -Knowledge acquisition and representation -Role of Knowledge Engineering in AI and expert systems	
UNIT II: KNOWLEDGE REPRESENTATION TECHNIQUES	**9**
Logic-based representation: propositional and predicate logic -Semantic networks and frames -Ontologies and description logics -Rule-based systems and production rules	
UNIT III: KNOWLEDGE ACQUISITION AND MANAGEMENT	**9**
Knowledge elicitation methods -Automated and semi-automated knowledge acquisition -Knowledge bases and knowledge management systems- Handling uncertainty: fuzzy logic, probabilistic reasoning	
UNIT IV: INFERENCE AND REASONING TECHNIQUES	**9**
Deductive, inductive, and abductive reasoning -Forward and backward chaining -Reasoning with uncertain and incomplete knowledge -Case-based reasoning and explanation facilities	
UNIT V: APPLICATIONS AND TOOLS	**9**
Expert systems design and implementation -Knowledge-based systems in decision support -Semantic web and linked data -Tools and platforms for knowledge engineering -Protégé, CLIPS	
Total Periods:	**45**

Text Book:

1. ***"Knowledge Engineering and Knowledge Management: The CommonKADS Methodology"***, Guus Schreiber, Bob Wielinga, Walter Van de Velde 2022,MIT Press
2. **Stuart Russell and Peter Norvig**, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson, 2020.
3. **Franz Baader, Ian Horrocks, Ulrike Sattler**, *Description Logic*, Cambridge University Press, 2017.

References:

1. **Jan Vanthienen and Dirk Vermeir**, *Knowledge Engineering and Management*, Springer, 2019.
2. **"Expert Systems: Principles and Programming", Joseph Giarratano & Gary Riley,**5th Edition , 2018.
3. **Grigoris Antoniou and Frank van Harmelen**, *A Semantic Web Primer*, MIT Press, 2008.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1							1	1	2	3
CO2	3	2	2	1	1						1		1	2
CO3	3	3	2	1							1	1	1	3
CO4	3	3	2								1		1	3
CO5	3	3	2		1						1		1	3
CO6	3	2	2	1	1						1	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231OE9A	FUNDAMENTALS OF DATA SCIENCE	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	OE
Prerequisite:	Nil				

Aim:	To introduce students to the key concepts, techniques, and tools of data science, enabling them to collect, preprocess, analyze, and visualize data effectively for informed decision-making.

Course Outcomes: The Students will be able to

CO1:	Understand the fundamental concepts and importance of data science and its applications in various domains.
CO2:	Outline Data collection and preprocessing
CO3:	Summarize data analysis and visualization to uncover patterns and insights.
CO4:	Interpret classification, clustering algorithms and its model performance.
CO5:	Use data visualization tools to create effective visual representations and dashboards for communicating insights.
CO6:	Develop data-driven results to both technical and non-technical audiences.

UNIT I: INTRODUCTION TO DATA SCIENCE — **9**

Definition, Importance, and Scope of Data Science -Data Science Life Cycle -Difference between Data Science, Big Data, and Data Analytics -Roles and skills of a Data Scientist -Applications of Data Science in various domains -healthcare, finance, social media

UNIT II: DATA COLLECTION AND PREPROCESSING — **9**

Types of Data: Structured, Unstructured, Semi-structured -Data Collection Methods: Web scraping, APIs, Databases -Data Cleaning Techniques: Handling missing values, noise removal, outlier detection - Data Transformation: Scaling, Normalization, Encoding categorical variables-Feature Engineering and Feature Selection

UNIT III: EXPLORATORY DATA ANALYSIS — **9**

Statistical Summaries: Mean, Median, Mode, Variance, Standard Deviation - Data Visualization Techniques: Histograms, Boxplots, Scatter Plots, Heatmaps-Correlation and Covariance analysis - Detecting and Treating Outliers

UNIT IV: INTRODUCTION TO MACHINE LEARNING — **9**

Overview of Machine Learning: Types -Supervised, Unsupervised, Reinforcement -Basic Algorithms: Linear Regression, Logistic Regression, Decision Trees, K-Means Clustering -Model Evaluation Metrics: Accuracy, Precision, Recall, F1-score, Confusion Matrix -Concepts of Overfitting, Underfitting, Bias-Variance Tradeoff -Cross-validation and Train-Test Split

UNIT V: DATA VISUALIZATION AND COMMUNICATION — **9**

Importance of Data Visualization in Data Science -Data Visualization Tools: Matplotlib, Seaborn, Tableau, Power BI -Designing Effective Visuals: Choosing Chart Types, Color, Layout -Storytelling with Data: Presenting Insights and Reports -Dashboards and Interactive Visualization

Total Periods: 45

Text Book:

1. **“Foundations of Data Science with Python”,** John M. Shea,2024
2. **"Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython"**, Wes McKinney, O’Reilly Media,2022.

References:

1. **"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”**, Aurelien Géron, O’Reilly Media**,** 2019 ,2nd Edition.
2. **"Data Science from Scratch: First Principles with Python",** Joel Grus, O’Reilly Media **,**2019, 2nd Edition
3. **"Practical Statistics for Data Scientists: 50 Essential Concepts"** Peter Bruce, Andrew Bruce, Peter Gedeck**,** O’Reilly Media, 2020

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1							1	1	2	2
CO2	3	2	1	1							1		1	2
CO3	3	3	1	1								1	1	3
CO4	2	1	1								1		2	2
CO5	2	2	1										1	2
CO6	3	2	2	1								1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231OE9B	DATA ANALYTICS USING R	L	T	P	C
		3	0	0	3

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:		Category:	OE
Prerequisite:	Nil				

Aim:	To equip students with the skills to analyze and visualize data using R for informed decision-making.

Course Outcomes: The students will be able to

CO1:	Understand the basics of R programming and data manipulation techniques.
CO2:	Infer data visualization using base R and advanced packages like `ggplot2`.
CO3:	Outline statistical methods and hypothesis testing to analyze datasets.
CO4:	Apply predictive models using regression, classification, and clustering techniques.
CO5:	Interpret machine learning packages in R to data analytics solutions.
CO6:	Summarize analytical results and communicate findings effectively for decision-making.

UNIT I: INTRODUCTION TO R AND DATA HANDLING	**9**
Overview of R programming language -Installing and setting up R and RStudio -Basic R syntax and commands -Data types, vectors, lists, matrices, data frames -Importing and exporting data -CSV, Excel -Data manipulation using packages like `dplyr`	
UNIT II: DATA VISUALIZATION	**9**
Basic plotting functions in R -Advanced visualization using `ggplot2` −Creating histograms, bar charts, boxplots, scatter plots -Customizing graphs -colors, labels, themes -Multivariate visualizations -Interactive plots using `plotly`	
UNIT III: STATISTICAL ANALYSIS AND HYPOTHESIS TESTING	**9**
Descriptive statistics -mean, median, variance -Probability distributions -Sampling and sampling distributions -Confidence intervals -Hypothesis testing -t-tests, chi-square tests, ANOVA -Correlation and regression analysis	
UNIT IV: PREDICTIVE ANALYTICS AND MODELING	**9**
Introduction to machine learning concepts -Regression models -linear and logistic regression -Decision trees and random forests -Clustering techniques -K-means, hierarchical clustering- -Model evaluation and validation (confusion matrix, ROC curves	
UNIT V: DATA MINING AND ADVANCED ANALYTICS USING R	**9**
Text mining basics and techniques -Sentiment analysis -Time series analysis and forecasting -Using R packages like `caret`, `e1071`, `randomForest`, `xgboost`	
Total Periods:	**45**

Text Book:

1. **“Modern Statistics with R “, Måns Thulin,2nd edition,2024**
2. **"R for Data Science: Import, Tidy, Transform, Visualize, and Model Data"** H. Wickham & G. Grolemund, O’Reilly Media , 2023

References:

1. **"Business Analytics Using R”,** M. Kumar *Publisher*: Excellence Brings Success,2022
2. **"Introductory Statistics with R”,** P. Dalgaard *Publisher*: Springer-Verlag New York,2002
3. **"Data Science and Predictive Analytics: Biomedical and Health Applications Using R"**,I. D. Dinov, Springer , 2023 ,2nd Edition

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1							1	1	2	2
CO2	2	2	1	1							1		1	2
CO3	3	3	2	1							1	1	1	2
CO4	3	2	1	1							1		1	2
CO5	3	2	1	1							1		1	2
CO6	3	3	2	1							1	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231OE9C	INFORMATION STORAGE AND RETRIEVAL	L	T	P	C
		3	0	0	3

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:		Category:	OE
Prerequisite:	Nil				

Aim:	To teach the fundamentals of information retrieval and web search techniques for effective data storage and retrieval.

Course Outcomes: The students will be able to

CO1:	Infer the fundamental concepts of information retrieval and search engines.
CO2:	Illustrate the different retrieval models like Boolean, Vector, and Probabilistic models.
CO3:	Construct the efficient indexing structures to speed up the search process.
CO4:	Demonstrate the different information retrieval models
CO5:	Interpret the performance of information retrieval systems using standard metrics.
CO6:	Analyze web search techniques including crawling, indexing, and ranking algorithms.

UNIT I: INTRODUCTION TO INFORMATION RETRIEVAL	**9**
Basics of information retrieval- working of Search Engines-Boolean search and simple retrieval-History and impact of the web on searching	
UNIT II: INFORMATION RETRIEVAL MODELS	**9**
Different ways to model search -Boolean, Vector, Probabilistic -Mapping of documents and queries - Ranking and scoring of search results	
UNIT III: INDEXING	**9**
Creating and managing indexes for fast search -Techniques to compress and update indexes -query processing - query expansion	
UNIT IV: EVALUATION AND PERFORMANCE	**9**
Good and fast search system Measurements -Different evaluation methods-Basics of parallel and distributed searching	
UNIT V: WEB SEARCH AND ADVANCED TOPICS	**9**
Web search engines- crawling and indexing-Ranking web pages - PageRank-Searching multimedia and XML data-Introduction to digital libraries and distributed retrieval	
Total Periods:	**45**

Text Book:

1. **"Introduction to Information Retrieval, Christopher",** D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge University Press,2008
2. **"Modern Information Retrieval: The Concepts and Technology behind Search"***,* Ricardo Baeza-Yates, Berthier Ribeiro-Neto, ACM Press Books, Second Editiion,2011
3. **"Implementing and Evaluating Search Engines",** Stefan Buettcher, The MIT Press, 2016

References:

1. **Search Engines: Information Retrieval in Practice** *Authors*: Bruce Croft, Donald Metzler, Trevor Strohman *Publisher*: Addison-Wesley *Edition*: First Edition *Year*: 2009.
2. **"An Introduction to Search Engines and Web Navigation** *",* Mark Levene Wiley, Second Edition,2010
3. **"Information Retrieval: Algorithms and Heuristics", Ophir** Frieder, Springer, Second Edition *Year*: 2004

Cos	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	1							1	1	1	1
CO2	3	2	2	1									2	2
CO3	3	3	1	1							1	1	1	2
CO4	2	2	1	1							1		2	1
CO5	3	2	1	1							1		1	3
CO6	3	2	2	1							1	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231OE9D	FUNDAMENTALS OF AI AND ML	L	T	P	C
		3	0	0	3

Programme:	B. Tech Artificial Intelligence and Data Science	Sem:		Category:	OE
Prerequisite:	Nil				

Aim:	To provide foundational knowledge of Artificial Intelligence and Machine Learning concepts, techniques, and applications, and implement basic AI/ML solutions.
Course Outcomes: The students will be able to	
CO1:	Understand the fundamental concepts, history, and scope of Artificial Intelligence and Machine Learning.
CO2:	Summarize AI search problems and suitable search strategies
CO3:	Recall different types of machine learning techniques and their performance using appropriate metrics.
CO4:	Apply supervised learning algorithms for classification and regression tasks.
CO5:	Interpret unsupervised learning techniques for data clustering and dimensionality reduction.
CO6:	Analyze practical applications of AI/ML tools and discuss their ethical and societal implications

UNIT I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE	**9**
Definition and History of AI -Applications of AI -Healthcare, Finance, Robotics -Types of AI: Narrow, General, and Super AI -AI vs Machine Learning vs Deep Learning -Philosophical Foundations and Ethics of AI -Intelligent Agents and Environments	
UNIT II: PROBLEM SOLVING AND SEARCH TECHNIQUES	**9**
Problem Formulation -Search Strategies: Uninformed Search BFS, DFS, UCS-Informed Search: A*, Greedy -Game Playing: Minimax Algorithm and Alpha-Beta Pruning -Constraint Satisfaction Problems	
UNIT III: FUNDAMENTALS OF MACHINE LEARNING	**9**
Introduction to ML and Types -Supervised, Unsupervised, Reinforcement Learning -ML Process: Data Collection, Cleaning, Training, Testing -Evaluation Metrics: Accuracy, Precision, Recall, F1 Score -Overfitting and Underfitting -Cross-validation and Model Selection	
UNIT IV: SUPERVISED AND UNSUPERVISED LEARNING	**9**
Supervised Learning: Linear Regression, Logistic Regression, Decision Trees, K-NN -Classification vs Regression -Unsupervised Learning: K-Means Clustering, Hierarchical Clustering, PCA -Introduction to Neural Networks an Applications, Tools, and Future Trends, Deep Learning- Basic Concepts	
UNIT V: APPLICATIONS AND TRENDS OF AI	**9**
Real-world Applications of AI/ML -AI Tools and Libraries: Python, Scikit-learn, TensorFlow, Keras -Introduction to Natural Language Processing, and Computer Vision -Ethical and Social Implications of AI -Current Trends: Generative AI, Explainable AI, AI in Edge Devices	
Total Periods:	**45**

Text Book:

1. **"Artificial Intelligence: A Modern Approach",** Stuart Russell and Peter Norvig, 4th Edition, Pearson, **2021**.
2. **"Introduction to Machine Learning",** Ethem Alpaydin, 4th Edition, MIT Press, **2020**.
3. **"*Machine Learning* ",**Tom M. Mitchell, 1st Edition, McGraw-Hill, **1997**.

References:

1. **"Deep Learning***",* **I**an Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, **2016**.
2. *"***Machine Learning: A Probabilistic Perspective***",* Kevin P. Murphy, MIT Press, **2012**.

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1							1	1	2	1
CO2	3	2	1	1							1		3	1
CO3	3	2	2	1							1	1	2	1
CO4	2	2	2	1							1		2	
CO5	3	3	2	1							1	1	3	1
CO6	3	2	2	1							1	1	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADH01	HUMAN CENTERED COMPUTING	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD51 - Machine Learning				

Aim:	To equip students with the skills to design and evaluate computing systems that are centered around human needs and usability.

Course Outcomes: The Students will be able to

CO1:	Understand the fundamentals, history, and interdisciplinary foundations of Human-Centered Computing and its relationship with Human-Computer Interaction.
CO2:	Identify user needs and apply design thinking and user-centered design principles to create inclusive and accessible computing solutions.
CO3:	Develop effective interaction designs and prototypes using modern UI/UX tools and design methods.
CO4:	Apply usability evaluation techniques, both qualitative and quantitative, to assess and improve user interfaces.
CO5:	Analyze the ethical, cultural, and societal implications of computing systems in diverse user contexts.
CO6:	Summarize the emerging trends in Human-Centered Computing, applications in AI, IoT, and immersive technologies.

UNIT I: INTRODUCTION TO HUMAN-CENTERED COMPUTING	**9**
Definition, scope, and history of HCC -Relationship with Human-Computer Interaction -Interdisciplinary foundations: psychology, design, computer science -Human cognition and perception in computing -Overview of user-centered design principles	
UNIT II: USER NEEDS, REQUIREMENTS, AND DESIGN THINKING	**9**
Identifying user needs and contexts -Personas, scenarios, and user journey maps -Design thinking process -Participatory and co-design methods -Ethical and inclusive design considerations -Accessibility and universal design principles	
UNIT III: INTERACTION DESIGN AND PROTOTYPING	**9**
Design of user interfaces and interactions -Information architecture and navigation design -Wireframing and mockup tools -Figma, Adobe XD -Prototyping: low fidelity to high fidelity -Visual design principles and usability heuristics	
UNIT IV: EVALUATION AND USABILITY TESTING	**9**
Usability goals and metrics -Qualitative and quantitative evaluation methods -Cognitive walkthroughs, heuristic evaluations, think-aloud protocol -A/B testing and user feedback analysis -Tools for usability testing	
UNIT V: EMERGING TRENDS AND APPLICATIONS	**9**
HCC in AI, IoT, and ubiquitous computing -Emotional and affective computing -Social computing and collaborative systems -Virtual, augmented, and mixed reality -Future directions and challenges in HCC	
Total Periods:	**45**

Text Book:

1. **"Designing the User Interface: Strategies for Effective Human-Computer Interaction"**, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Pearson, 7th Edition, **2018**.
2. **"Interaction Design: Beyond Human-Computer Interaction",** Helen Sharp, Yvonne Rogers, Jenny Preece, Wiley**,**5th Edition, **2019**
3. **"About Face: The Essentials of Interaction Design", Alan** Cooper, Robert Reimann, David Cronin, Christopher Noessel, Wiley, 4th Edition, **2014**

References:	

1. **"Human-Computer Interaction", Alan** Dix, Janet Finlay, Gregory Abowd, Russell Beale, Pearson,3rd Edition, **2003**
2. **"The Design of Everyday Things", Don** Norman**er:** MIT Press,**2013**
3. **"The UX Book: Agile UX Design for a Quality User Experience",:** Rex Hartson, Pardha Pyla, Morgan Kaufmann, 2nd Edition, **2018**

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1							1	1	2	2
CO2	3	3	2	1							1		2	1
CO3	3	3	3	1							1	1	1	2
CO4	3	2	2	1							1	1	2	1
CO5	3	2	1	1							1		2	2
CO6	3	2	1	1							1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADH02	BUSINESS INTELLIGENCE AND ANALYTICS	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Artificial Intelligence & Machine Learning				

Aim:	To enable students to use Business Intelligence and Analytics tools to turn data into actionable insights for effective decision-making..

Course Outcomes: The Students will be able to

CO1:	Understand the fundamental concepts and scope of Business Intelligence and Analytics.
CO2:	Infer the architecture and components of data warehousing and ETL processes.
CO3:	Apply data mining and analytics techniques to extract insights from data.
CO4:	Use BI tools for data visualization, reporting, and dashboard creation.
CO5:	Analyze real-world business problems using BI and recommend data-driven solutions.
CO6:	Summarize emerging trends and ethical considerations in Business Intelligence and Analytics.

UNIT I: INTRODUCTION TO BUSINESS INTELLIGENCE AND ANALYTICS	**9**
Definition and scope of Business Intelligence - Role of BI in decision-making -Data, information, and knowledge -BI vs Data Analytics vs Data Science-Applications of BI in various industries -Introduction to Data Warehousing and Data Marts	
UNIT II: DATA WAREHOUSING AND ETL PROCESSES	**9**
Data warehouse architecture -Star schema and Snowflake schema-Extract, Transform, Load process -Data cleaning and preprocessing -Online Analytical Processing -Data Integration and Data Quality	
UNIT III: BUSINESS ANALYTICS TECHNIQUES	**9**
Descriptive, Predictive, and Prescriptive analytics -Data Mining concepts and techniques-Association rule mining, Classification, Clustering -Regression analysis and forecasting -Text mining and Web analytics	
UNIT IV: BUSINESS INTELLIGENCE TOOLS AND PLATFORMS	**9**
Overview of popular BI tools -Power BI, Tableau, QlikView, SAP BI -Dashboards and Scorecards -KPIs and performance measurement -Reporting and data visualization -Cloud-based BI and mobile BI	
UNIT V: APPLICATIONS AND TRENDS IN BUSINESS INTELLIGENCE	**9**
BI applications in Marketing, Finance, HR, and Operations -Big Data and BI -Real-time BI and IoT integration -AI in BI – Machine Learning applications -Challenges and ethical considerations in BI -Future trends in BI and Analytics	
Total Periods:	**45**

Text Book:

1. "**Business Intelligence, Analytics, and Data Science: A Managerial Perspective***",* Ramesh Sharda, Dursun Delen, Efraim Turban, Pearson Education, 5th Edition, 2023
2. ***"Data Mining for Business Analytics: Concepts, Techniques, and Applications in R"****,* Galit Shmueli, Peter C. Bruce, Inbal Yahav, Nitin R. Patel, Kenneth C. Lichtendahl Jr. Wiley, 5th Edition, 2023

References:

1. ***"Data Mining: Concepts and Techniques",*** Jiawei Han, Micheline Kamber, Jian Pei Morgan Kaufmann (Elsevier)**,** 4th Edition, 2022
2. "***Data Analytics****",* Anil Maheshwari, McGraw-Hill Education, 2nd Edition, 2020
3. "***Business Intelligence****",* Seema Acharya, Subhashini Chellappan Wiley India, 1st Edition, 2015

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1							1		2	3
CO2	3	2	2	1							1		2	2
CO3	2	2	1	1							1	1	1	3
CO4	2	2	1	1							1	1	2	3
CO5	3	3	2	2							1	1	1	3
CO6	3	2	2	1							1	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADH03	STATISTICAL MACHINE LEARNING	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Artificial Intelligence & Machine Learning				

Aim:	To introduce students to statistical methods and models for building and analyzing machine learning systems.

Course Outcomes: The Students will be able to

CO1:	Infer the foundational concepts and statistical principles underlying machine learning algorithms.
CO2:	Outline linear and Bayesian models to solve supervised learning problems.
CO3:	Apply kernel methods and support vector machines for classification and regression tasks.
CO4:	Utilize probabilistic models and clustering techniques for unsupervised learning.
CO5:	Analyze ensemble methods and dimensionality reduction techniques to improve model performance.
CO6:	Interpret machine learning models, considering challenges and recent advances.

UNIT I: INTRODUCTION TO STATISTICAL MACHINE LEARNING	**9**
Overview of machine learning and statistical learning theory -Bias-variance tradeoff -Probability basics and distributions in ML -Supervised vs unsupervised learning -Performance evaluation metrics	
UNIT II: LINEAR MODELS AND BAYESIAN METHODS	**9**
Linear regression and logistic regression -Maximum likelihood estimation -Bayesian inference and MAP estimation -Bayesian networks and graphical models -Regularization techniques -L1, L2	
UNIT III: KERNEL METHODS AND SUPPORT VECTOR MACHINES	**9**
Concept of kernels and feature spaces -Kernel functions and properties -Support Vector Machines for classification and regression -Dual formulation and optimization -Applications and limitations	
UNIT IV: PROBABILISTIC MODELS AND CLUSTERING	**9**
Mixture models and Expectation-Maximization algorithm -Gaussian Mixture Models -Hidden Markov Models -Clustering algorithms: k-means, hierarchical clustering -Model selection and validation	
UNIT V: ADVANCED TOPICS AND CHALLENGES	**9**
Ensemble methods -Bagging, Boosting, Random Forests -Dimensionality reduction PCA, LDA -Introduction to deep learning and neural networks -Model interpretability and explainability -Challenges and future directions in statistical ML	
Total Periods:	**45**

Text Book:

1. **"Introduction to Machine Learning",**Ethem Alpaydin **,**MIT Press **2020** ,4th Edition
2. **"Probabilistic Machine Learning ",** Kevin P. Murphy, MIT Press **,2023**
3. **"Bayesian Reasoning and Machine Learning",** David Barber ,Cambridge University Press,**2012**

References:

1. **"The Elements of Statistical Learning ",** Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer, **2009** ,2nd Edition
2. **"Pattern Recognition and Machine Learning ",**Christopher M. Bishop ,Springer,**2006**

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1							1	1	2	1
CO2	2	2	1	1							1		2	
CO3	3	3	2								1	1	2	1
CO4	2	2	1								1			1
CO5	2	2	1								1		2	1
CO6	3	2	2	1							1	1	2	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADH04	INTELLIGENT AND LEARNING AGENTS	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	Artificial Intelligence				

Aim:	To introduce students to the design, learning methods, and applications of intelligent agents in AI systems.

Course Outcomes: The Students will be able to

CO1:	Infer the fundamental concepts and architectures of intelligent agents and their role in artificial intelligence.
CO2:	Summarize various problem-solving and search algorithms to develop intelligent agent systems.
CO3:	Outline the principles of machine learning and incorporate learning components into agent designs.
CO4:	Apply reinforcement learning techniques to enable agents to learn optimal behaviors in dynamic environments.
CO5:	Analyze multi-agent systems focusing on agent communication, coordination, and cooperation.
CO6:	Interpret ethical considerations and future challenges in the design and deployment of intelligent agents.

UNIT I: INTRODUCTION TO INTELLIGENT AGENTS	**9**
Definition and characteristics of intelligent agents -Agent architectures: simple reflex, model-based, goal-based, utility-based agents -Types of agents: autonomous, reactive, deliberative -Environment types and agent-environment interaction -Applications of intelligent agents	
UNIT II: PROBLEM SOLVING AND SEARCH TECHNIQUES FOR AGENTS	**9**
Problem formulation in agent systems -Uninformed search algorithms: BFS, DFS, Uniform cost -Informed search algorithms: A*, Greedy search -Adversarial search and game playing agents -Constraint satisfaction problems	
UNIT III: LEARNING AGENTS AND MACHINE LEARNING BASICS	**9**
Components of a learning agent -Supervised, unsupervised, and reinforcement learning overview-Learning models: decision trees, neural networks, Bayesian learning -Exploration vs exploitation -Applications of learning agents	
UNIT IV: REINFORCEMENT LEARNING AND ADVANCED LEARNING METHODS	**9**
Markov decision processes (MDPs) -Q-learning and Temporal Difference learning -Policy gradients and function approximation -Multi-agent learning and collaboration -Case studies and real-world applications	
UNIT V: AGENT COMMUNICATION, COORDINATION, AND ETHICS	**9**
Communication protocols and languages for agents-Coordination and cooperation in multi-agent systems -Agent architectures for social interaction -Ethical considerations and challenges in autonomous agents -Future trends in intelligent agents	
Total Periods:	**45**

Text Book:

1. **"Artificial Intelligence: A Modern Approach ",** Stuart Russell, Peter Norvig, Pearson **,2020**,4th Edition
2. **"Reinforcement Learning: An Introduction Authors:",** Richard S. Sutton, Andrew G. Barto MIT Press , **2018** ,2nd Edition

References:

1. **"Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations",** Yoav Shoham, Kevin Leyton-Brown ,Cambridge University Press, **2008**.
2. **"Machine Learning ",**Tom M. Mitchell **,** McGraw-Hill, **1997**

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1							1	1	2	3
CO2	2	2	1	1							1	1	2	2
CO3	3	2	2	1							1	1	1	3
CO4	3	2	1	1							1	1	1	3
CO5	3	3	2	2							1	1	2	3
CO6	3	2	2	1							1	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADH05	INFORMATION THEORY AND CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231CS46-Computer Networks				

Aim:	To provide students with foundational knowledge of information theory and cryptographic techniques for secure communication

Course Outcomes: The Students will be able to

CO1:	Understand the fundamental concepts of information theory including entropy, mutual information, and channel capacity.
CO2:	Summarize classical and modern cryptographic algorithms and their underlying principles.
CO3:	Apply data compression and encoding techniques based on information theory.
CO4:	Outline symmetric and asymmetric cryptographic protocols for secure communication.
CO5:	Interpret cryptographic hash functions, digital signatures, and authentication mechanisms.
CO6:	Infer security challenges, ethical issues, and quantum cryptography.

UNIT I: FUNDAMENTALS OF INFORMATION THEORY	**9**
Introduction to Information Theory-Concepts of Information, Entropy, and Uncertainty-Mutual Information and Relative Entropy -Source Coding Theorem and Data Compression -Channel Capacity and Channel Coding Theorem	
UNIT II: CLASSICAL CRYPTOGRAPHY	**9**
Historical Cryptosystems -Caesar, Vigenère, Playfair-Symmetric Key Cryptography Basics -Substitution and Transposition Ciphers -Cryptanalysis techniques -Frequency analysis, brute force-Introduction to Modern Block Ciphers	
UNIT III: MODERN CRYPTOGRAPHIC TECHNIQUES	**9**
Stream Ciphers and Block Ciphers -Data Encryption Standard and Advanced Encryption Standard ,Modes of Operation -ECB, CBC, CFB, OFB -Cryptographic Hash Functions -Message Authentication Codes	
UNIT IV: PUBLIC KEY CRYPTOGRAPHY AND PROTOCOLS	**9**
Principles of Public Key Cryptography -RSA Algorithm and Key Generation -Diffie-Hellman Key Exchange -Digital Signatures and Certificates -Introduction to Cryptographic Protocols	
UNIT V: INFORMATION SECURITY AND APPLICATIONS	**9**
Key Management and Distribution -Security Models and Attacks -Introduction to Quantum Cryptography -Applications: SSL/TLS, Blockchain basics -Ethical and Legal Issues in Cryptography	
Total Periods:	**45**

Text Book:

1. **"Information-Theoretic Cryptography**", **2023**, Cambridge.
2. **Elements of Information Theory"** Thomas M. Cover, Joy A. Thomas, Wiley Publication **2006** ,2nd Edition
3. **"Introduction to Modern Cryptography",** Jonathan Katz, Yehuda Lindell CRC Press **,**2014, 2nd Edition
4. **"Cryptography and Network Security: Principles and Practice" ,**William Stallings Pearson**, Year: 2017** ,7th Edition

References:

1. "Applied Cryptography: Protocols, Algorithms, and Source Code in C ", Bruce Schneier Wiley **,1996** ,1st Edition

2."Information Theory, Inference, and Learning Algorithms ",David J.C. MacKay Cambridge University Press, **2003**

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	1							1	1	2	2
CO2	2	1	1	1							1		1	2
CO3	3	3	2	1							1	1	1	2
CO4	2	2	2	1							1		2	1
CO5	2	2	2	1							1		1	2
CO6	3	3	2	1							1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231ADH06	OPERATIONS AND SUPPLY CHAIN ANALYTICS	L	T	P	C
		3	0	0	3

Programme:	B.Tech Artificial Intelligence and Data Science	Sem:		Category:	PE
Prerequisite:	231AD61-Data Analytics				

Aim:	To develop students' ability to apply analytical methods and data-driven techniques for effective decision-making and optimization in operations and supply chain management
Course Outcomes: The Students will be able to	
CO1:	Understand the fundamentals of operations and supply chain management and the role of analytics in improving performance.
CO2:	Apply forecasting techniques to predict demand accurately using statistical and machine learning methods.
CO3:	Analyze inventory systems to balance cost and service levels.
CO4:	Summarize linear and integer programming models for supply chain and operations problems.
CO5:	Identify supply chain network design and make data-driven decisions for facility location and capacity planning.
CO6:	Outline advanced analytics tools and emerging technologies to enhance supply chain visibility, sustainability, and risk management.

UNIT I: INTRODUCTION TO OPERATIONS AND SUPPLY CHAIN MANAGEMENT	**9**
Overview of operations and supply chains -Strategic role of supply chain analytics -Types of supply chains: push vs pull, lean vs agile -Key performance indicators and metrics -Introduction to decision-making under uncertainty	
UNIT II: FORECASTING AND DEMAND PLANNING	**9**
Types of demand patterns -Time-series analysis: moving averages, exponential smoothing -ARIMA and seasonal models -Machine learning methods for demand forecasting -Accuracy metrics: MAE, MAPE, RMSE	
UNIT III: INVENTORY ANALYTICS	**9**
Economic Order Quantity and variants -ABC analysis and safety stock calculation -Newsvendor model -Multi-echelon inventory systems -Inventory optimization using simulation	
UNIT IV: OPTIMIZATION AND NETWORK ANALYTICS	**9**
Linear and integer programming in operations -Transportation and assignment problems -Supply chain network design -Facility location and capacity planning –Solver based modeling Python + PuLP, Excel Solver	
UNIT V: ADVANCED TOPICS AND DIGITAL SUPPLY CHAINS	**9**
Real-time data and IoT in supply chain visibility -Blockchain in supply chain transparency, Sustainability and green supply chains -Risk analytics and scenario modelling -Analytics platforms Tableau, Power BI, Python	
Total Periods:	**45**

Text Book:

1. **"Supply Chain Management: Strategy, Planning, and Operation ",** Sunil Chopra, Peter Meindl, Pearson **,2019,** 7th Edition
2. **"Operations Management ",** William J. Stevenson, McGraw-Hill Education,**2020** ,14th Edition
3. **"Business Analytics for Supply Chain Management",** Nada R. Sanders, Wiley,**2019**

References:

1. **"Data Science for Supply Chain Forecasting",** Nicolas Vandeput, Wiley , **2018**
2. **"The Analytics Supply Chain: How Analytics Transforms Supply Chain Management",** Magnus Bergfors, Christopher S. Tang ,Kogan Page**,2020**
3. **"Supply Chain Analytics: Using Data to Optimise Supply Chain Processes**", Peter W. Robertson, Kogan Page, **2018**

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2		1							1	1	2	2
CO2	2	2	1								1		1	1
CO3	3	3	2								1	1	1	1
CO4	2	2	1	1							1		2	2
CO5	3	3	2								1		1	1
CO6	3	2	2	1							1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

MANAGEMENT ELECTIVES

231BAE1	ENGINEERING ECONOMICS AND ACCOUNTING			L-T-P	C
				3-0-0	3
Programme:	**B.E. /B.Tech**	**Sem:**	**-**	**Category:**	**HS**
Prerequisites:	-				
Objectives :	To enable the students and provide an analytical idea about economics and accounting practices.				

INTRODUCTION TO ECONOMICS& DEMAND	**9**
Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis. Demand - Types of demand - Determinants of demand - Demand function - Demand elasticity - Demand forecasting.	
SUPPLY, PRODUCTION AND COST CONCEPTS	**9**
Supply - Determinants of supply - Supply function - Supply elasticity. **Production function** - Introduction - Production Process & Function - One Variable and Two Variable Inputs - Isoquants - Returns to scale. **Cost Concepts** - Cost function – Types of Cost - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.	
PRICING AND CAPITAL BUDGETING	**9**
Pricing - Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice. Capital Budgeting - Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value – Internal rate of return.	
FINANCIAL ACCOUNTING	**9**
Financial Accounting - Trail balance, balance sheet and related concepts: Trading Account, Profit & Loss Statement and related concepts - analysis & interpretation of financial statements - Financial Ratio Analysis.	
COST ACCOUNTING	**9**
Cost Accounting - Types of costing - traditional costing approach - activity based costing - full cost pricing - marginal cost pricing - going rate pricing - bid pricing - feasibility reports - technical, economic and financial feasibility.	
Total Periods	**45**
TEXT BOOKS:	

1. Mc Guigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics, Cengage Learning, 13th Edition, 2013.
2. Prasanna Chandra. 'Fundamentals of Financial Management', Tata McGraw Hill Publishing Ltd., 8th Edition, 2011.

REFERENCES

1. Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, New Delhi, 2007.
2. Sasmitha Mishra, 'Engineering Economics and costing', PHI Learning, 2nd Edition, 2010.

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Interpret the concepts of economic theories and demands. (UN)
CO2	Illustrate the concept of Supply and production. (UN)
CO3	Investigate the concept of cost. (AP)
CO4	Analyze the concepts of pricing and capital budgeting. (AN)
CO5	Examine financial accounting systems. (AN)
CO6	Analyze the cost accounting techniques. (AN)

Mapping with Programme Outcomes:

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PS O1**	**PS O2**	**PS O3**
CO1	1	1	1	1	2	3			1	1	3	3		1
CO2	1			1	2					1	3	3		2
CO3	1	1	1	2	2				1	1	3	3		2
CO4	1				2					1	3	3		1
CO5	1	2	1	1	2				1	2	3	3		2
CO6	1	2		1	2					2	3	3		2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BAE2	ENTREPRENEURSHIP			L-T-P	C
				3-0-0	3
Programme:	**B.E. /B.Tech**	**Sem:**	**-**	**Category:**	**HS**
Prerequisites:	-				
Objectives :	To impart entrepreneurial skills to run a business effectively.				

ENTREPRENEURSHIP	**9**
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth. Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager.	
MOTIVATION	**9**
Attributes and Characteristics of a successful Entrepreneur, Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives -women Entrepreneurs.	
BUSINESS PLAN PREPARATION	**9**
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of information – Classification of needs and agencies.	
FINANCING AND ACCOUNTING	**9**
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.	
SUPPORT TO ENTREPRENEURS	**9**
Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.	
Total Periods	**45**

TEXT BOOKS:

1. Hisrich, Entrepreneurship, Edition 9, Tata McGraw Hill, New Delhi, 2014
2. S. S. Khanka, Entrepreneurial Development, S.Chand and Co. Ltd., New Delhi, (Revised Edition), 2013.

REFERENCES

1. Abzug, R., & Webb, N. J. (1999). Relationships between nonprofit and for-profit organizations: A stakeholder perspective. *Nonprofit and Voluntary Sector Quarterly, 28*(4).
2. Anderson, R. B., Dana, L. P., & Dana, T. E. (2006). Indigenous land rights, entrepreneurship, and economic development in Canada: "Opting-in" to the global economy. *Journal of World Business*, *41*(1), 45-55.

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Compare entrepreneur and entrepreneurship. (UN)
CO2	Demonstrate characteristics of a successful entrepreneur. (UN)
CO3	Develop feasible business plans and project reports for initiating businesses. (AP)
CO4	Analyze the sources of financing the business. (AN)
CO5	Categorize the ways of sickness in business and corrective measures. (AN)
CO6	Make use of Government policies and growth strategies for Small Scale Enterprises. (AP)

Mapping with Programme Outcomes:

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2		1	2	3			3		3	3		2
CO2	2	1			2	3			2		2	3		2
CO3	2	3	3	3	2						1	3	1	2
CO4	1	2	1	1	2			1				3		1
CO5	1	1	2	1	2						2	3	1	1
CO6	1	1	2	1	2				3	1	2	3	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BAE3	ESSENTIALS OF MANAGEMENT			L-T-P	C
				3-0-0	3
Programme:	**B.E. /B.Tech**	**Sem:**	**-**	**Category:**	**HS**
Prerequisites:	-				
Objectives :	To study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.				

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	**9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

PLANNING	**9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

ORGANISING	**9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

DIRECTING	**9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

CONTROLLING	**9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

Total Periods	**45**

TEXT BOOKS:

1. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata McGraw Hill, 12th edition, 2014.
2. James A.F. Stoner, R. Edward Freeman, Daniel R. Gilbert Jr., 'Management ', Prentice-Hall of India, 6th edition, 2012.

REFERENCES

1. JAF Stoner, Freeman R.E and Daniel R Gilbert 'Management', 6th Edition, Pearson Education, 2004.
2. Robert Kreitner & Mamata Mohapatra, 'Management', Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, 'Fundamentals of Management', 7th Edition, Pearson Education, 2011.

Course Outcomes:	
On completion of the course, the students will be able to	
CO1	Demonstrate knowledge of managerial functions, types of organizations, managers, and managerial roles and skills. (UN)
CO2	Apply the planning, organizing and control processes.(AP)
CO3	Analyze organizational structure, and organizational control and culture.(AN)
CO4	Explain motivation and leadership qualities and effective communicate through both oral and written presentations.(UN)
CO5	Analyze information by using both human and technological resources.(AN)
CO6	Illustrate the control management system and process.(UN)

Mapping with Programme Outcomes:

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1		1	1				3	3	3	3		2
CO2	2			1	1				3	2	3	3		2
CO3	2	1		1	1	2		2		1	2	2		2
CO4	2	1		1	1				1	3	2	2		2
CO5	2	3		3	3					1	2	2		1
CO6	1	1		1	1					1	3	3		1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BAE4	INTELLECTUAL PROPERTY RIGHTS			L-T-P	C
				3-0-0	3
Programme:	**B.E. /B.Tech**	**Sem:**	**-**	**Category:**	**HS**
Prerequisites:	-				
Objectives :	To provide an idea about IPR, registration and its enforcement.				

INTRODUCTION	**9**
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.	
REGISTRATION OF IPRs	**9**
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.	
AGREEMENTS AND LEGISLATIONS	**9**
International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act..	
DIGITAL PRODUCTS AND LAW	**9**
Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.	
ENFORCEMENT OF IPRs	**9**
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies	
Total Periods	**45**

TEXT BOOKS:

1. S.V. Satarkar, 'Intellectual Property Rights and Copy Rights', ESS Publications, New Delhi, 2002.
2. Vinod V. Sople, 'Managing Intellectual Property', PHI Learning Pvt. Ltd, 4th Edition, 2014.

REFERENCES

1. Deborah E. Bouchoux, 'Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets', Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli, 'Intellectual Property Rights: Unleashing the Knowledge Economy',

McGraw Hill Education, 2011.

3. Derek Bosworth and Elizabeth Webster, 'The Management of Intellectual Property', Edward Elgar Publishing Ltd., 2013.

Course Outcomes:

On completion of the course, the students will be able to

CO1	Make use of the Intellectual property rights in professional society.(UN)
CO2	Identify the process that shapes the registration of various categories of Intellectual Property Rights.(AP)
CO3	Explain agreements, and legislations of act relating to IPR.(UN)
CO4	Identify digital products and respective legislations.(AP)
CO5	Develop the ability of individuals to recognize and enforcing the legislations.(AP)
CO6	Interpret an idea about IPR, registration and its enforcement.(UN)

Mapping with Programme Outcomes:

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2				1	3		3		1	3	2	1	1
CO2	2	2			1	2		2		1	2	2	1	2
CO3	2	2			1	2		2		1	2	2	1	1
CO4	2	2			2	2		2		1	2	2	1	2
CO5	2	1			1			2		1	3	2	1	1
CO6	2	2			1	2		2	2	1	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BAE5	PROFESSIONAL ETHICS IN ENGINEERING				L-T-P	C
					3-0-0	3
Programme:	**B.E. /B.Tech**	**Sem:**	**-**	**Category:**		**HS**
Prerequisites:	-					
Objectives :	To enable the students to create an awareness on Engineering Ethics and Human Values.					

HUMAN VALUES	**9**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

ENGINEERING ETHICS	**9**

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

ENGINEERING AS SOCIAL EXPERIMENTATION	**9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – a balanced outlook on Law.

SAFETY, RESPONSIBILITIES AND RIGHTS	**9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

GLOBAL ISSUES	**9**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

Total Periods	**45**

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, 'Ethics in Engineering', McGraw Hill, New York, 2012.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, 'Engineering Ethics – Concepts and Cases', 6th Edition, Ray James, Elian Englehardt Wadsworth publishing co, 2013.

REFERENCES

1. Charles D Fleddermann, 'Engineering Ethics', Prentice Hall, New Mexico, 2012.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2013.

3. Edmund G Seebauer and Robert L Barry, 'Fundamentals of Ethics for Scientists and Engineers', Oxford University Press, 2013. 4. David Erman & Michele Shauf, 'Computers, Ethics and Society, Oxford University Press, 2012.	
Course Outcomes:	
On completion of the course, the students will be able to	
Co1	Infer human values in professional society. (UN)
Co2	Identify the core values that shape the ethical behavior of an engineer. (AP)
Co3	Illustrate codes of conduct and responsibilities of engineers in professional society. (UN)
Co4	Explain the awareness about ethical concerns and conflicts. (UN)
Co5	Interpret the safety and risk analysis. (UN)
Co6	Analyze the global issues in ethics. (AN)

Mapping with Programme Outcomes:

COs	Program Outcomes (POs)											Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1		1	1	3			3		3	2		1
CO2	2	1		1	1	3		2	2		2	2		1
CO3	2	3	3	3	1						1	2		1
CO4		1		1	1			1				2		1
CO5		1		1	1			2			2	2		1
CO6	1	1		1	1			2	3	1	2	2		1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

231BAE6	WOMEN STUDIES AND WOMEN EMPOWERMENT				L-T-P	C
					3-0-0	3
Programme:	**B.E. /B.Tech**	**Sem:**	**-**	**Category:**		**HS**
Prerequisites:	-					
Objectives :	To study the legal provisions for women and women's access to justice and also familiarize the students with the notion of gender and its operation in society.					

WOMEN'S STUDIES: AN INTRODUCTION	**9**
Women's Studies -Definition, Scope and Controversies. Basic concepts of Women's Studies- Women's Studies perspectives- Gender: Perspectives-Gender sensitive approach- Gender and sex- Biological determinism- stereotyping- Socialization- Patriarchy- Devaluation- Marginalization- Silencing- Male Gaze- Power politics- Gynocriticism- Gender mainstreaming- Gender and work- Invisibility-Glass ceiling. Women's Studies in India.	
LEGISLATION AND GENDER JUSTICE	**9**
Women's rights as human rights, UN Conventions, Convention on the Elimination of all forms of Discrimination against Women (CEDAW), Millennium Development Goals (MDGs) - Women's Rights in the Indian Constitution, Fundamental Rights, Directive Principles- Protective legislation for women in the Indian constitution- Anti dowry, SITA, PNDT, and Prevention Sexual Harassment at Workplace (Visaka case), Domestic violence (Prevention) Act- Women's Rights to property, Uniform Civil Code, Property rights according to religions background Muslim, Christian.	
FEMINIST THEORIES	**9**
Early feminist thinkers- J.S Mill, Mary Wollstonecraft - Women's Movements before and during the world war.- Recent trends in feminist thinking- Masculinities, Eco-feminism, queer theory, transgender politics, Cyber feminism, Post-colonial - Different Schools of feminist through in the Indian contest- National and regional feminist thoughts.	
GENDER AND MASS MEDIA	**9**
Definition of gender, difference between sex and gender- Feminist terminology, stereotyping, patriarchy, silencing, margin alisation - Male Gaze, Feminist film criticism, thematic and semiotic analysis- Various forms of mass media. Print media, radio, visual, new media- internet, feminism and cyber space, texting, SMS and cell phone usage - Influence of media in society, patriarchy - in operation, use of feminist methods for - critiquing media representation, practice sessions.	
WOMEN AND SOCIETY IN INDIA	**9**
Women's position from Vedic times to the present, women participation in India's independence movement - Social construction of gender and gender roles – Socialisation - Women in family- Women in family- feminization of poverty, violence against women, empowerment measures - Women and	

environment- eco-feminist movements, women and globalization- women's labour, discriminatory wages, changing working conditions and work place related issues.
Total Periods **45**
TEXT BOOKS:
1. Roberta Rosenberg, "Women's Studies: An Interdisciplinary Anthology", Peter Lang, 2001. 2. Jean Fox O'Barr, "Feminism in Action: Building Institutions and Community through Women's Studies", University of North Carolina Press, 1994.
REFERENCES
1. Jill Duerr Berrick, "Faces of Poverty: Portraits of Women and Children on Welfare", Oxford University Press, 1997.

Course Outcomes: The students will be able to	
CO1:	Make use of the laws related to women's, rights protection.(AP)
CO2:	Organize the students to look at stereotypical representation of women in the media and equip them to critique them. (AP)
CO3:	Illustrate the specific cultural contexts of women in India.(UN)
CO4:	Explain the legal provisions for women and women's access to justice. (UN)
CO5:	Illustrate with the notion of gender operation in society. (UN)
CO6:	Explain work place related issues and discriminatory wages.(UN)

Mapping with Programme Outcomes:

COs	**Program Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1		1	1	3		3			2	2		1
CO2	2	1		1	1	3				3	2	2		2
CO3	2	1		2	1	3					2	2		1
CO4	2	2		2	1	3					2	2		1
CO5	2	1	1	2	1	3			2		2	2		1
CO6	2	1	1	2	1	3			2		2	2		1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)