4 Year B.Tech Program
of
CSE (Data Science)

R-24 Regulations & Scheme
(w.e.f. 2024-2025)

DEPARTMENT OF CSE (DATA SCIENCE)

BAPATLA ENGINEERING COLLEGE :: BAPATLA

(AUTONOMOUS UNDER ACHARYA NAGARJUNA UNIVERSITY)

(SPONSORED BY BAPATLA EDUCATION SOCIETY)

BAPATLA - 522102 GUNTUR DISTRICT, A.P.

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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)

Summary

S. No.	Category	AICTE Recommended Credits (%)	# of Courses	# of Credits	Breakup of Credits (Total 160)
1.	Humanities and Social Sciences including Management (HM)	5 – 8 %	6	9	5.6
2.	Basic Science Courses (BS)	12 – 16 %	8	20	12.5
3.	Engineering Science Courses (ES)	10 – 18 %	11	24	15
4.	Professional Core Courses (PC)	30 – 36 %	21	51.5	32.3
5.	Electives – Professional Electives (PE); Job Oriented Electives (JOE); Open Electives (OE); Skill Enhancement Courses (SEC)	19 – 27 %	5+6+1+4 =16	15+ 13.5+3 +8 = 39.5	24.6
6.	Internships & Project Work (PR)	8 – 11 %	3	16	10
7.	Mandatory Courses (MC)	-	4		Non-credit
		Total	**69**	**160**	

Semester Wise Courses and Credits

Semester	# of Theory Courses	Skill Enhanced Courses	# of Lab Courses	Mandatory Courses	Other Courses	Total Courses	Credits	With Honor Credits
Semester-I	4	0	5	0	0	9	18	18
Semester-II	5	0	4	0	0	9	21	21
Semester-III	5	1	3	1	1	11	22.5	22.5
Semester-IV	5	1	3	1	1	11	22.5	26.5
Semester-V	5	1	2	1	SI1	10	22	26
Semester-VI	5	1	2	1	0	9	20	24
Semester-VII	5	1	2	0	SI2	9	22	26
Semester-VIII	0	0	1	0	0	1	12	12
Total	**34**	**5**	**22**	**4**	**4**	**69**	**160**	**176**

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
First Year B.Tech. (SEMESTER – I) W.E.F. A.Y. 2024-25 (R24)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
24DS101	BS	Linear Algebra and Ordinary Differential Equations	2	1	0	3	40	60	100	3
24DS102	BS	Semiconductor Physics and Nano materials	3	0	0	3	40	60	100	3
24DS103	HM	Communicative English	2	0	0	2	40	60	100	2
24DS104	ES	Introduction to Programming	3	0	0	3	40	60	100	3
24DSL101	ES	Engineering Graphics Lab	1	0	3	4	40	60	100	2.5
24DSL102	BS	Semiconductor Physics Lab	0	0	2	2	40	60	100	1
24DSL103	HM	English Communication skills Lab	0	0	2	2	40	60	100	1
24DSL104	ES	Introduction to Programming Lab	0	0	3	3	40	60	100	1.5
24DSL105	ES	IT Workshop	0	0	2	2	40	60	100	1
Induction Program		**First Three Weeks** (Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Familiarization to Dept./Branch & Innovations)								
TOTAL			**11**	**1**	**12**	**24**	**360**	**540**	**900**	**18**

L: Lecture T: Tutorial P: Practical
CIE: Continuous Internal Evaluation SEE: Semester End Examination

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
First Year B.Tech. (SEMESTER – II) W.E.F. A.Y. 2024-25 (R24)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
24DS201	BS	Numerical methods& Advanced Calculus	2	1	0	3	40	60	100	3
24DS202	BS	Engineering Chemistry	3	0	0	3	40	60	100	3
24DS203	ES	Basic Electrical & Electronics Engineering	3	0	0	3	40	60	100	3
24DS204	ES	Programming for Problem Solving	3	0	0	3	40	60	100	3
24DS205	BS	Discrete Mathematics	3	1	0	3	40	60	100	3
24DSL201	ES	Engineering Mechanics Lab	1	0	2	3	40	60	100	2
24DSL202	BS	Engineering Chemistry Lab	0	0	2	2	40	60	100	1
24DSL203	ES	Basic Electrical & Electronics Engineering Lab	0	0	3	3	40	60	100	1.5
24DSL204	ES	Programming for roblem Solving Lab	0	0	3	3	40	60	100	1.5
TOTAL			**15**	**1**	**10**	**26**	**360**	**540**	**900**	**21**

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Second Year B.Tech. (SEMESTER – III) W.E.F. A.Y. 2024-25 (R24)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
24DS301	BS	Probability & Statistics	2	1	0	3	40	60	100	3
24DS302	ES	Digital Logic Design	3	0	0	3	40	60	100	3
24DS303	PC	Data Structures	2	1	0	3	40	60	100	3
24DS304	PC	Object Oriented Programming	2	1	0	3	40	60	100	3
24DS305	PC	Introduction to Data Science	3	0	0	3	40	60	100	3
24DSL301	SEC	Python Programming (Skill Enhancement Course - I)	1	0	2	3	40	60	100	2
24DSL302	PC	Computational Statistics	1	0	2	3	40	60	100	2
24DSL303	PC	Data Structures Lab	0	0	3	3	40	60	100	1.5
24DSL304	PC	Object Oriented Programming Lab	0	0	3	3	40	60	100	1.5
24DSL305	HM	Health and Wellness, Yoga and Sports	0	0	1	1	100	-	100	0.5
24DS306	MC	Constitution of India	2	0	0	2	40	0	40	0
TOTAL			**16**	**3**	**11**	**30**	**500**	**540**	**1040**	**22.5**

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Second Year B.Tech. (SEMESTER – IV) W.E.F. A.Y. 2024-25 (R24)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
24DS401	PC	Computer Organization	3	0	0	3	40	60	100	3
24DS402	PC	Operating Systems	2	1	0	3	40	60	100	3
24DS403	PC	Client-Side Web Technologies	3	0	0	3	40	60	100	3
24DS404	PC	Database Management Systems	3	0	0	3	40	60	100	3
24DS405	PC	Design and Analysis of Algorithms	2	1	0	3	40	60	100	3
24DSL401	SEC	Advanced Python Programming (Skill Enhancement Course - II)	1	0	2	3	40	60	100	2
24DSL402	ES	Design Thinking & Innovation	1	0	2	3	40	60	100	2
24DSL403	PC	Client-Side Web Technologies Lab	0	0	3	3	40	60	100	1.5
24DSL404	PC	RDBMs Lab	0	0	3	3	40	60	100	1.5
24DSL405	HM	NSS/ NCC/Scouts & Guides/Community Service	0	0	1	1	100	0	100	0.5
24DS406	MC	Environmental Science	2	0	0	2	40	0	40	0
TOTAL			**17**	**2**	**11**	**30**	**500**	**540**	**1040**	**22.5**
	Honors/Minor Course		**3**	**0**	**2**	**5**	**40**	**60**	**100**	**4**

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Third Year B.Tech. (SEMESTER – V) W.E.F. A.Y. 2024-25 (R24)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
24DS501	PC	Automata Theory &Compiler Design	3	0	0	3	40	60	100	3
24DS502	PC	Computer Networks	3	0	0	3	40	60	100	3
24DS503	PC	Machine Learning	3	0	0	3	40	60	100	3
24DS504	PE	Professional Elective – I	3	0	0	3	40	60	100	3
24DS505	JOE	Job Oriented Elective – I	3	0	0	3	40	60	100	3
24DSL501	SEC	Competitive Prog. Skills (Skill Enhancement Course - III)	1	0	2	3	40	60	100	2
24DSL502	PC	Machine Learning Lab	0	0	3	3	40	60	100	1.5
24DSL503	JOE	Job Oriented Elective – I Lab	0	0	3	3	40	60	100	1.5
24DSL504	PR	Summer Internship - I*	0	0	0	0	0	100	100	2
24DS506	MC	Campus Recruitment Skills	2	0	0	2	40	0	40	0
TOTAL			**18**	**0**	**8**	**26**	**360**	**580**	**940**	**22**
	Honors/Minor Course		**3**	**0**	**2**	**5**	**40**	**60**	**100**	**4**

Job Oriented Elective – I

1A	Server-Side Web Technologies
	Server-Side Web Technologies Lab
1B	Enterprise Programming
	Enterprise Programming Lab
1C	Middleware Technologies
	Middleware Technologies Lab

Professional Elective – I

1A	Software Engineering
1B	Design Patterns & Frameworks
1C	Parallel Algorithms

* Summer Internship - I (PR01) need to be completed after 4th semester and it is evaluated by the end of 5th semester.

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Third Year B.Tech. (SEMESTER – VI) W.E.F. A.Y. 2024-25 (R24)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
24DS601	HM	Industrial Management & Entrepreneurship Development	3	0	0	3	40	60	100	3
24DS602	PC	Big Data Analytics	3	0	0	3	40	60	100	3
24DS603	PE	Professional Elective – II	3	0	0	3	40	60	100	3
24DS604	PE	Professional Elective – III	3	0	0	3	40	60	100	3
24DS605	JOE	Job Oriented Elective – II	3	0	0	3	40	60	100	3
24DSL601	HM	Soft Skills (Skill Enhancement Course - IV)	1	0	2	3	40	60	100	2
24DSL603	PC	Big Data Analytics Lab	0	0	3	3	40	60	100	1.5
24DSL604	JOE	Job Oriented Elective – II Lab	0	0	3	3	40	60	100	1.5
24dS606	MC	Technical paper writing & IPR	2	0	0	2	40	0	40	0
TOTAL			**18**	**0**	**8**	**26**	**360**	**480**	**840**	**20**
	Honors/Minor Course		**3**	**0**	**2**	**5**	**40**	**60**	**100**	**4**

Job Oriented Elective - II	
2A	Cloud Programming
	Cloud Programming Lab
2B	Mobile Application Development
	Mobile Application Development Lab
2C	Industrial IoT
	Industrial IoT Lab

Professional Elective – II	
2A	Cryptography & Network Security
2B	Augmented Reality & Virtual Reality
2C	Software Defined Networks

Professional Elective – III	
3A	Block Chain Technology
3B	Computer Vision
3C	Distributed Systems

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Fourth Year B.Tech. (SEMESTER – VII) W.E.F. A.Y. 2024-25 (R24)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
24DS701	PC	Feature Engineering	3	0	0	3	40	60	100	3
24DS702	PE	Professional Elective – IV	3	0	0	3	40	60	100	3
24DS703	PE	Professional Elective – V	3	0	0	3	40	60	100	3
24DS704	OE	Open Elective	3	0	0	3	40	60	100	3
24DS705	JOE	Job Oriented Elective – III	3	0	0	3	40	60	100	3
24DSL701	SEC	DevOps (Skill Enhancement Course - V)	1	0	2	3	40	60	100	2
24DSL702	PC	Feature Engineering Lab	0	0	3	3	40	60	100	1.5
24DSL703	JOE	Job Oriented Elective – III Lab	0	0	3	3	40	60	100	1.5
24DSL704	PR	Summer Internship – II*	0	0	0	0	0	100	100	2
TOTAL			**16**	**0**	**8**	**24**	**320**	**580**	**900**	**22**
	Honors/Minor Courses (MOOCs - 1)		**0**	**0**	**0**	**0**	**40**	**60**	**100**	**2**
	Honors/Minor Courses (MOOCs - 2)		**0**	**0**	**0**	**0**	**40**	**60**	**100**	**2**

Job Oriented Elective – III	
3A	Generative AI Technologies
	Generative AI Technologies Lab
3B	Natural Language Processing
	Natural Language Processing Lab
3C	Web & Social Media Analytics
	Web & Social Media Analytics Lab

Professional Elective – IV	
4A	Federated learning
4B	Exploratory Data Analytics
4C	Data Stream Mining

Professional Elective – V	
5A	Deep Learning.
5B	Reinforcement Learning
5C	Quantum Computing

* Summer Internship – II (PR02) need to be completed after 6th semester and it is evaluated by the end of 7th semester.

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
CSE (Data Science)
Fourth Year B.Tech. (SEMESTER – VIII) W.E.F. A.Y. 2024-25 (R24)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total	
24DSL801	PR	Project Work	0	0	24	24	40	60	100	12
Total			**0**	**0**	**24**	**24**	**40**	**60**	**100**	**12**

LINEAR ALGEBRA AND ORDINATRY DIFFERENTIAL EQUATIONS

I B. Tech. – I Semester (Code: 24DS101)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Solve a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors
- Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order ordinary differential equations.
- Create and analyze mathematical models using higher order differential equations to solve application problems that arise in engineering.
- Verify mean value theorems and expand functions of a single variable using Taylor's and Maclaurin's series.

Course Outcomes: At the end of this course, Students will be able to

CO1 Find the eigen values and eigen vectors of a given matrix and its inverse.

CO2 Apply the appropriate analytical technique to find the solution of a first order ordinary differential equation.

CO3 Solve higher order linear differential equations with constant coefficients arise in engineering applications.

CO4 Learn the applications of mean value theorems and Taylor's theorem.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	2	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	2	-	-	-

UNIT-I

Linear Algebra: Rank of a Matrix; Elementary transformations of a matrix; Gauss-Jordan method of finding the inverse; Normal form of a matrix, Consistency of linear System of equations: Rouche's theorem, System of linear Non-homogeneous equations, System of linear homogeneous equations; vectors; Eigen values; properties of Eigen values(without proofs); Cayley-Hamilton theorem (without proof).

[Sections: 2.7.1; 2.7.2; 2.7.6; 2.7.7; 2.10.1; 2.10.2; 2.10.3; 2.12; 2.13; 2.14; 2.15.]

UNIT-II

Differential Equations of first order: Definitions; Formation of a Differential equation; Solution of a Differential equation; Equations of the first order and first degree; variables separable; Linear Equations; Bernoulli's equation; Exact Differential equations; Equations reducible to Exact equations: I.F found by inspection, I.F of a Homogeneous equation, In the

equation M dx+ N dy = 0, $\frac{\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}}{N}$ is a function of x and $\frac{\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}}{M}$ is a function of y.

Applications of a first order Differential equations: Newton's law of cooling; Rate of decay of Radio-active materials.
[Sections: 11.1; 11.3; 11.4.1; 11.5; 11.6; 11.9; 11.10; 11.11; 11.12.1; 11.12.2; 11.12.4; 12.6; 12.8]

UNIT-III

Linear Differential Equations: Definitions; Theorem; Operator D; Rules for finding the complementary function; Inverse operator; Rules for finding the Particular Integral; Working procedure to solve the equation; Method of Variation of Parameters; Applications of Linear Differential Equations: Introduction, Oscillatory Electrical Circuits.
[Sections: 13.1; 13.2; 13.3; 13.4; 13.5; 13.6; 13.7;13.8.1;14.1;14.5].

UNIT-IV

Differential Calculus:
Mean Value Theorems: Rolle's theorem, Lagrange's mean value theorem with their geometrical interpretation. Cauchy's mean value theorem. Taylor's and Maclaurin theorems with remainders (without proof),Maclaurin's series, Expansion by use of known series, Taylor's series.
[4.3.1; 4.3.2; 4.3.3; 4.3.4; 4.4.1; 4.4.2; 4.4.3]

Text Books :
1. B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

References :
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

SEMICONDUCTOR PHYSICS AND TECHNOLOGY

I B. Tech. – I Semester (Code: 24DS102)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- This unit aim to build the interest on the concept of quantum mechanics and its importance to solve and evaluate the properties of materials (conductors and semiconductors)
- This unit provides various types of properties of semiconductor materials and their importance in various device fabrications
- This unit aim to educate the student on various opto-electronic devices and their applications.
- This unit provide information about the principles of processing, manufacturing and characterization of nano materials, nanostructures and their applications

Course Outcomes: At the end of this course, Students will be able to

CO1 Understand concepts of quantum mechanics and its applications to explain material properties

CO2 Know the concept of Fermi level and various semiconductor junctions.

CO3 Familiar with working principles of various opto-electronic devices and their applications.

CO4 Understand importance of nano-materials and their characteristic properties.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	2	2	-	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	2	2	-	-	-	-	2	-	-	-	-
CO4	3	-	-	2	2	-	-	-	-	2	2	-	-	-

UNIT-I

QUANTUM MECHANICS AND APPLICATIONS:

Schrodinger time independent wave equation, Applications: Particle in one dimensional box, Quantum Tunneling, Scanning Tunneling Microscope, Somerfield free electron theory: conductivity of metals and concept of Fermi level, Failure of quantum free electron theory (Qualitative), Band theory of solids (Kronig –Penny model), E-K diagrams, Effective mass, Concept of hole, Types of Electronic materials: Metals, Semiconductors and Insulators.

UNIT-II

SEMICONDUCTORS AND PROPERTIES: Introduction to semiconductors, intrinsic and extrinsic semiconductors, Direct and Indirect band gap semiconductors. Density of states, carrier concentration equations, Fermi level and temperature dependence, Drift and Diffusion currents, Continuity equation, P-N junction diode (V-I characteristics).

UNIT-III

OPTO-ELECTRONIC DEVICES AND DISPLAY DEVICES: Principle and working of LED, Semiconducting laser (Laser diode), Photo detectors: Photo diode, PIN & APD Diode,

Applications of Photo detectors, Photo voltaic effect, Solar cell, Efficiency of solar cell and applications, Types of liquid crystals, Liquid crystal display(LCD), Opto electric effect(Kerr effect), Magneto optic effect (Faraday Effect)

UNIT-IV

NANO MATERIALS: Introduction to nano technology, quantum confinement, surface to volume ratio, properties of nano materials, synthesis of nano-materials: CVD, sol-gel methods, laser ablation.

Carbon nano tubes: types, properties, applications. Characterization of nano materials: XRD, SEM, applications of nano materials.

Text Books :

1. A textbook of engineering physics by Avadhanulu and Kshirsagar S.Chand & Co. (2013)
2. Applied physics by Dr.*P.SrinivasaRao*. Dr.K.*Muralidhar*

References :

1. Text book on Nanoscience and Nanotechnology (2013): B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath and J. Murday, Springer Science & Business Media.
2. Opto electronics by T. Wilson, J.F.Hawkes, PHI

COMMUNICATIVE ENGLISH

I B. Tech. – I Semester (Code: 24DS103)

Lectures	2	Tutorial	0	Practical	0	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- to enhance the vocabulary competency of the students
- to enable the students to demonstrate proficiency in the use of written English, including proper spelling, grammar, and punctuation
- to enhance theoretical and conceptual understanding of the elements of grammar
- understand and apply the conventions of academic writing in English

Course Outcomes: At the end of this course, Students will be able to

CO1 Understand how to build academic vocabulary to enrich their writing skills
CO2 Produce accurate grammatical sentences
CO3 Analyse the content of the text in writing
CO4 Produce coherent and unified paragraphs with adequate support and detail

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO2	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO3	-	-	-	-	-	-	2	2	3	2	2	-	2	-
CO4	-	-	-	-	-	-	2	2	3	2	2	-	2	-

UNIT-I

1.1 **Vocabulary Development:** Word formation-Formation of Nouns, Verbs & Adjectives from Root words-Suffixes and Prefixes
1.2 **Essential Grammar:** Prepositions, Conjunctions, Articles
1.3 **Basic Writing Skills:** Punctuation in writing
1.4 **Writing Practices:** Mind Mapping, Paragraph writing (structure-Descriptive, Narrative, Expository & Persuasive)

UNIT-II

2.1 **Vocabulary Development:** Synonyms and Antonyms
2.2 **Essential Grammar:** Concord, Common Errors: Practice
2.3 **Basic Writing Skills**: Coherence in Writing: Jumbled Sentences
2.4 **Writing Practices**: Letter writing

UNIT-III

3.1 **Vocabulary Development:** One word Substitutes
3.2 **Essential Grammar:** Tenses, Modal Verbs, Voices
3.3 **Basic Writing Skills:** Using Phrases and clauses
3.4 **Writing Practices:** Note Making

UNIT-IV

4.1 **Vocabulary Development**: Words often confused
4.2 **Essential Grammar**: Reported speech, Common Errors: Practice

4.3 **Basic Writing Skills**: Sentence structures (Simple, Complex & Compound)
4.4 **Writing Practices**: Paraphrasing &Summarizing, Essay Writing

Text Books :

1. Communication Skills, Sanjay Kumar & Pushpa Latha. Oxford University Press: 2011.
2. Practical English Usage, Michael Swan. Oxford University Press: 1995.
3. Remedial English Grammar, F.T.Wood. Macmillan: 2007.
4. Study Writing, Liz Hamplyons & Ben Heasley. Cambridge University Press:2006

INTRODUCTION TO PROGRAMMING

I B. Tech. – I Semester (Code: 24DS104)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, and Arithmetic rules.
- Develop problem-solving skills to translate 'English' described problems into programs written using C language.
- Use conditional branching, looping and Arrays.
- Understand the concepts of functions and recursion in C.

Course Outcomes: At the end of this course, Students will be able to

CO1 Choose the right data representation formats based on the requirements of the problem and solve the mathematical problems using operators.

CO2 Solve problems which contain multiple decisions using else…if.

CO3 Work with lists and matrices using arrays.

CO4 Solve real time complex problems by decomposition using user defined functions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	-	1	-	1	-	-	-	-	-	-	3	2
CO2	-	1	3	2	1	1	-	-	-	-	-	-	2	1
CO3	-	1	2	3	-	1	-	-	-	-	-	-	2	2
CO4	2	1	1	2	-	1	-	-	-	-	-	-	2	1

UNIT-I

Introduction: Computers, Classification of Computers, Software Life Cycle, Algorithms, Flowcharts, Structured Programming, Compilers, Linker, Preprocessor, Standard Input and Output Devices, Popular Features of C.

Variables and Expressions: Introduction, Character Set, Identifiers and Keywords, Variables, Displaying Variables, Reading Variables, Characters and Character Strings, Qualifiers, typedef Statement, Promotion and Typecasting, Value-initialized Variables, Constants, const Qualifier, Operators and Expressions, Operator Precedence and Associativity, Programming Examples.

UNIT-II

Basic Input-Output: Introduction, Single Character Input-Output, String Input and Output, General Output, General Input, Types of Characters in Format Strings, scanf Width Specifier, Search Sets, Assignment Suppression Character, Format Specifiers for scanf, Input Fields for scanf, When scanf Stops Scanning, Programming Examples.

Control Structures: Introduction, if Statement, if-else Statement, Multi-way Decisions, Compound Statements, Loops - for Loop, while Loop, do-while Loop, break Statement, switch Statement, continue Statement, goto Statement, Programming Examples.

UNIT-III

Arrays and Strings: Introduction, How Arrays are Useful? Multidimensional Arrays, Strings, Arrays of Strings, Functions in string.h, Programming Examples.

Scope and Extent: Introduction, Scope, Extent.

UNIT-IV

Functions: Introduction, Function main, Where are Functions Useful? Functions Accepting More than One Parameter, User Defined and Library Functions, Concepts Associated with Functions (Review), Function Parameters, Return Values, Recursion, Comparison of Iteration and Recursion, Variable Length Argument Lists, Programming Examples.

Text Books :

1. Mastering C by K R Venugopal and Sudeep R Prasad McGraw -Hill Edition.

References :

1. Programming in ANSI C by E. Balaguruswamy, Fifth Edition.
2. Kernighan BW and Dennis Ritchie M, "C programming language", 2nd ed, Prentice Hall.
3. Yashavant P. Kanetkar, "Let us C", BPB Publications.
4. Ashok N.Kamthane, "Programming in C", PEARSON 2nd Edition.

ENGINEERING GRAPHICS

I B. Tech. – I Semester (Code: 24DSL101)

Lectures	1	Tutorial	0	Practical	3	Credits	2.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Clear picture about the importance of engineering graphics in the field of engineering
- The drawing skills and impart students to follow Bureau of Indian Standards
- To give an idea about Geometric constructions and orthographic projections
- Imagination skills about orientation of points, surfaces and solids
- Basic drafting skills of AutoCAD

Course Outcomes: At the end of this course, Students will be able to

CO1 Draw projections of points and projections of lines using Auto CAD
CO2 Plot projections of surfaces like circle, pentagon, hexagon and rhombus
CO3 Plot the Projections of solids like Prisms and pyramids
CO4 Convert the Isometric views into Orthographic views for simple objects.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	1	2	1	-	-	-	-	-	-	-	-	1	1	2
CO2	3	2	1	-	-	-	-	-	-	-	-	2	3	2
CO3	1	2	3	-	-	-	-	-	-	-	-	1	3	2
CO4	1	2	1	-	-	-	-	-	-	-	-	1	2	3

UNIT-I

INTRODUCTION: Introduction to Engineering drawing, geometrical constructions.

INTRODUCTION TO AUTOCAD: Advantages of AutoCAD over manual drafting, Basics of sheet selection, Draw tools, Modify tools, Dimensioning.

METHOD OF PROJECTIONS: Principles of projection, First angle and third angle projections, projections of points, projections of straight lines inclined to one plane only.

UNIT-II

PROJECTIONS OF PLANES: Projections of plane figures: circle, triangle, pentagon, hexagon and rhombus.

UNIT-III

PROJECTIONS OF SOLIDS: Projections of solids like square, pentagonal, hexagonal prisms and pyramids, axis inclined to one plane only.

UNIT-IV

ORTHOGRAPHIC PROJECTIONS: Conversion of pictorial views into Orthographic views. (Treatment is limited to simple castings only).

Text Books :

1. Engineering Drawing with AutoCAD by Dhananjay M. Kulkarni, Revised Edition, (PHI publication), 2018.
2. Engineering Drawing by N.D. Bhatt & V.M. Panchal, 43rd Edition,(Charotar Publishing House, Anand). (First angle projection) 2014.

References :

1. Engineering Drawing by Dhananjay A Jolhe, Revised Edition, Tata McGraw hill publishers,2019.

SEMICONDUCTOR PHYSICS LAB

I B.Tech – I Semester (Code: 24DSL102)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Basic experiments such as Magnetic Field Measurements, Hall Effect and LCR resonance give the knowledge to apply them in magnetic applications and circuits design.
- The measurements relating to various physical parameters of materials make the student to understand their utility, design and fabrication of several devices.
- The experiments like CRO, Solar Cell, Photocell provides the thorough understanding of Opto Electronic devices useful in Engineering and Industrial applications.
- Utilization of the principles of light such as interference and diffraction to measure wavelength and radius of curvature of Lenses.

Course Outcomes: At the end of this course, Students will be able to

CO1 Acknowledge the important aspects of earth magnetic field, realize the use of Maxwell's equations in various magnetic applications

CO2 Realization of material properties and parameters

CO3 Get hands-on experience in various opto-electronic devices like CRO, Solar Cell, Photo Cell and their applications

CO4 To apply the phenomenon of interference and LASER principles to find radius of curvature and wavelength respectively by various methods

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	2	-	-	-	2	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	2	2	-	-	-	-	-
CO3	3	3	2	2	2	-	-	2	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	2	-	-	-

LIST OF EXPERIMENTS

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. To study the variation of intensity of magnetic field along the axis of a circular coil using Stewart-Gee's apparatus.
3. To draw the characteristic curves of P-N Junction diode.
4. Determination of radius of curvature of a Plano convex lens by forming Newton's rings.
5. Determination of wavelengths of mercury spectrum using grating normal incidence method.
6. To draw the characteristic curves of Zener diode.
7. To draw the resonant characteristic curves of L.C.R. series circuit and calculate the Resonant frequency.
8. To draw the characteristic curves of a photocell and calculate the maximum velocity of electron.
9. Verify the laws of transverse vibration of stretched string using Sonometer.

10. Determination of rigidity modulus of the given material of the wire using Torsional pendulum.
11. To draw the load characteristic curves of a solar cell.
12. Determination of Hall coefficient of a semiconductor.
13. Determination of voltage and frequency of an A.C. signal using C.R.O.
14. Determination of Forbidden energy gap of Si &Ge.
15. Determination of wavelength of laser source using Diode laser.
16. To draw the characteristic curves of Photo diode.
17. To draw the Diode valve characteristics.

Any three experiments are virtual

Note: A minimum of **ten (10 no.)** experiments to be done and recorded

ENGLISH COMMUNICATION SKILLS LAB

I B.Tech – I Semester (Code: 24DSL103)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- To comprehend the importance, barriers and strategies of listening skills in English.
- To illustrate and impart practice Phonemic symbols, stress and intonation.
- To practice oral skills and receive feedback on learners' performance.
- To practice language in various contexts through pair work, role plays, group work and dialogue conversations

Course Outcomes: At the end of this course, Students will be able to

CO1 Better understand the nuances of English language through audio- visual experience and group activities

CO2 Develop neutralization of accent for intelligibility

CO3 Build confidence to enhance their speaking skills

CO4 Use effective vocabulary both in formal and informal situations

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO2	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO3	-	-	-	-	-	-	-	2	3	-	2	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	2	-	-	-

LIST OF EXPERIMENTS

Unit-I

1.1 Introduction to Communication Skills- Importance-Process-Types
1.2 Barriers to Communication & Strategies for effective Communication
1.3 Listening Skills; Importance – Purpose- Process- Types
1.4 Barriers to Listening & Strategies for Effective Listening

Unit-II

2.1 Phonetics; Introduction to Consonant, Vowel and Diphthong sounds
2.2 Syllable & Stress
2.3 Rhythm & Intonation

Unit-III

3.1 Interpersonal Communication in English
3.2 Conversational Practice in English

Unit-IV

4.1 JAM Session
4.2 Debates

Text Books :

1. Communication Skills, Sanjay Kumar and Pushpa Lata. Oxford University Press. 2011
2. Better English Pronunciation, J.D. O' Connor. Cambridge University Press:1984
3. New Interchange (4rth Edition), Jack C Richards. Cambridge University Press:2015
4. English Conversation Practice, Grant Taylor. McGraw Hill:2001

References :

1. iTell Orell Digital Lab
2. Buzzers for conversations, New Interchange series

INTRODUCTION TO PROGRAMMING LAB

I B.Tech – I Semester (Code: 24DSL104)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, Arithmetic rules.
- Develop problem-solving skills to translate "English" described problems into Programs written using C language.
- Use Conditional Branching, Looping, and Functions.
- Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, Arithmetic rules.

Course Outcomes: At the end of this course, Students will be able to

CO1	Choose the right data representation formats based on the requirements of the problem and solve the mathematical problems using operators.
CO2	Solve problems which contain multiple decisions using else…if.
CO3	Work with lists and matrices using arrays.
CO4	Solve real time complex problems by decomposition using user defined functions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	1
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO4	2	1	2	-	-	-	-	-	-	-	-	-	2	1

LIST OF EXPERIMENTS

1. a) Write a C program to demonstrate the use of printf statement to print values of variables of different data types.
   b) Write a C program to demonstrate the use of printf and scanf statements to read and print values of variables of different data types.
2. Write a C program to perform addition, subtraction, multiplication, division and modulo division on two integer numbers.
3. Write a C program for electricity bill tacking different categories of users, different slabs in each category. (using nested if else statement).
4. Write a C program to evaluate the following using loops
   a)1+x2/2!+x4/4!+...upto 5 terms
   b) x+x3/3!+x5/5!+...upto 5 terms
5. Write a C program to check whether the given number is
   a) Prime or not
   b) Perfect or abundant or deficient

6. Write a C program to print the following patterns

   i)
   ```
   1
   12
   123
   1234
   ```

   ii)
   ```
   1
   1 2 1
   1 2 3 2 1
   1 2 3 4 3 2 1
   ```

7. Write a C program to find the mean, mode, median, and variance of list of values by using one dimensional array.
8. Write a menu driven program to read a list of numbers and perform the following operations
   a) Print the list
   b) Delete duplicates from the list
   c) Reverse the list
9. Write a program to read a list of numbers and search for given number using binary search algorithm and if found display its index otherwise display the message "element not found in the list" using functions.
10. Write a menu driven program to read two matrices and compute their sum and product using functions.
11. Write a menu driven program to read list of student names and perform the following operations using functions.
    a) To print list of names
    b) To sort them in ascending order
    c) To print the list after sorting
12. Write a c program that consists of recursive functions to find
    a) Factorial of a given number
    b) Solve towers of Hanoi with three towers (A,B,C) with three towers initially on tower

IT WORKSHOP

I B.Tech – I Semester (Code: 24DSL105)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Introduce the internal parts of a computer, peripherals, and I/O ports.
- Demonstrate configuring the system with Windows Operating System and other Application Software's.
- Introduce Office tools such as Word processors, Excel and Presentation tools.
- Demonstrate AI tools such as ChatGPT, Dialogflow.

Course Outcomes: At the end of this course, Students will be able to

CO1	Explore computer system peripherals and components of a mother board and evaluate computer system architectures.
CO2	Troubleshoot a computer system.
CO3	Prepare a PPT, Certificate and Calculate GPA and Generate a report using Mail merge.
CO4	Implement AI Solutions in their respective engineering branches.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	3	1	-
CO3	-	2	-	-	-	-	-	-	-	-	-	3	1	-
CO4	-	-	3	1	3	-	-	-	-	-	-	3	2	-

LIST OF EXPERIMENTS

1. Explore Peripherals of a Computer, Components of a motherboard and its functions.
2. Install and Uninstall System and Application software on a Computer.
3. Disassemble and Assemble the PC.
4. Troubleshoot a computer.
5. Prepare the following using MS office:
   i) PPT using MS-Power Point.
   ii) Design a Project Certificate and Newsletter using MS-Word
6. Implement the following using Excel:
   i) Create an Excel Work sheet for the six subjects and calculate Total, Average, Grade and Rank.
   ii) Merge the contents of two excel sheets using VLOOKUP and sort them.
7. Generating reports using Mail Merge.
8. Prepare a report using Latex or equivalent (FOSS) tool word as word Processors.
9. Prompt Engineering in Chat GPT.
10. Develop a simple AI Chatbot.

References :

1. "IT Essentials PC Hardware and Software Companion Guide", by David Anfinson and Ken Quamme, Third edition, CISCO Press, Pearson Education, 2008, ISBN: 978-1-58713-199-8.
2. "LaTeX Companion" by Frank MittelBach, Ulrike Fischer, Third Edition, Addison-Wesley Professional, 2023. ISBN: 978-0138166489.
3. "ChatGPT: Comprehensive Study On Generative AI Tool " by Midhun Moorthi C, Dr. K. Vimala Devi, Dr. V. Manjula, Tareek Pattewar, First Edition, AG Publishing House,2023, ISBN: 978-81-19338-79-5

NUMERICAL METHODS AND ADVANCED CALCULUS

I B. Tech. – II Semester (Code: 24DS201)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Solve algebraic, transcendental and system of linear equations with the help of numerical methods.
- Apply the techniques of numerical integration whenever and wherever routine methods are not applicable and solve the first order ordinary differential equations numerically with the given initial condition using different methods.
- Evaluate double and triple integrals and apply them to find areas and volumes.
- Evaluate the line, surface and volume integrals and learn their inter-relations and applications.

Course Outcomes: At the end of this course, Students will be able to

CO1 Solve non-linear equations and system of linear equations with the help of Numerical techniques.

CO2 Solve the first order ordinary differential equations numerically with the given initial condition.

CO3 Find the area and volume of plane and three dimensional figures using multiple integrals.

CO4 Apply vector integral theorems to obtain the solutions of engineering problems involving circulation, flux, and divergence in vector fields.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	2	-	-	-

UNIT-I

Numerical Solution of Equations: Introduction; Solution of algebraic and transcendental equations: Bisection method, Method of false position, Newton-Raphson method; Useful deductions from the Newton-Raphson formula; Solution of linear simultaneous equations; Direct methods of solution: Gauss-Jordan method, Factorization method; Iterative methods of solution: Jacobi's iteration method, Gauss-Seidel iteration method.
[Sections: 28.1; 28.2; 28.3; 28.5; 28.6.2, 28.6.3; 28.7.1; 28.7.2].

UNIT-II

Finite differences and Interpolation: Finite differences: Forward differences, Backward differences; Newton's interpolation formulae: Newton's forward interpolation formula; Newton's backward interpolation formula; Interpolation with unequal intervals; Lagrange's interpolation formula; Divided differences; Newton's divided difference formula; Numerical integration; Trapezoidal rule; Simpson's one-third rule; Simpson's three-eighth rule;

Numerical solution of ODE's: Introduction; Euler's method; Runge-Kutta method.
[Sections: 29.1.1; 29.1.2; 29.6; 29.9; 29.10; 29.11; 29.12; 30.4; 30.6; 30.7; 30.8; 32.1; 32.4; 32.7].

UNIT-III

Multiple Integrals: Double integrals; Change of order of integration; Double integrals in polar coordinates; Area enclosed by plane curves; Triple integrals; Volumes of solids: Volume as Triple integral, Change of variables: For triple integrals.
[Sections: 7.1; 7.2; 7.3; 7.4; 7.5; 7.6.2; 7.7.2].

UNIT-IV

Vector calculus and its Applications: Scalar and vector point functions; Del applied to scalar point functions-Gradient: Definition, Directional derivative; Del applied to vector point functions: Divergence, Curl; Line integral; Surfaces: Surface integral, Flux across a surface; Green's theorem in the plane (without proof); Stokes theorem (without proof); Gauss Divergence theorem (without proof).
[Sections: 8.4; 8.5.1; 8.5.3; 8.6; 8.11; 8.12.2; 8.12.3; 8.13; 8.14; 8.16]

Text Books :
1. B.S.Grewal, "Higher Engineering Mathematics", 44th edition, Khanna publishers, 2017.

References :
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

ENGINEERING CHEMISTRY

I B. Tech. – II Semester (Code: 24DS202)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- To familiarize importance of usage of various polymers and fuels in household & industry
- Outline the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
- To impart the concept of soft and hard waters, softening methods of hard water and various instrumental methods of analysis of samples.
- Outline the basics of some advanced concepts like computational chemistry, nanomaterials and liquid crystals.

Course Outcomes: At the end of this course, Students will be able to

CO1 Explain the preparation, properties, and applications of plastics, elastomers and biodegradable polymers also to explain calorific value, characteristics and applications of conventional and alternative fuels.

CO2 Apply the knowledge of electrochemistry for understanding the working of electrodes and electrochemical energy systems, as well as corrosion theories and protection methods.

CO3 Analyse the methods to produce soft water for industrial use and potable water by economical means and study the principles of different analytical techniques and their applications.

CO4 Demonstrate the knowledge of computational chemistry, and applications of advanced materials in engineering.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	-	-	2	-	-	-	-	2	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	3	2	-	2	-	-	-	-	3	-	-	-
CO4	3	3	2	3	3	-	-	-	-	-	2	-	-	-

UNIT-I

Polymers and Fuel Chemistry: Introduction to polymers, functionality of monomers. Thermoplastics and Thermo-setting plastics- Preparation, properties and applications of PVC and Bakelite.

Biodegradable polymers- Preparation, properties and applications of PHB and PHBV

Elastomers-Preparation, properties and applications of Buna S and Buna N

Fuels-Types of fuels, calorific value of fuels-determination by Bomb calorimeter, Liquid Fuels-refining of petroleum, Knocking, Octane and Cetane number, Flue gas analysis by Orsat's apparatus, Introduction to alternative fuels-methanol, ethanol and bio fuel-bio diesel (preparation and applications).

UNIT-II

Electrochemical Cells and Corrosion: Single electrode potential, Reference electrodes-construction and working of standard hydrogen electrode and calomel electrode; Batteries (Li

ion battery and zinc air cells), fuel cells (H2-O2, and molten carbonate). Electrochemical sensors-potentiometric sensors and amperometric sensors with examples.
Corrosion-Definition, theories of corrosion (chemical and electrochemical), Types of corrosion-galvanic corrosion, differential aeration corrosion, stress corrosion, factors influencing rate of corrosion, corrosion control (cathodic protection), Protective coatings-electroplating (Gold) and electroless plating (nickel).

UNIT-III

Water Technology: Soft and hard water, Estimation of hardness of water by EDTA Method-numerical problems, Boiler troubles-Priming, foaming, scale and sludge, Caustic embrittlement, Specifications for drinking water- World health organization (WHO) standards, Industrial water treatment- Ion-exchange process, desalination of brackish water by reverse osmosis (RO) and electro dialysis.
Instrumental Methods of Analysis: Electromagnetic spectrum-UV (Principle, instrumentation, and applications), FT-IR (Principle, instrumentation, and applications), magnetic resonance imaging and CT scan (procedure and applications).

UNIT-IV

Organic reactions and synthesis of a drug molecule
Computational chemistry: Introduction to computational chemistry, and docking studies
Semiconductors-Introduction, basic concept, Types-Intrinsic & Extrinsic Semiconductors, applications.
Nano materials: Introduction, classification of nano materials, engineering applications, properties and applications of Carbon nano tubes and Graphenes nanoparticles.
Liquid crystals: Introduction, liquid crystalline displays (LCD)-applications. Polymers for light emitting diodes (LEDs)-Introduction, classification of polymer LEDs, Organic LEDs-their commercial uses.

Text Books :
1. P.C. Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi 17th edition (2017).
2. Seshi Chawla, "Engineering Chemistry" DhanpatRai Pub, Co LTD, New Delhi 13 th edition, 2013.
3. S.S. Dara, "A Textbook of Engineering Chemistry", S.Chand & Co, (2010).

References :
1. Engineering Chemistry by K. Maheswaramma, Pearson publishers 2015.
2. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition
3. B. S. Murthy, P. Shankar and others, "Textbook of Nanoscience and Nanotechnology", University press (latest edition)
4. CNR Rao and JM Honig (Eds) "Preparation and characterization of materials" Academic press, New York (latest edition)

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

I B. Tech. – II Semester (Code: 24DS203)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics, Physics and Chemistry

Course Objectives:

- **Develop** a comprehensive understanding of basic electrical circuit principles, including the analysis of DC and AC circuits using laws and theorems.
- **Analyze** the construction, working principles, and applications of various electrical machines like DC machines, transformers, and AC machines.
- **Comprehend** the fundamental properties and applications of semiconductor materials and devices, focusing on diodes and their practical uses.
- **Acquire** proficiency in the operation and applications of transistors and operational amplifiers in electronic circuits, including their use in amplification and switching.

Course Outcomes: At the end of this course, Students will be able to

CO1 **Solve** and analyze basic DC and AC electrical circuits using fundamental laws and theorems.

CO2 **Explain** the construction, operation, and applications of different types of electrical machines.

CO3 **Acquire** an understanding of semiconductor materials and devices and their practical applications in electronic circuits.

CO4 **Illustrate** and analyze basic electronic circuits involving transistors (BJTs and MOSFETs) and operational amplifiers.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	-	-	-	-	-	-	2	3	-	-
CO2	3	3	2	2	-	-	-	-	-	-	2	3	-	-
CO3	3	3	2	1	-	-	-	-	-	-	2	3	-	-
CO4	3	3	3	1	-	-	-	-	-	-	2	3	-	-

UNIT-I

Basic Definitions: Electric charge, Current, Voltage, Power, and Energy, Ohm's Law

DC Circuits: Series and Parallel Circuits their Characteristics and analysis, Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL), Simple problems on circuit analysis. Thevenin's, Norton's and Superposition theorem.

AC Fundamentals: Alternating Current (AC) and Voltage, Peak, RMS, and Average values of AC, form and peak factors, Phasors and phase relationships in AC circuits. AC excitation to R, L, C and their combination (series and parallel), Impedance and Power triangle.

3-Phase circuits: Star and Delta connections, relation between line and phase values of currents and voltages with derivations.

UNIT-II

DC Machines: Construction and working of DC generator and its emf equation. Types of DC generators. Open circuit characteristic of DC shunt generator. Construction and working of DC motor and its torque equation, load test on DC shunt motor. Applications of DC machines.

Transformers (AC non-rotating): Construction and working of Transformer, Types of transformers, Transformer emf equation, losses and efficiency, Regulation, load test on transformer, Applications.

AC Machines (AC rotating): Induction Motors: Construction and working of single-phase induction motor. Capacitors start single phase induction motor.

Synchronous Machines: Construction and working of Alternator, Construction and working of Synchronous motor and their applications.

UNIT-III

Diodes and Applications: Difference between Conductors, Insulators, and Semiconductors-Intrinsic and Extrinsic Semiconductors-N-type and P-type semiconductors.

PN Junction Diode: Construction, working, and VI characteristics.

Zener Diode: Construction, working, and VI characteristics, Its application as voltage regulator.

Rectifiers: Half-wave and Full-wave rectifiers, working principles, and efficiency

UNIT-IV

Transistors: Bipolar Junction Transistor (BJT): Construction, operation, and characteristics in Common Emitter, Common Base, and Common Collector configurations. MOSFET Construction, working principle, characteristics, and applications as amplifier and as switch.

Operational Amplifiers (Op-Amps): Characteristics and parameters, Inverting and Non-inverting Amplifiers, Summing amplifier, Difference amplifier, Integrator, Differentiator with their Circuit diagrams, formulas, and applications.

Text Books :

1. S.K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Publications, Second Edition.
2. V.K. MEHTA, ROHIT MEHTA, "BASIC ELECTRICAL ENGINEERING", S.Chand Publishers, Sixth edition.
3. V.K. MEHTA, ROHIT MEHTA, "PRINCIPLES OF ELECTRONICS" S.Chand Publishers, 11th edition.

References :

1. Nagsarkar T K and Sukhija M S, "Basics of Electrical and Electronics Engineering", Oxford press University Press, 3rd edition.
2. T. Thyagarajan,K.P. Sendur Chelvi, T.R. Rangaswamy, "Electrical, Electronics And Computer Engineering" by , New Age International (P) Ltd., Publishers.
3. PV Prasad, S.Sivanagaraju "Electrical Engineering Concepts and Applications"Cenage Publishers, 1st Edition.

PROGRAMMING FOR PROBLEM SOLVING

I B. Tech. – II Semester (Code: 24DS204)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Introduction to Programming(24DS104)

Course Objectives:

- Understand and apply pointers in C for memory management and manipulation, including arrays, strings, functions, and structures.
- Learn file handling, dynamic memory allocation, and object-oriented programming concepts, including classes, inheritance, and polymorphism.
- Learn to define and use classes and objects, including access control, member functions, and overloading in C++.
- Implement operator overloading and various forms of inheritance in C++.

Course Outcomes: At the end of this course, Students will be able to

CO1 Effectively use pointers for advanced data handling, perform pointer arithmetic, and manipulate structures and unions in C.

CO2 Manage files, allocate memory dynamically, and apply object-oriented principles like inheritance and polymorphism in programming.

CO3 Create and manage classes and objects, implement constructors and destructors, and use function overloading and inline functions effectively.

CO4 Overload operators and use different inheritance types, including abstract, multilevel, multiple, hierarchical, and hybrid inheritance.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	-	1	-	1	-	-	-	-	-	-	3	2
CO2	-	1	3	2	1	1	-	-	-	-	-	-	2	1
CO3	-	1	2	3	-	1	-	-	-	-	-	-	2	2
CO4	2	1	1	2	-	1	-	-	-	-	-	-	2	1

UNIT-I

Pointers: Introduction, Definition and Uses of Pointers, Address Operator &, Pointer Variables, Dereferencing Pointers, void Pointers, Pointer Arithmetic, Pointers to Pointers, Pointers and Arrays, Passing Arrays to Functions, Pointers and Functions, Accessing Arrays Inside Functions, Pointers and Two-dimensional Arrays, Array of Pointers, Pointer Constants, Pointers and Strings, Pointers in Standard String Library Functions, Two-dimensional Array of Characters, Array of Pointers to Strings, More String Library functions, Pointers to Functions.

Structures and Unions: Introduction, Declaring and Using Structures, Structure Initialization, Structure within Structure, Operations on Structures, Array of Structures, Array within Structure, Creating User Defined Data Types, Pointers to Structures, Pointers within Structures, Structures and Functions, Unions, Differences between Structures and Unions, Operations on A union, Scope of A union, Bit Fields in Structures.

UNIT-II

Files: Introduction, End of File, File-handling Functions, File Types, Unbuffered and Buffered Files, Error Handling.

Dynamic Memory Allocation: Introduction, Library Functions for Dynamic Memory Allocation.

Object-Oriented Paradigm: Why new Programming Paradigms?, Evolution of Programming Paradigms, Objects, Classes, Inheritance, Polymorphism, Streams based I/O, Scope Resolution Operator, Variable Definition at the Point of Use, Type Conversion.

UNIT-III

Classes and Objects: Introduction, Class Specification, Class Objects, Accessing Class Members, Defining Member Functions, Outside member functions as inline, Accessing member functions within the Class, Data hiding, Passing objects as arguments, Returning objects from functions, Friend functions and Friend classes, Static data and member functions, Constructors, Destructors.

Overloading: Introduction, Parameters Passing by Reference, Inline Functions, Function Overloading.

UNIT-IV

Operator Overloading: Introduction, Overloadable Operators, Unary Operator Overloading, operator Keyword, Operator return values, Binary Operator Overloading, Arithmetic Operator Overloading, Concatenation of strings, Comparison Operators, Arithmetic Assignment Operators, Overloading with friend functions, Assignment operator Overloading.

Inheritance: Introduction, Derived class declaration, forms of inheritance, inheritance and member accessibility, Constructors in derived classes, Destructors in derived classes, abstract classes, multilevel inheritance, multiple inheritance, hierarchical inheritance, hybrid inheritance, object composition-delegation.

Text Books :

1. "Programming with C" by Byron Gottfried, Second Edition, Schaum's Outline Series, McGraw-Hill.
2. "Programming with C++" by John R. Hubbard, Second Edition, Schaum's Outline Series, McGraw-Hill.

References :

1. Nagsarkar T K and Sukhija M S, "Basics of Electrical and Electronics "Programming in ANSIC" by E. Balaguruswamy, Fifth Edition, McGraw Hill Education India.
2. "Let us C" by Yashavant P.Kanetkar, 14th Edition, BPB Publications.
3. Kernighan BW and Dennis Ritchie M, "C programming language", 2nd edition, Prentice Hall.

DISCRETE MATHEMATICS

I B. Tech. – II Semester (Code: 24DS205)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Understand operations on discrete structures such as sets, functions, and relations. Formulate short proofs using methods of proof of an implication. Verify the correctness of an argument using propositional logic and truth tables. Construct mathematical arguments using logical connectives and quantifiers.
- Verify the correctness of an argument using rules of inference for quantified propositions. Apply algorithms and use definitions to solve problems to prove statements in elementary number theory. Understand counting and indirect counting techniques and combinatory in the context of discrete probability.
- Understand sequences, generating functions, and recurrence relations. Understand and compute coefficients for generating functions. Understand and solve homogeneous recurrence relations.
- Understand and solve Inhomogeneous recurrence relations. Understand the properties of binary relations, partial orderings and lattices. Construct graphs and adjacency matrices for binary relations.

Course Outcomes: At the end of this course, Students will be able to

CO1 Understand the basic principles of sets, relations, functions and inference rules for validating arguments.

CO2 Prove that the given statement is valid by using mathematical induction and utilize a variety of counting strategies to solve computational problems.

CO3 Discuss different methods for solving different types of recurrence relations.

CO4 Understand various operations and representations of a binary relation.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-

UNIT-I

Foundations: Sets, Relations and Functions, Fundamentals of Logic, Logical Inferences, Methods of Proof of an implication, First order Logic & Other methods of proof.

UNIT-II

Rules of Inference for Quantified propositions, Mathematical Induction.

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Permutation with Constrained repetitions.

UNIT-III

Recurrence relations: Generating functions of sequences, Calculating Coefficients of Generating Functions

Recurrence Relations: Solving recurrence relations by Substitution and generating functions, The methods of characteristic roots.

UNIT-IV

Recurrence Relations: solutions of Inhomogeneous recurrence relations.

Relations: Special properties of binary relations, Operations on relation. Ordering relations, Lattice, Paths and Closures, Directed Graphs and Adjacency Matrices.

Text Books :

1. Toe L.Mott, Abraham Kandel &Theodore P.Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", PHI 2nd edition, 2012.

References :

1. C.L. Liu, "Elements of Discrete Mathematics", McGraw-Hill Education, 2nd edition.
2. Rosen, "Discrete Mathematics", McGraw-Hill Education, 8th edition.

ENGINEERING MECHANICS AND SURVEYING LAB

I B.Tech – II Semester (Code: 24DSL201)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basics of Mathematics & Physics

Course Objectives:

- The course aims to equip students with the fundamental principles and techniques necessary to solve problems related to forces and supports in engineering mechanics.
- The course is designed to provide students with a thorough understanding of frictional forces and their applications in engineering mechanics.
- The course is designed to provide students with the essential skills and knowledge to analyze truss structures.
- The course aims to provide students with a deep understanding of rotational dynamics and the principles governing the motion of rigid bodies.
- The course aims to provide students with the fundamental skills and techniques required for various surveying methods in civil engineering.

Course Outcomes: At the end of this course, Students will be able to

CO1 Utilize the Parallelogram Law, Triangle Law, and Polygon Law to determine the resultant of concurrent forces. Apply Varignon's Principle to find the magnitude and position of the resultant force in a system. Calculate support reactions for beams subjected to transverse loads using principles of equilibrium. Calculate the geometric center (centroid) of various lamina shapes through integration and composite area methods.

CO2 Determine the coefficient of static friction between a block and a rough surface under horizontal force. Calculate the angle of inclination at which a block just starts to slide down an inclined plane and Determine the axial forces in truss members using the method of joints.

CO3 Experimentally determine and verify the angular acceleration of a rolling disc on an inclined plane. Calculate the moment of inertia of a flywheel through experimental procedures.

CO4 Perform a cross-staff survey to determine the area of a plot. Determine the elevation difference between two points and the height of the ceiling of a building using leveling techniques. Determine the horizontal distance between inaccessible points and the height of an object using a theodolite.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	-	2	-	-	-	-	1	-	2	3	3	3
CO2	3	3	-	2	-	-	-	-	1	-	2	3	3	3
CO3	3	3	-	2	-	-	-	-	1	-	2	3	3	3
CO4	3	3	-	2	-	-	-	-	1	-	2	3	3	3

LIST OF EXPERIMENTS

FORCE SYSTEM: Force – characteristics of force – system of forces – moment of a force - laws of forces – supports and their reactions, Centroid – determination of centroid for plane figures. (2)

List of experiments

1. Determination of the magnitude of the resultant force using a) Parallelogram law and b) Triangle law c) Polygon law
2. Determination of the magnitude of the resultant force using Varignon's principle.
3. Determination of the support reactions for a beam subjected to transverse loads.
4. Determination of the geometric center of different lamina.

FRICTION: Friction–laws of friction – coefficient of friction – angle of repose. (2)

List of experiments

5. Determination of the coefficient of static friction between the block and rough surface when the block is subjected to horizontal force.
6. Determination of the angle of inclination at which a block just starts to slide down an inclined plane.

ANALYSIS OF TRUSS: Truss – Method of analysis. (2)

List of experiments

7. Determination of the axial forces in the truss members.

MASS MOMENT OF INERTRIA & ROTATION OF A RIGID BODY ABOUT A FIXED AXIS: Area moment of inertia – mass moment of inertia – Relation between mass and area moment of inertia, Kinematics of rotation – Equation of motion for a rigid body rotating about a fixed axis – D'Alembert's principle. (3)

List of experiments

8. Verification of angular acceleration of a rolling disc on an inclined plane.
9. Determination of the moment of inertia of flywheel.

SURVEYING: Surveying – principles of surveying – chain surveying – theodolite surveying – leveling. (5)

List of experiments

10. Determination of the area of a plot using cross - staff survey.
11. Determination of the elevation difference between two points using leveling and height of ceiling of a building.
12. Determination of the horizontal distance between inaccessible points using theodolite.
13. Determination of the height of an object using theodolite.

ENGINEERING CHEMISTRY LAB

I B.Tech – II Semester (Code: 24DSL202)

Lectures	0	Tutorial	0	Practical	2	Credits	1
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- To familiarize students with practical chemical analysis techniques for determining key water quality parameters.
- To provide hands-on experience in performing volumetric and instrumental titrations to understand their chemical principles and applications.
- To develop proficiency in using laboratory equipment, following safety protocols, and accurately conducting experiments.
- To teach students the synthesis of common organic compounds and their characterization techniques.

Course Outcomes: At the end of this course, Students will be able to

CO1	Determine water quality parameters such as alkalinity and hardness.
CO2	Conduct volumetric titrations to estimate the concentration of chemical substances.
CO3	Apply instrumental methods such as pH metry and conductometry for titration experiments and colorimetry for verification of Beers law.
CO4	Synthesize and characterize common organic compounds like soap, resins, and aspirin.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	3	-	3	-	-	-	-	2	-	-	-
CO2	3	3	2	2	-	3	-	-	-	-	2	-	-	-
CO3	3	3	2	3	3	-	-	-	-	-	2	-	-	-
CO4	2	-	-	3	-	2	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Determination of Alkalinity of Tap water.
2. Determination of Total Hardness of ground water sample by EDTA method
3. Estimation of Mohr's salt by Permanganometry.
4. Estimation of Active Chlorine Content in Bleaching Powder
5. pH metric titration between strong acid and strong base.
6. Conductometric Titrations between Strong acid and strong base.
7. Verification of Beers Law using potassium permanganate by colorimetry.
8. Preparation of Soap.
9. Preparation of Urea-formaldehyde resin
10. Preparation of Aspirin.

Text Books :

1. Practical Engineering Chemistry by K.Mukkanti, Etal, B.S. Publicaitons, Hyderabad, 2009.
2. Inorganic quantitative analysis, Vogel, 5th edition, Longman group Ltd. London, 1979.

References :

1. Text Book of engineering chemistry by R.n. Goyal and HarrmendraGoel.
2. A text book on experiments and calculations- Engineering Chemistry. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

I B.Tech – II Semester (Code: 24DSL203)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Enable students to verify and apply basic electrical laws and theorems
- Equip students with practical skills to conduct experiments on electrical machines
- Provide students with hands-on experience in analyzing the V-I characteristics of semiconductor devices and their applications
- Develop students' abilities to analyze and characterize the operations transistor, MOSFET and Op-Amps.

Course Outcomes: At the end of this course, Students will be able to

CO1 Verify and apply basic network theorems Theorem through practical experimentation, thereby gaining a deep understanding of circuit analysis techniques.

CO2 Demonstrate the ability to perform experiments on electrical machines and interpret their operational characteristics and performance metrics.

CO3 Analyze the V-I characteristics of diodes, and understand their roles in rectifier circuits and enhancing their understanding of semiconductor behavior in practical applications.

CO4 Characterize the performance of BJTs, MOSFETs and designing and analyzing operational amplifier circuits to prepare them for advanced electronic circuit design.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	3	-	-	-	3	2	-	1	3	-	-
CO2	3	3	2	3	-	-	-	3	2	-	1	3	-	-
CO3	3	3	2	3	-	-	-	3	2	-	1	3	-	-
CO4	3	3	2	3	-	-	-	3	2	-	1	3	-	-

LIST OF EXPERIMENTS

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Parameters of choke coil
6. Open Circuit Characteristics of DC Shunt Generator
7. Load Test on DC Shunt Motor
8. Load Test on Transformer
9. V-I characteristics of PN junction Diode
10. V-I characteristics of Zener Diode
11. Half-Wave Rectifier
12. Full-Wave Rectifier

13. Characteristics of BJT in Common Emitter Configuration
14. Characteristics of MOSFET
15. Summing and Difference Amplifiers using Op-Amps

Note: Minimum 10 experiments should be carried.

PROGRAMMING FOR PROBLEM SOLVING LAB

I B.Tech – II Semester (Code: 24DSL204)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Introduction to Programming(24DS104)

Course Objectives:

- Understand and apply pointers in C for memory management and manipulation, including arrays, strings, functions, and structures.
- Learn file handling, dynamic memory allocation, and object-oriented programming concepts, including classes, inheritance, and polymorphism.
- Learn to define and use classes and objects, including access control, member functions, and overloading in C++.
- Implement operator overloading and various forms of inheritance in C++.

Course Outcomes: At the end of this course, Students will be able to

CO1 Effectively use pointers for advanced data handling, perform pointer arithmetic, and manipulate structures and unions in C.

CO2 Manage files, allocate memory dynamically, and apply object-oriented principles like inheritance and polymorphism in programming.

CO3 Create and manage classes and objects, implement constructors and destructors, and use function overloading and inline functions effectively.

CO4 Overload operators and use different inheritance types, including abstract, multilevel, multiple, hierarchical, and hybrid inheritance.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO2	2	3	2	-	-	-	-	-	-	-	-	-	2	1
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO4	2	1	2	-	-	-	-	-	-	-	-	-	2	1

LIST OF EXPERIMENTS

1. Write C programs for the following using pointers and functions:
   a) Declare the array of 20 integer numbers. Find and display the average of only even numbers by using pointers.
   b) Write a program to reverse the string using pointers.
   c) Calculate the addition of two 4 X 4 matrices using pointers. Take the input from user.

2. A Bookshop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book the sales person inputs the title and the author, and the system searches the list and displays whether it is available or not. If it is not, an appropriate message is displayed, if it is, then the system displays the book details and request for the number of copies required, if the requested copies are available the total cost of the requested copies is displayed otherwise the message "required copies not in stock" is displayed. Write a program for the above in structures with suitable functions.

3. Write a program in C to merge two files and write them to another file.

4. Write a C program to read a data file of students' records with fields (Regno, Name, M1, M2, M3, M4, M5) and write the successful students data (percentage > 40%) to a data file.

5. Write a C++ program with a class to represent a bank account. Include the following members: Data Members – 1. Name of the depositor 2. Account Number 3. Type of account 4. Balance amount in the account.
   Member function – 1. To assign initial values 2. To deposit an amount 3. To withdraw an amount after checking the balance 4. To display name and Balance.

6. Create a class called 'TIME' that has
   - three integer data members for hours, minutes and seconds
   - constructor to initialize the object to zero
   - constructor to initialize the object to some constant value
   - member function to add two TIME objects
   - member function to display time in HH:MM:SS format
   Write a main function to create two TIME objects, add them and display the result in HH:MM:SS format.

7. Write a C++ program to illustrate static member functions.

8. Write a C++ program to implement function overloading in order to compute power(m,n) where i) m is double and n is int ii) m and n are int. Use a default value of 2 for n to make the function to calculate squares when this argument is omitted.

9. Create a 'STRING' class which overloads '==' operator to compare two STRING objects using a) friend function b) without using friend function.

10. Write a C++ program to overload '++' and '--'operators to convert a string to uppercase and lowercase respectively.

11. Write a C++ program on Composition.

12. Write a C++ program on Inheritance.

PROBABILITY & STATISTICS

II B. Tech. – III Semester (Code: 24DS301)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives:

- Apply the continuous probability densities to various problems in science and engineering.
- Estimate the point and interval estimators of the mean, variance and proportion for the given Sample data and apply Z-test, t-test to various real-life problems
- Apply various sample tests like F-test and $\chi 2$ -test for decision making regarding the population based on sample data.
- Compute the level of correlation, the best fit curve to the given data by the method of least squares and also perform ANOVA arising in the field of engineering.

Course Outcomes: At the end of this course, Students will be able to

CO1	Apply discrete and continuous probability distributions to various problems arising in Engineering applications.
CO2	Perform Test of Hypothesis for a population parameter for single sample.
CO3	Perform Test of Hypothesis for population parameters for multiple samples.
CO4	Interpret the results of correlation, regression and one way ANOVA for the given data.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	-	-	-	-	-	-	-	-	2	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	2	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	2	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	2	-	3	-

UNIT-I

Continuous Random Variables, Normal Distribution, Normal Approximation to the Binomial Distribution, Uniform Distribution, Gamma Distribution and its applications, Beta Distribution and its applications, Weibull distribution.
(Sections 5.1, 5.2, 5.3, 5.5, 5.7, 5.8, 5.9.)

UNIT-II

Populations and Samples, The sampling distribution of the mean (σ known), The sampling distribution of the mean (σ unknown), The sampling distribution of the variance, Point estimation, Interval estimation, Tests of Hypotheses, Null Hypothesis and Tests of hypotheses, Hypothesis concerning one mean.
(Sections 6.1, 6.2, 6.3, 6.4, 7.1, 7.2, 7.4, 7.5, 7.6)

UNIT-III

Comparisons-Two independent Large samples, Comparisons-Two independent small samples, matched pairs comparisons, The estimation of variances, Hypotheses concerning one variance, Hypotheses concerning two variances. (Sections 8.2, 8.3, 8.4, 9.1, 9.2, 9.3)

UNIT-IV

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning two proportions. The method of least squares, curvilinear regression, multiple regression, correlation, Completely Randomized Designs (One way ANOVA).
(10.1, 10.2, 10.3, 11.1, 11.3, 11.4, 11.6, 12.1, 12.2)

Text Books : 1. Miller & Freund's "Probability and Statistics for Engineers", Richard A. Johnson, 8th Edition, PHI.

References : 1. R.E Walpole, R.H. Myers & S.L. Myers „Probability & Statistics for Engineers and Scientists", 6th Edition, PHI.
2. Murray R Spiegel, John J. Schiller, R. Alu Srinivas Probability & Statistics", Schaum's outline series.

DIGITAL LOGIC DESIGN

II B. Tech. – III Semester (Code: 24DS302)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Basic Computer Knowledge.

Course Objectives:

- Apply various simplification methods to simplify the Boolean expressions.
- Design and analysis of combinational circuits.
- Design and analysis of sequential circuits.
- Design various counters, registers and PLD's.
- Apply various simplification methods to simplify the Boolean expressions.

Course Outcomes: At the end of this course, Students will be able to

CO1	Understand different number systems, binary codes and conversion between number system. Understand and apply Boolean algebra and K-maps to simplify Boolean functions
CO2	Understand and apply tabulation method to simplify the Boolean functions. Understand, analyze and design various combinational circuits.
CO3	Know the fundamentals of various flip-flops, analyze and design sequential circuits.
CO4	Understand design of various registers and counters. Design of various PLD's for Boolean functions.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	-	-

UNIT-I

DIGITAL SYSTEMS AND BINARY NUMBERS: Digital System, Binary Numbers, Number base Conversions, Octal and Hexadecimal Numbers, Complements of Numbers, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic, Error Detection and Correction: 7 bit Hamming Code.

BOOLEAN ALGEBRA & LOGIC GATES: Introduction, Basic definitions, Axiomatic definition of Boolean algebra, Basic theorems and properties of Boolean algebra, Boolean functions, Canonical and Standard Forms, Other Logic Operations, Digital logic gates.

GATE –LEVEL MINIMIZATION: Introduction, The map method, Four-variable K-Map, Product-of-Sums Simplification, Don't –Care Conditions.

UNIT-II

MINIMIZATION: The Tabulation method, Determination of prime implicants, Selection of prime-implicants.

COMBINATIONAL LOGIC: Introduction, Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adders - Subtractors, Decimal Adder, Magnitude Comparator, Decoders, Encoders, Multiplexers.

UNIT-III

SYNCHRONOUS SEQUENTIAL LOGIC: Introduction, Sequential Circuits, Storage Elements - Latches, Storage Elements -Flip Flops, Analysis of Clocked Sequential Circuits: State Equations, State Table, State Diagram, Flip Flop Input Equations, Analysis with D, JK and T Flip Flops; State reduction and Assignment, Design Procedure.

UNIT-IV

REGISTERS and COUNTERS: Registers, Ripple Counters, Synchronous Counters.
MEMORY and PROGRAMMABLE LOGIC: Introduction, Random Access Memory: Read and Write Operations, Types of Memories; Read Only Memory, Programmable Logic Devices: PROM, PLA, PAL.

Text Books :
1. M. Morris Mano, Michael D. Ciletti, "Digital Design", 5th Edition, PrenticeHall, 2013. ISBN-10: 0-13-277420-8.
2. A. Anand Kumar, "fundamentals of digital circuits", 4th Edition, PHI.

References :
1. John F. Wakerly, "Digital Design: Principles and Practices", 4th Edition, Pearson, 2006.
2. Brian Holdsworth, Clive Woods, "Digital Logic Design", 4th Edition, Elsevier Publisher, 2002.
3. Donald E Givone, "digital principles and design", TMT.

DATA STRUCTURES

II B. Tech. – III Semester (Code: 24DS303)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Programming for Problem Solving (24DS204)

Course Objectives:

- Understand the role of Data structures in structuring and analysis procedure of an algorithm.
- Learn the concept of Stack, Queue and various Sorting techniques.
- Understand the concept of Binary Tree, Binary Search Tree, AVL tree, Heap Data Structures
- Learn the concept of Hashing and Graph traversals

Course Outcomes: At the end of this course, Students will be able to

CO1	Analyze the concepts of algorithm evolution and compute their time & space complexities. To elaborate various lists along with their operations.
CO2	Solve various real time problems using stack and queue data structures. Develop algorithms and programs for various sorting techniques.
CO3	Analyze the concepts of trees, binary trees, AVL trees and priority queues.
CO4	Analyze various hashing techniques and Graph traversals

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	-

UNIT-I

Introduction: Algorithm, Importance of Algorithm Analysis, Complexity of an Algorithm, Asymptotic Analysis and Notations. Data Structure, Classification of Data Structures.

Lists: Abstract Data Types, The List ADT, Singly Linked List ADT, Doubly Linked List ADT, Circular Linked List ADT, Polynomial ADT: addition, multiplication operations.

UNIT-II

Stacks and Queues: The Stack ADT and its applications such as Infix to Postfix expression conversions, Evaluation of Postfix expressions. The Queue ADT, Queue Application-Radix sort.

Basic Sorting Techniques: Bubble sort, Selection sort, Insertion sort, Shell sort

UNIT-III

Trees: Preliminaries, Binary Trees, The Search Tree ADT, Binary Search Trees, Implementations, AVL Trees-Single Rotations, Double rotations, Implementations.

Priority Queues (Heaps): Model, Simple implementations, Binary Heap, Heap Sort.

UNIT-IV

Hashing: General Idea, Hash Function, Separate Chaining, Open Addressing.

Graphs: Preliminaries, Representation of graphs, Graph traversals (DFS, BFS)

Text Books : 1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2013, Second Edition, ISBN- 978-81-7758-358-8.

References :
1. Y.Langsam, M.J.Augeustein and A.M.Tenenbaum, "Data Structures Using C", Pearson Education Asia, 2006, Second Edition, ISBN- 81-203-1177-9.
2. Richard F.Gilberg, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", Thomson Brooks / COLE, 1998, Second Edition, ISBN- 978-0-534-39080-8
3. Aho, J.E. Hopcroft and J.D. Ullman, "Data Structures and Algorithms", Pearson Education Asia, 1983, 1st edition, ISBN- 978-0201000238.

OBJECT ORIENTED PROGRAMMING

II B. Tech. – III Semester (Code: 24DS304)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: IPS (24DS104), PPS(24DS204)

Course Objectives:

- Understand the advantages of Object Oriented Programming over Procedural-Oriented Programming; learn the basics of variables, operators, control statements, arrays, classes and objects.
- Understand, write and implement the following concepts: Inheritance, Exception Handling, Interfaces, Packages and Strings and StringBuffer.
- Understand and write programs on Collections, Multithreading and I/O.
- Understand and implement applications using JFX.

Course Outcomes: At the end of this course, Students will be able to

CO1	Demonstrate OOP concepts, its advantages over structured programming.
CO2	Develop and implement Inheritance, Exception Handling, Interfaces, Packages and Strings and StringBuffer.
CO3	Analyze Collections, Multithreading and I/O.
CO4	Create code using JavaFX.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	3	-	-	-	-	-	-	-	-	3	3	2
CO2	3	2	3	-	-	-	-	-	-	-	-	3	3	2
CO3	3	2	3	-	-	-	-	-	-	-	-	3	3	2
CO4	3	2	3	-	2	-	-	-	-	-	-	3	3	2

UNIT-I

An Introduction to Java: History, Java Byte Code, Java Buzzwords
Data Types, Variables and Arrays
Operators
Control Statements
Introducing Classes
A Closer Look at Methods and Classes

UNIT-II

Inheritance
Exception Handling
Packages and Interfaces
Strings: String Constructors, Any 10 String class methods, StringBuffer class, Any 10 StringBuffer class methods.

UNIT-III

Type Wrappers, Autoboxing/Unboxing
Collections: Collections Overview, Names of Collection Interfaces, Collection Classes: LinkedList, Array List

Multithreaded Programming: Introduction, Life Cycle, Thread creation – Thread Class, Runnable Interface, Thread Priority, Synchronization, Interthread Communication.
I/O: I/O Basics, Reading Console Input, Writing Console Output, The Print Writer class, Reading and Writing Files, Automatically Closing a File.

UNIT-IV

Introducing JavaFX GUI Programming: JavaFX Basic Concepts, A JavaFX Application Skeleton, Compiling and Running a JavaFX Program, The Application Thread, A Simple JavaFX Control: Label, Using Buttons and Events, Drawing Directly on a Canvas.
Exploring JavaFX Controls: Using Image and ImageView, ToggleButton, RadioButton, CheckBox, ListView, ComboBox, TextField, ScrollPane, TreeView.
Introducing JavaFX Menus: Menu Basics, An Overview of MenuBar, Menu, and MenuItem, MenuBar, Menu, MenuItem, Create a Main Menu, Add Mnemonics and Accelerators to Menu Items, Add Images to Menu Items, Use RadioMenuItem and CheckMenuItem, Create a Context Menu, Create a Toolbar, Put the Entire MenuDemo Program Together, Continuing Your Exploration of JavaFX

Text Books :
1. "Java The Complete Reference", 10th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi, 2017.

References :
2. "Big Java ", 4th Edition, Cay Horstman, John Wiley & Sons, 2009.
3. "Java How to Program (Early Objects)", H. M. Dietel and P. J. Dietel, 11th edition Pearson Education, 2018.

INTRODUCTION TO DATA SCIENCE

II B. Tech. III Semester (24DS305)

Lectures:	3	Tutorial:	0	Practical:	0	Credits:	3
Continuous Internal Evaluation:			40	Semester End Examination:			60

Pre-Requisite: None.

Course Objectives:

- To learners with foundational knowledge and practical skills in data science, covering data concepts, sources, preparation techniques, and real-world applications.
- Understand the fundamentals of Exploratory Data Analysis (EDA), its tools, visual techniques, and data transformation methods to derive meaningful insights from data.
- Understand and apply data grouping, correlation analysis, time series characteristics, and foundational machine learning concepts including paradigms, inductive bias, and classifier evaluation.
- Understand and apply regression, classification, and feature selection techniques, including linear regression evaluation, nearest-neighbour classifiers, and principal component analysis.

Course Outcomes: At the end of this course, Students will be able to

CO1 Demonstrate foundational knowledge and practical skills in data science, including understanding data concepts, identifying data sources, performing data preparation, and applying data science to real-world scenarios.

CO2 Apply Exploratory Data Analysis (EDA) techniques to analyze datasets using appropriate tools, visual methods, and data transformation techniques to uncover patterns and insights.

CO3 Perform data grouping, correlation analysis, and time series analysis, and explain key machine learning concepts such as learning paradigms, inductive bias, and evaluation of classifiers.

CO4 Implement core machine learning techniques, including linear regression, nearest-neighbour classification, feature selection methods, and principal component analysis, and evaluate their performance effectively.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	2	2	2	1	2	-	-	-	-	-	1	3	2	2
CO2	2	2	1	1	2	-	-	-	-	-	1	3	2	3
CO3	2	2	1	1	2	-	-	1	-	2	2	2	2	2
CO4	2	2	2	2	2	-	-	1	-	2	2	3	2	3

UNIT-I **12** Hrs

Introduction: Data, information, and knowledge, Data Science: the art of data exploration, Data Science tasks, Data Science objectives, Applications of Data Science. (TB 1)

Data, sources, and generation: Introduction, Data attributes, Data-storage formats, Data sources, Data generation. (TB1)

Data preparation: Introduction, Data cleaning, Data reduction, Data transformation, Data normalization, Data integration. (TB1)

UNIT-II **12** Hrs

Exploratory Data Analysis Fundamentals: The significance of EDA, Making sense of data, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA. (TB2).

Visual Aids for EDA: Line chart, Bar charts, Scatter plot, Pie chart, Table chart, Polar chart, Histogram, Lollipop chart. (TB2)

Data Transformation: Merging database-style dataframes, Transformation techniques, Benefits. (TB2)

UNIT-III **12** Hrs

Grouping Datasets: Groupby mechanics, Data aggregation, Pivot tables and cross-tabulations. (TB2)

Correlation: Introducing correlation, Types of analysis, Characteristics of time series data. (TB2)

Machine learning: Introduction, Machine Learning paradigms, Inductive bias, evaluating a classifier. (TB1)

UNIT-IV **12** Hrs

Regression & Classification: Introduction to Regression, Evaluating linear regression, Introduction to classification, Nearest-neighbour classifiers. (TB1)

Feature selection: Introduction, Steps in feature selection, Principal-component analysis for feature reduction. (TB1)

Text Book(s) :

1. "Fundamentals of Data Science Theory and Practice", by Jugal K. Kalita, Dhruba K. Bhattacharyya, Swarup Roy, Academic Press, 2024.
2. "Hands-On Exploratory Data Analysis with Python", by Suresh Kumar Mukhiya, Usman Ahmed, Packt Publishing, 2020.

References :

1. "Statistics for Data Science and Analytics", by Peter C. Bruce, Peter Gedeck, Janet Dobbins, John Wiley & Sons, Inc., 2025.
2. "An Introduction to Statistical Methods & Data Analysis", by R. Lyman Ott, Michael Longnecker, Cengage Learning, 2016.
3. "Introduction to Machine Learning with Python", by Andreas C. Müller, Sarah Guido, O'Reilly Media, Inc., 2017.

PYTHON PROGRAMMING

(Skill Enhancement Course - I)

II B. Tech. – III Semester (Code: 24DSL301/SEC1)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives:

- Understand and write code using the basics of Python, Statements, Expressions, Conditional Executions, and Functions.
- Write code for Iteration, Strings, File I/O.
- Write code in creating, usage of Lists, Dictionaries, and Tuples.
- Understand the concepts of Object Orientation, Databases and write code implementing them.

Course Outcomes: At the end of this course, Students will be able to

CO1	Identify the basic python constructs with a view of using them in problem solving.
CO2	Explore the usability of functions and strings in modular programming
CO3	Apply lists,dictionaries,tuples and file operations to organize the data in real world problems.
CO4	Implement the problems in terms of real world objects using object oriented and database concepts.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	-	-	2	-	2	-	3	3	3	3

Topic	L
Python: Introduction, Basic elements, Control structures.	4
Functions: function calls, built-in functions, type conversion functions, random numbers, math functions, adding new functions, definitions and uses, flow of execution, parameters and arguments, fruitful functions and void functions.	3
Strings: string is a sequence, getting the length of a string using len, traversal through a string with a loop, string slices, strings are immutable, looping and counting, the in operator, string comparison, string methods, parsing strings, format operator.	3
Lists: a list is a sequence, lists are mutable, traversing, operations, slices, methods, deleting elements, functions, strings, parsing lines, objects and values, aliasing, arguments.	3
Dictionaries: dictionary as a set of counters, dictionaries and files, looping and dictionaries, advanced text parsing.	3
Tuples: tuples are immutable, comparing tuples, tuple assignment, dictionaries and tuples, multiple assignment with dictionaries, the most common words, using tuples as keys in dictionaries, sequences.	2
Functional Programming: Join function, comprehension (list and dict), lambda, reduce, filter and map function.	5

Object-Oriented Programming: Classes and Objects, Classes and Functions, Classes and Methods, Inheritance	4
Files I/O: persistence, opening files, text files and lines, reading files, searching through a file, letting the user choose the file name, using try except and open, writing files.	3

LIST OF EXPERIMENTS

Basic elements, Control structures:

1. Write a Python program to input two numbers and display their sum, difference, product, and quotient of division. (Covers variables, expressions, operators, input/output).
2. Write a Python program to check if a number is positive, negative, or zero. (Covers if, elif, else).
3. Write a Python program to find the largest of three numbers using nested if. (Covers nested conditionals).
4. Write a Python program to print the Fibonacci sequence up to n terms using a loop. (Covers loops, updating variables).
5. Write a Python program to find the factorial of a number using a while loop. (Covers while loop and loop control).

Functions:

6. Write a Python program to define a function that checks whether a number is prime. (Covers user-defined functions, return values).
7. Write a Python program using built-in functions like len(), type(), int() and random.randint() to demonstrate their usage. (Covers built-in and standard library functions).

Strings:

8. Write a Python program to count the number of vowels, consonants, digits, and special characters in a string. (Covers string traversal, conditions, in operator).
9. Write a Python program to extract the domain name from an email address. (Covers slicing, find(), string methods)

Lists:

10. Write a Python program to remove duplicates from a list and sort it. (Covers list methods and operations).
11. Write a Python program to split a list every Nth element.

Sample Input: list1 = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j', 'k', 'l', 'm', 'n']

Expected Output: output_list = [['a', 'd', 'g', 'j', 'm'], ['b', 'e', 'h', 'k', 'n'], ['c', 'f', 'i', 'l']]

12. Write a Python program to compute the similarity between two lists.

Sample Input: Colors1 = ["red", "orange", "green", "blue", "white"]
Colors2 = ["black", "yellow", "green", "blue"]

Expected Output: Colors1-Colors2 = ['white', 'orange', 'red']
Colors2-Colors1 = ['black', 'yellow']

13. Write a Python program to find the second largest number in a list. (Covers list traversal and conditions).

Dictionaries:

14. Write a Python program to count the frequency of each word in a user-provided string using a dictionary. (Covers dictionary creation and looping).
15. Write a Python program to combine two dictionaries by adding values for common keys.

Sample Input: dict1 = {'a': 100, 'b': 200, 'c':300}
dict2 = {'a': 300, 'b': 200, 'd':400}
Sample output: Combined_dict = {'a': 400, 'b': 400, 'd': 400, 'c': 300}

Tuples:

16. Write a Python program to replace last value of tuples in a list.

Sample Input: list1 = [(10, 20, 40), (40, 50, 60), (70, 80, 90)]
Expected Output: new_list = [(10, 20, 100), (40, 50, 100), (70, 80, 100)]

17. Write a Python program to sort a list of tuples based on the second element. (Covers tuples and sort).

Functional Programming:

18. Write a Python program to join the list elements using join function.

Sample Input: ['Department', 'of', 'Computer', 'Science', 'and', 'Engineering']
Expected Output1: DepartmentofComputerScienceandEngineering
Expected Output2: Department of Computer Science and Engineering
Expected Output3: Department-of-Computer-Science-and-Engineering
Expected Output4: Department@-of@-Computer@-Science@-and@-Engineering
Expected Output5: Department+of+Computer+Science+and+Engineering

19. Write a Python single line script to create a list of squares of even numbers in a range of numbers using comprehension.

Sample Input: [1, 2, 3, 4, 5, 6]
Expected Output: [4, 16, 36]

20. Write a Python Program to create a lambda function to add two numbers.
21. Write a Python single line script to filter odd numbers from a list using lambda and filter functions.

Sample Input: [1, 2, 3, 4, 5, 6]
Expected Output: [1, 3, 5]

22. Write a python single line script to convert a list of numbers to strings and join them with any special character.

Sample Input: [1, 2, 3, 4, 5, 6]
Expected Output1: 1+2+3+4+5+6
Expected Output2: “1” “2” “3” “4” “5” “6”
Expected Output3: 123456
Expected Output4: 1-2-3-4-5-6
Expected Output5: 1^2^3^4^5^6

23. Write a Python single line script to double the list values using map and anonymous function.

Sample Input: [1, 2, 3, 4, 5, 6]
Expected Output: [2, 4, 6, 8, 10, 12]

24. Write a Python single line program to get the transpose of a 2D matrix using nested list comprehension.

Sample Input: matrix = [[1, 2, 3],
[4, 5, 6]]

Expected Output: [[1, 4], [2, 5], [3, 6]]

25. Write a Python single line program to sort a dictionary by values using lambda function.

Sample Input: {'S1': 88, 'Stu2': 72, 'Stu3': 91, 'S4': 90, 'S5': 79}

Expected Output: {'Stu2': 72, 'S5': 79, 'S1': 88, 'S4': 90, 'Stu3': 91}

26. Write a Python single line script to assign grades based on marks using conditional logic in list. Where student_grade = 'A' if student_marks >= 90, student_grade = 'B' if student_marks >= 75, student_grade = 'C' if student_marks >= 50, else student_grade = 'F'.

Sample Input: student_marks = [95, 67, 80, 45, 76]

Sample Output: student_grades = ['A', 'C', 'B', 'F', 'B']

27. Write a Python single line script to join dictionary keys into a single special character separated string using join function.

Sample Input: {'name': 'John', 'age': 20, 'grade': 'A'}

Sample Output: name, age, grade

28. Write a Python single line script to sort a list of tuples using lambda on the second element of the tuple.

Sample Input: [('apple', 3), ('banana', 1), ('cherry', 2)]

Sample Output: Sorted Tuples: [('banana', 1), ('cherry', 2), ('apple', 3)]

29. Write a Python program to filter prime numbers using a helper function (like: is_prime) and filter with lambda.

30. Write a Python single line script to flatten a nested list of two dimension into a single dimension list using list comprehension.

Sample Input: nested_list = [[1, 2], [3, 4], [5, 6], [7], [8, 9, 10]]

Sample Output: flat_list = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

31. Write a python single line script for the following using map() function

    a. Given a list of numbers, return the list of squares

    Sample Input: numbers = [1, 2, 3, 4, 5]

    Sample Output: squares = [1, 4, 9, 16, 25]

    b. Convert a list of string numbers to actual integers

    Sample Input: string_numbers = ['1', '2', '3', '4', '5']

    Sample Output: numeric_numbers = [1, 2, 3, 4, 5]

    c. Convert Celsius to Fahrenheit (Formula F = (C * 9/5) + 32

    Sample Input: Celsius = [0, 20, 37, 100]

    Sample Output: Farhenheit = [32.0, 68.0, 98.6, 212.0]

    d. Add two lists element-wise

    Sample Input: list1 = [1, 2, 3, 4, 5, 6], list2 = [6, 7, 8, 1, 2, 9]

    Sample Output: combined_list = [7, 9, 11, 5, 7, 15]

e. Capitalize list of Names

Sample Input: names = ['computer', 'science', 'and', 'engineering']

Sample Output: capitalized_names = ['Computer', 'Science', ‘And’, 'Engineering']

f. Extract first letter of each word

Sample Input: words = ['apple', 'banana', 'cherry']

Sample Output: words_first_letters = ['a', 'b', 'c']

g. Define a custom function that return the factorial of a number and use map() to apply it to a list of numbers.

Sample Input: numbers = [3, 4, 5]

Sample Output: numbers_factorial = [6, 24, 120]

Object-Oriented Programming:

32. Write a Python program to define a class Student with attributes name and marks, and a method to display them. (Covers class, object, methods).
33. Write a Python program to demonstrate inheritance with classes Person and Employee. (Covers inheritance and method overriding).

Files I/O:

34. Write a Python program to read a text file and count the number of lines, words, and characters. (Covers file reading and parsing)
35. Write a Python program to write a list of strings into a text file. (Covers file writing).
36. Write a Python program to find the longest word in each line of given file.

Text Books :

1. A Python Book: Beginning Python, Advanced Python, and Python Exercises, Dave Kuhlman, Open Source MIT License.
2. Python for Data Analysis, Wes McKinney, O’ Reilly.

References :

1. Python Data Science Handbook-Essential Tools for Working with Data Science from Scratch, JoelGrus, O’Reilly.

COMPUTATIONAL STATISTICS

II B. Tech. – III Semester (Code: 24DSL302)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives:

- Understand installation of R and installing packages. Understand writing R code for mathematical functions.
- Write R Code for importing and exporting data.,Understand and write R code for graphs.
- Understand the various types of Discrete and Continuous Probability Distributions
- Understand and write R code for hypothesis testing, regression

Course Outcomes: At the end of this course, Students will be able to

CO1 Installation of R Studio & installation of required packages. Write commands for mathematical calculations, vectors, Matrices, Data frames & Arrays. Write programs using functions.

CO2 Implement R Programs to import & export csv files, excel files. write R code for Different Visualizations

CO3 Apply various built-in functions in R to solve various probability and distributions like Normal, Binomial and Poisson distributions.

CO4 Implement Hypothesis testing, Linear regression.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	-	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	-	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	-	-	2	-	2	-	3	3	3	3

SYLLABUS

Introduction to R: Use of R, Obtaining and installing R-Studio.

Basics of R: Basic Math, Variables, Data types, Vectors, Calling function, Function documentation, Missing data.

Advanced Data Structures: Data frames, Lists, Matrices and Arrays.

Reading and Writing Data in R: Reading and Writing CSV , Excel files

Basic graphs: Bar plot, Pie chart, Histograms, Kernel Density plots, Box plots, Dot plots.

Descriptive Statistics: Mean, median, mode, Variance and standard deviation, Covariance and Correlation.

Probability Distributions: Normal Distribution, Poison Distribution and Binomial Distribution.

Statistical Inference: Hypothesis testing: t-test, chi-square test, Goodness-of-fit tests, Confidence intervals using R, P-values and statistical significance.

Linear Models: Simple linear regression, Multiple linear regressions.

LIST OF EXPERIMENTS

1. a). Write R Code using R as a calculator. b). Write R Code on Vector Operation.
2. Write R code which demonstrate i) Array ii) List iii) Matrix iv) Data Frames
3. Write R code which demonstrate functions and control loops
4. Write R Code to Importing & Exporting data from i) CSV file ii) Excel file
5. Write R code which demonstrate plotting of graphs i) Histogram ii) Pie Graph iii) Plot Graph iv) Box Plot v) Dot Plot vi) Kernel Density Plots
6. Write an R – Script to demonstrate the concept of Normal Probability distribution, Binomial Distribution and Poisson distribution.
7. Write an R – Script to demonstrate the concept of one sample t-test and Two sample t-test
8. Write R code to demonstrate chi-square test of Good fit and Independent.
9. Write R code which demonstrate statistics functions i) Mean ii) Median iii) Range iv) Variance v) Co- variance
10. Write R code which demonstrates Linear Regression.

Text Books :

1. R for Every One, Advanced analytics and graphics by Jared P Lander,Addison Wisley Data and analytics series.
2. R in Action, Data Analysis and graphics with R,Robert L Kabacoff, Manning Publisher
3. Maria Dolores Ugarte, Ana F. Militino, Alan T. Arnholt "Probability and Statistics with R", 2nd edition on, CRC Press, 2016.
4. P. Dalgaard, Introductory Statistics with R, 2nd edition. (Springer 2008).

References :

1. Beginning R by Dr. Mark Gardener, Wrox Publisher.
2. Associate Analytics Facilitator Guide Provided by NASSCOM. http://183.82.43.252/~gopam/html/NASSCOM.
3. Michale Akritas, "Probability & Statistics with R for Engineers and Scientists", 2nd edition on, CRC Press, 2016

DATA STRUCTURES LAB

II B. Tech. – III Semester (Code: 24DSL303)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Programming for Problem Solving Lab (24DSL204)

Course Objectives:

- Understand and program basic data structures like arrays and linked lists with their applications.
- Understand and Program data structures like stacks and queues with their applications. Understand and implement sorting algorithms.
- Understand and program on trees, binary trees, binary search trees, AVL trees, expression trees and their traversal methods and priority queues
- Basic knowledge of graphs representations and traversing methods. Understand the concept of hashing and their mechanisms.

Course Outcomes: At the end of this course, Students will be able to

CO1	Apply programming techniques using pointers, DMA and structures to implement SLL and DLL.
CO2	Design and implement ADTs of stack, queue and its applications and implement different sorting techniques.
CO3	Analyze and implement BST, AVL tree and priority queue.
CO4	Analyze and implement graph traversals (DFS and BFS)

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	-	3	-	2	-	2	-	3	3	3	3
CO2	3	3	3	-	3	-	2	-	2	-	3	3	3	3
CO3	3	3	3	-	3	-	2	-	2	-	3	3	3	3
CO4	3	3	3	-	3	-	2	-	2	-	3	3	3	3

LIST OF EXPERIMENTS

1. Write a program to perform the following operations on an ArrayList.
   a). Creation, b). Insertion, c). Deletion, d). Search, e). Display
2. Write a program to perform the following operations on a Singly Linked List.
   a). Creation, b). Insertion, c). Deletion, d). Search, e). Display
3. Write a program to perform the following operations on a Circular Single Linked List.
   a). Creation, b). Insertion, c). Deletion, d). Search, e). Display
4. Write a program to perform addition and multiplication of two polynomials using a Single Linked List.
5. Write a program to implement stack operations using a linked list.
6. Write a program to convert a given infix expression to postfix notation and then evaluate the resulting postfix expression using a stack.
7. Write a program to implement queue operations using a linked list.
8. Write a program that performs Radix sort on a given set of elements using a queue.
9. Write a program to sort the array elements using the following techniques.
   a). Bubble Sort, b). Selection Sort, c). Insertion Sort, d). Shell Sort.

10. Write a program to perform Binary Search tree operations.
    a). Creation, b). Insertion, c). Deletion, d). Search, e). Traversals
11. Write a program to implement an AVL tree that interactively allows
    a). Insertion, b). Find_min, c). Find_max.
12. Write a program to sort the array elements using Heap Sort.
13. Write a program to perform the following hashing techniques.
    a). Linear Probing b). Quadratic Probing.
14. Write a program to implement the following graph traversal methods.
    a). DFS b). BFS.

Text Books : 1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education

References : 1. Y.Langsam, M.J.Augeustein and A.M.Tenenbaum, "DataStructures Using C", Pearson Education Asia, 2004.
2. Richard F.Gilberg, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", ThomsonBrooks / COLE, 1998.

OBJECT ORIENTED PROGRAMMING LAB

II B.Tech – III Semester (Code: 20DSL304)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: IPS (24DSL104), PPS(24DSL204)

Course Objectives:

- Understand the advantages of Object Oriented Programming over Procedural-Oriented Programming, learn the basics of variables, operators, control statements, arrays, classes and objects.
- Understand, write and implement the following concepts: Inheritance, Exception Handling, Interfaces, Packages and Strings and StringBuffer.
- Understand and write programs on Collections, Multithreading and I/O.
- Understand and implement applications using Events and JFX.

Course Outcomes: At the end of this course, Students will be able to

CO1 Demonstrate OOP concepts, its advantages over structured programming.
CO2 Develop and implement Inheritance, polymorphism.
CO3 Analyze Exception Handling, Multithreading, I/O.
CO4 Create code for Event Handling, JavaFX.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	3	-	-	-	-	-	-	-	-	3	3	2
CO2	3	2	3	-	-	-	-	-	-	-	-	3	3	2
CO3	3	2	3	-	-	-	-	-	-	-	-	3	3	2
CO4	3	2	3	-	2	-	-	-	-	-	-	3	3	2

LIST OF EXPERIMENTS

1. Write a Java program to declare, initialize and access the elements of single-dimensional Arrays and multi-dimensional Arrays. Display the array elements using loops.
2. Develop a Java program to demonstrate the use of static variables, static methods, and static blocks.
3. Create a Java program that demonstrates method overloading (Compile-time Polymorphism) and method overriding (Runtime Polymorphism) using inheritance.
4. Write a Java program to illustrate the concept of multiple inheritance through the implementation of multiple interfaces.
5. Develop a Java program that demonstrates the use of all exception handling keywords: *try*, *catch*, *throw*, *throw*s, and *finally*.
6. Write a Java program to create and handle one or more user-defined exceptions with meaningful messages.
7. Design a Java program to demonstrate the creation and use of packages. Include at least two classes from different packages.
8. Implement a Java program to demonstrate inter-thread communication using *wait(), notify()*, and *notifyAll()* methods.
9. Write a Java program to copy the contents of one file to another using ***FileInputStream*** and ***FileOutputStream***. Demonstrate the use of try-with-resources for automatic resource management.

10. Design a JavaFX application that enables users to draw directly on a Canvas using mouse events.
11. Create a JavaFX application to demonstrate handling action events with appropriate UI components.
12. Develop a JavaFX application to demonstrate the usage of list-based controls with event handling.
13. Design a JavaFX application that demonstrates the creation and use of menus with event handling.

Text Books :
1. "Java The Complete Reference", 10th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi, 2017.

References :
1. "Big Java ", 4th Edition, Cay Horstman, John Wiley & Sons, 2009.
2. "Java How to Program (Early Objects)", H. M. Dietel and P. J. Dietel, 11th edition Pearson Education, 2018.

HEALTH & WELLNESS, YOGA & SPORTS

II B.Tech – III Semester (Code: 20DSL305)

Lectures	0	Tutorial	0	Practical	2	Credits	0.5
Continuous Internal Evaluation			100	Semester End Examination			

Pre-Requisite: None

Course Objectives:

- The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life.
- It mainly enhances the essential traits required for the development of the personality

Course Outcomes: At the end of this course, Students will be able to

CO1	Outline the importance of yoga and sports for Physical fitness and sound health.(L2)
CO2	Make use of various activities that help to enhance their health.(L3)
CO3	Develop Positive Personality for individual and group work.(L3)
CO4	Categorize the health-related fitness components and analyze the current personal fitness levels.(L4)

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	2	-	3	-	-	-

LIST OF ACTIVITIES

Module -1

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

Module -2

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas-Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices -Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

Module -3

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi , Kho-kho, Table Tennis, Cricket etc., Practicing general and specific warm up, aerobics.
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running

Text Books : 1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022

2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993

References :

1. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
2. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

CONSTITUTION OF INDIA

II B.Tech – III Semester (Code:24DS306/MC02)

Lectures	2	Tutorial	0	Practical	0	Credits	0
Continuous Internal Evaluation			40	Semester End Examination			0

Pre-Requisite: None.

Course Objectives:

- To provide basic information about fundamental law of the country.
- To educate the student about fundamental Rights and fundamental duties of citizens.
- To educate the students about Government organs, methods of functioning
- To motivate students to leave narrow selfish outlook and inculcate broad national, human outlook.

Course Outcomes: At the end of this course, Students will be able to

CO1	Understand the importance of the constitution in a Democratic Society
CO2	Understand the fundamental rights, duties of a citizen by discharging his duties to become a good citizen.
CO3	Remember about judicial supremacy and independence of judiciary and fight for his legitimate rights through court of law.
CO4	Applying the principles to participate in the democratic process of governance and in nation building activities.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	1	2	2	-	1	-	-	-	3	-	3	3	-	-
CO2	-	-	1	1	1	-	-	-	-	-	3	3	3	2
CO3	-	-	1	-	1	-	2	-	-	-	3	3	-	-
CO4	3	1	2	-	-	-	-	-	3	-	1	3	2	-

UNIT-I

1.1 Meaning of the constitutional law and constitutionalism.
1.2 Historical perceptive of the constitution of India
1.3 Salient features and characteristics of the constitution of India.
1.4 Preamble, union and its territory and citizenship.

UNIT-II

2.1. Fundamental rights principles.
2.2. Directive principles of state policy.
2.3. Fundamental duties.
2.4. The government of the union, the president, The Prime Minister, and the council of ministers, The parliament of India, The supreme court, the union judiciary

UNIT-III

3.1. The Machinery of Government in the states, The Governor, The Chief Minister and council of Ministers, The State legislature, High court, Judiciary in the states
3.2. Union territories.

3.3. The Federal System, division of powers between centre and states, legislative administration and financial relation.
3.4. Emergency Provisions, President Rule, National Emergency, Financial Emergency

UNIT-IV

4.1. Local self-Government, Panchayat Raj, Municipalities and municipal Corporation
4.2. Miscellaneous Provisions, the comptroller and Auditor general of India, The Public Service commission, Special Provisions relating to certain classes, Elections — Political parties.
4.3. Amendment of the Constitution.
4.4. Laws Relating to Women

Text Books:

1. Introduction to constitution of India, D.D.Basu, 24th Edition, Lexis Nexus, 2019.
2. The constitution of India by P.M.Bhakshi, 18th Edition, UniversaI law publishing, 2021.

Reference:

1. Constitutional Government in India - M V Pylee , Kindle Edition, Asia Publishing House, 2004.
2. Indian Government and Politics — D C Dasgupta,8th Edition,Vikas Publishing house, 2007.
3. The Oxford Hand Book of the Indian Constitution, Sujit Chowdary, Madhav Khosla Pratapabhem Mehla, oxford university press UK, 2016.
4. Laws Relating to Women, National Commission For Women, New Delhi, July 2020.

COMPUTER ORGANIZATION

II B. Tech. – IV Semester (Code: 24DS401)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Digital logic design (24DS302)

Course Objectives:

- Represent the data, micro-operations, and hardware implementation of arithmetic, logic and shift unit.
- Know about the instruction codes and generation of control signals using hardwired and micro-programmed approaches.
- Learn about the different types of instructions and arithmetic operations.
- Understand the organization of the memory and I/O units.

Course Outcomes: At the end of this course, Students will be able to

CO1 Understand the basic structure of computer and analyzing the concepts of machine instructions.

CO2 Illustrate the various arithmetic operation and learn about basic processing time.

CO3 Review the basic computer instruction set and create flowcharts for the arithmetic operations.

CO4 Recognize the I/O and memory organizations.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO3	2	-	2	-	-	-	-	-	-	-	-	3	-	-
CO4	2	-	2	-	-	-	-	-	-	-	-	3	-	-

UNIT-I

COMPUTER DATA REPRESENTATION: Introduction to Computer Organization, Data Types, Complements, Fixed-Point Representation, Floating-Point Representation.

REGISTER TRANSFER LANGUAGE AND MICROOPERATIONS: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro Operations, Logic micro operations, Shift Micro Operations, Arithmetic Logic Shift Unit.

UNIT-II

BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Design of Accumulator Logic.

MICRO PROGRAMMED CONTROL: Control Memory, Address Sequencing, Microprogram Example, Design of Control Unit.

UNIT-III

CENTRAL PROCESSING UNIT: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer vs Complex Instruction Set Computers.

COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication Algorithms, Division Algorithms.

UNIT-IV

THE MEMORY SYSTEM: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory.

INPUT-OUTPUT ORGANIZATION: Peripheral Devices, Input-Output Interface, Modes of Transfer, Priority Interrupt, Direct Memory Access.

Text Books : Computer System Architecture, M.MorrisMano, 3rdEdition, Pearson/PHI

References :

1. Computer Organization, Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill.
2. Computer Organization and Architecture, William Stallings, Sixth Edition, Pearson/PHI.

OPERATING SYSTEMS

II B.Tech – III Semester (Code: 24DS402)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives:

- To learn the mechanism of OS to handle processes & Threads and their communication.
- To learn the algorithms involved in CPU scheduling.
- To gain knowledge on concepts that includes Dead locks and Main Memory
- To know the concepts related to Virtual Memory, File Access Methods & Mass Storage structure.

Course Outcomes: At the end of this course, Students will be able to

CO1 Analyze the structure of OS and basic architectural components involved in OS design.

CO2 Develop various process scheduling algorithms for a given specification of CPU utilization, throughput, TAT, WT & RT.

CO3 Articulate the causes and effects of deadlocks and comprehend memory management concepts.

CO4 Comprehend virtual memory management, Design and implement various file allocation methods and Disk Scheduling Algorithms.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	-	-	-		-	-		-	3	-	-

UNIT-I

Introduction: What OSs do? Computer System Organizations Operations.

Operating-System Structures: OS Services, User and operating system Interface, System Calls, Types of System Calls, Linkers & Loaders, OS Structures.

Processes: Process Concept, Process Scheduling, Operations on Processes

Inter- process Communication: IPC in shared memory, IPC in Message passing.

Threads & Concurrency: Overview, Multicore Programming, Multithreading Models.

[Sections: 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3, 2.5, 2.8.1 to 2.8.4, 3.1,3.2, 3.3, 3.4,3.5,3.6, 4.1, 4.2, 4.3]

UNIT-II

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

Synchronization Tools: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores.

Synchronization Examples: Classic Synchronization Problems

[Sections: 5.1, 5.2, 5.3, 6.1, 6.2, 6.3,6.4,6.5,6.6,6.7,7.1]

UNIT-III

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance, Detection and Recovery.

Main Memory: Background, Contiguous Memory Allocation, Non-contiguous memory allocation: Paging, Hierarchical paging.

Virtual-Memory: Background, Demand Paging, Page Replacement, Thrashing,

[Sections: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7,8.8, 9.1, 9.2, 9.3, 9.4.1,10.1,10.2,10.4.1 to 10.4.4,10.6]

UNIT-IV

Mass Storage Structure: Over View of Disk Structure, Disk Scheduling, Disk storage, Management, RAID levels.

File System Interface: File concept, Access Methods, Directory Structure.

File System Implementation: Allocation Methods.

Protection: Goals of Protection, Principles of Protection, Domain of Protection- Domain Structure, Access Matrix.

[Sections: 11.1.1, 11.2, 11.5,11.8.1 to 11.8.3,13.1,13.2,13.3,14.4,17.1,17.2,17.4,17.5]

Text Books :

1. Silberschatz & Galvin, "Operating System Concepts", 10th edition, John Wiley & Sons (Asia) Pvt.Ltd. **ISBN 9781118063330**.

References :

1. William Stallings, "Operating Systems –Internals and Design Principles", 9th edition, Pearson. ISBN 9789352866717
2. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Co., 2019 edition. **ISBN-9780074635513**
3. Andrew S.Tanenbaum, "Modern Operating Systems", 4nd edition,2017 PHI.**ISBN-9781292061429**

CLIENT SIDE WEB TECHNOLOGIES

II B.Tech – IV Semester (Code: 24DS403)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Know skills in creating standards-compliant web pages having semantic elements, Formatting, arranging text, Multimedia, Forms.
- Apply CSS3 and DHTML features in creating dynamic and interactive web pages.
- Know the basics of JavaScript Objects, DOM and ES6 features.
- Understand the React.js front-end framework basics.

Course Outcomes: At the end of this course, Students will be able to

CO1 Develop basic HTML5 web applications using standard and semantic elements, formatting, Arranging Text, Multimedia and Forms.

CO2 Apply CSS3 styling concepts and basic JavaScript Functions, arrays and Events to create dynamic and interactive web pages

CO3 Build dynamic web pages using JavaScript Objects, DOM, and ES6 features.

CO4 Develop React applications using Props, State, handling Events, Forms and React Router.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	2	1	1	-	-	-	1	2	-	2	3	2
CO2	3	3	3	2	2	-	-	-	1	2	-	2	3	3
CO3	3	3	3	2	2	-	-	-	1	2	-	3	3	3
CO4	3	3	3	3	3	-	-	-	2	2	-	3	3	3

Unit-I

HTML 5: Understanding elements: ROOT, Metadata, Heading, Flow, Basic HTML data types, Character Entities.

Formatting Text: Physical style elements, Logical style elements.

Arranging Text: Preformatted Text, DIV, SPAN; Exploring the hyperlink, Structuring URL; Creating Tables.

Working with Images and Colors: Image Formats, exploring Colors; Working with Forms.

Unit-II

CSS3: Overview of Styles, Exploring the Box model, Font and Text styles. Displaying, Positioning and Floating an Element, List Styles and Table Layouts.

Dynamic HTML: Overview of JavaScript**:** JavaScript Functions, Arrays and Events.

Unit-III

JavaScript Objects: Understanding the Window Object, working with the Document Object.

DOM (Document Object Model): Understanding DOM nodes, Node interface, Document interface and Element interface.

ES6 Features: Arrow functions, let and const, template literals, spread and rest.

Unit-IV

Introduction to React: React Benefits, Disadvantages, Basic React App**,** JSX, Components, Props, State, Functional Components and Class Components, Handling Events in React, Forms in React, **Project**: Menu Component.
Routing in React: React Router Basics
.

Text Books :

1. **HTML5 Black Book:** Covers CSS3, JavaScript, XML, XHTML, Ajax, PHP and Jquery, Kogent Learning Solutions Inc., Wiley India 7 edition. 2011. ISBN: 9789350040959.
2. **Learning React**, Alex Banks & Eve Porcello, O'Reilly, 2nd Edition, 2020.

References :

1. Harvey M.Deitel and Paul J. Deitel, "Internet & World Wide Web How to Program", 4/e, Pearson Education.
2. Jason Cranford Teague, "Visual Quick Start Guide CSS, DHTML & AJAX", 4e, Pearson Education.
3. Tom Nerino Doli smith, "Java Script & AJAX for the web", Pearson Education 2007.

DATABASE MANAGEMENT SYSTEMS

II B. Tech. – IV Semester (Code: 20DS404)

Lectures	3	Tutorial	0	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives:

- Familiarize with fundamental concepts of database and various database architectures and Design relations for Relational databases using conceptual data modeling.
- Implement formal relational operations in relational algebra and SQL.
- Identify the Indexing types and normalization process for relational databases
- Use mechanisms for the development of multi user database applications.

Course Outcomes: At the end of this course, Students will be able to

CO1 Apply knowledge of database design methodology which give a good formal foundation in relational data model and Understand and apply the principles of data modeling using ER Model.

CO2 Create relational algebra expressions, relational calculus, and SQL for queries and be familiar with relational database theory

CO3 Design database schema and Identify and solve the redundancy problem in database tables using normalization.

CO4 Learn about transaction processing, concurrency management, and recovery methods.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	2

UNIT-I 12 Hours

Databases and Database Users: Introduction - An Example, Characteristics of the Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach.

Database System Concepts: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, Classifications of Database management systems.

Data Modeling Using the Entity-Relationship (ER) Model: Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database - ER Diagrams, Naming Conventions, and Design Issues

UNIT-II 12 Hours

The Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, The Tuple Relational Calculus, The Domain Relational Calculus.

Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, Views (Virtual Tables) in SQL

UNIT-III 12 Hours

Indexing Structures for Files: Types of Single-Level Ordered Indexes, Multilevel Indexes - Dynamic Multilevel Indexes Using B+-Trees.

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Relational Database Design Algorithms and Further Dependencies: Properties of Relational Decompositions -Lossless Join Decomposition and Dependency Preserving Decomposition, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

UNIT-IV 12 Hours

Transaction & ACID: Transaction, ACID properties, States of the transaction

Transaction Problems: Lost update and dirty read problem, unrepeatable read and phantom problem, incorrect summary problem.

Schedules: Number of schedules, types of schedules : Serial schedule, complete schedule, recoverable schedule, cascading aborts, cascade-less schedule, strict schedule

Serializability: Conflict Serializability, View Serializability, comparison between conflict and view serializability

Concurrency Control Protocols: locks, 2-phase locking protocol, strict 2PL, rigorous 2PL, conservative 2PL, example on strict 2PL.

Graph & Timestamp Protocols: Graph-based protocol, timestamp ordering protocol, examples on timestamp ordering protocol, Thomas Write Rule

Text Books :

1. Fundamentals of Database Systems, Ramez Elmasri and Navathe Pearson Education, 6thedition

References :

1. Introduction to Database Systems, C.J. Date Pearson Education
2. Database Management Systems, Raghu Rama krishnan, Johannes Gehrke, TATA McGraw Hill3rdEdition
3. Database System Concepts, Silberschatz, Korth, McGraw hill,5thedition

DESIGN AND ANALYSIS OF ALGORITHMS

II B. Tech. - IV Semester (Code: 24DS405)

Lectures	2	Tutorial	1	Practical	0	Credits	3
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Data Structures (24DS303)

Course Objectives: Students will be able to

- Understand about designing and the effectiveness of an algorithm, and applying the Master Theorem to find the complexity.
- Strengthen the divide and conquer paradigms and know the optimal solution finding with the greedy method.
- Acquaintance with algorithm design strategies of Dynamic programming and easily know the significant graph algorithms and their analyses.
- Get the ability to backtrack and branch with bound values and NP problems.

Course Outcomes: At the end of this course, Students will be able to

CO1 Analyze algorithms' performance using various strategies and apply the Master theorem to estimate the complexity of divide-and-conquer algorithms.

CO2 Apply the divide-and-conquer and greedy techniques to solve problems and perform complexity analysis.

CO3 Articulate on graph problems and identify the applicability of the dynamic programming paradigm for designing solutions to problems.

CO4 Utilize the backtracking and branch and bound algorithms to find every potential solution to combinatorial and optimization issues. In addition, classify the P and NP complicated problems.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	3	-	-	-	-	-	-	-	3	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	3	3	3	-
CO4	3	3	3	-	-	-	-	-	-	-	3	3	3	-

UNIT-I

Introduction: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation.

Master Theorem: Introduction, Generic Form- Case1, Case2, Case3, Inadmissible equations, Application to standard algorithms.

UNIT-II

Divide and conquer: General method, applications - Quicksort, Merge sort, Stassen's matrix multiplication.

Greedy method: General method, applications-Job sequencing with deadlines, Fractional knapsack problem, Minimum cost spanning trees – Prim's Algorithm, Kruskal's Algorithm, Single source shortest paths – Dijkstra Algorithm.

UNIT-III

Dynamic Programming: General method, applications - Multi-stage graphs using Forward & Backward approach, 0/1 knapsack problem, Reliability design, The Travelling salesperson problem, Longest common subsequence algorithm.

Graph Applications: Connected components, Bi-Connected Components, Strongly Connected Components.

UNIT-IV

Backtracking: General method, applications - The 8-queens problem, sum of subsets problem.

Branch and Bound: General method, applications- LC Branch and Bound solution for 0/1 knapsack problem.

NP-Hard and NP-Complete problems: Basic concepts - non-deterministic algorithms, NP-Hard and NP Complete classes, Cook's theorem.

Text Books : E. Horowitz, S.Sahniand S. Rajasekaran, "Fundamentals of Computer Algorithms", Galgotia Publication.

References :

1. T. H. Cormen, Leiserson, Rivest, and Stein, "Introduction to Computer Algorithms" The MITPress.
2. Sara Basse, A.V. Gelder, "Computer Algorithms: Introduction to Design & Analysis, 3e ", Pearson Education.

ADVANCED PYTHON PROGRAMMING

(Skill Enhancement Course – 2)

II B. Tech. – IV Semester (Code: 24DSL401/SEC2)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: Programming for Problem Solving (24DS204), Data Structures (24DS302)

Course Objectives:

- Earn the skills to understand and implement Python modules and packages, and perform database connectivity and operations for effective data management and application development.
- Learn the foundational knowledge and practical skills in using the NumPy module for efficient numerical computing and array-based operations in Python.
- Learn the ability to efficiently manipulate, analyze, and clean data using the Pandas module for effective data wrangling.
- Equip with the skills to create effective data visualizations using Matplotlib and Seaborn for insightful data analysis and presentation.

Course Outcomes: At the end of this course, Students will be able to

CO1 Develop the ability to understand and implement Python modules and packages, along with performing database connectivity and operations for efficient data management and application development.

CO2 Gain foundational knowledge and practical skills in utilizing the NumPy module for high-performance numerical computations and array-based operations in Python.

CO3 Acquire the capability to manipulate, clean, and analyze data effectively using the Pandas module, enabling robust data wrangling techniques.

CO4 Attain proficiency in creating insightful and impactful data visualizations using Matplotlib and Seaborn to support data analysis and presentation.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											**PSOs**		
CO	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	1	1	1	3	-	-	-	1	2	2	2	1	1
CO2	2	3	2	2	3	-	-	-	1	2	2	1	2	1
CO3	1	3	2	2	3	-	-	-	1	2	2	2	1	2
CO4	1	2	2	2	3	-	-	-	-	2	2	2	1	2

SYLLABUS

Modules and Packages: Introduction python module, creating module, using the module, accessing from module, creating package, package initialization, importing from packages, different ways to import modules and packages, creating sub packages and importing.

Database Connectivity & Operations: Introduction to **Python SQLite3** DB module, using **SQLite3 to** create insert, retrieve, delete, update and drop table operations on tables.

NumPy Module: Introduction to NumPy, A Multidimensional Array Object, Creating ndarrays, Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations, Expressing Binary and Bitwise Operators, Methods for Boolean Arrays , Sorting , Unique.

Pandas Module: Introduction to pandas, Pandas Series, Pandas DataFrames, creating DataFrame, reading from csv files & Excel files, reading from json files, data cleaning, cleaning wrong format, cleaning wrong data, data correlations, pandas for plotting, displaying plots.

Data Wrangling: Combining and Merging Data Sets, Database style Data Frame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap, Reshaping and Pivoting, Reshaping with Hierarchical Indexing, Data Transformation, Removing Duplicates, Replacing Values.

Plotting and Visualization using Matplotlib: Introduction to Matplotlib, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots, Pie chart using Matplotlib.

Plotting and Visualization using Seaborn: Introduction to Seaborn, Plotting using Scatter Plot, Strip Plot, Swarm Plot, Count Plot, Box Plot, Pair Plot, Cat Plot, lmplot Plot, DistPlot.

LIST OF THE PROGRAMS

1. **Implement Modules and packages in Python**
   a. Write a Python program to Create a Module to use a Module.
   b. Write a Python program to Rename a Module.
   c. Write a Python program to import specific names from a module without importing the module as a whole.
   d. Write a Python program to list all the functions (or variable names) in a module.
   e. Write a Python program to create and import packages
   f. Write a Python program to create and import subpackages

2. **Database Connectivity & Operations**: Python SQLite3.
   a. Write a Python program to demonstrate database operations such as create, insert, select, & where in below Student Table.
   b. Write a Python program to demonstrate database operations such as update, delete, & drop table in below Student Table.
   c. Write a python program to create the below Employee table.
   d. Write a python program to sort employee names in the Employee table.
   e. Write a python program using Aggregate functions (MIN, MAX, SUM and AVG) for below table.

STUDENT TABLE		
Name	**Branch**	**Address**
Naresh	IT	Hyderabad
Venkat	CSE	Bapatla
Rajesh	AIML	Guntur
Vinay	CBDS	Tenali
Bose	CIVIL	Ongole

EMPLOYEE TABLE			
Emp_ID	**Emp_Name**	**Dept**	**Salary**
400	Suresh	Physics	40000
401	Jaya Lakshmi	Chemistry	50000
402	Durgesh	Maths	50000
403	Sai	Physics	45000
404	Pallavi	English	48000

3. **NumPy**
   a. Develop a Python Program to create & split arrays using NumPy module.
   b. Develop a Python Program to test all aggregate functions in NumPy module.
   c. Develop a Python Program to generate a matrix of random numbers within range and print its Transpose.

d. Develop a Python Program that calculates variance, co variance, correlation by taking sample statistical data.
e. Develop a python program to find rank, determinant, and trace of a matrix.
f. Develop a Python program on Boolean arrays and Binary Operators.
g. Develop a Python program for Expressing Conditional Logic as Array Operations.

4. **Pandas**
   a. Develop a python program to implement Pandas Series with labels and dictionary.
   b. Develop a program to creating a Pandas DataFrame using dictionary and 2-D array.
   c. Develop a program which makes use of following Panda's methods.
      i) describe () ii) head() iii) tail() iv) info().
   d. Develop a program for Preprocessing of Dataframe.
   e. Develop a python program of group by() and pivot() method.
   f. Demonstrate pandas Merging, Joining and Concatenating.
   g. Write code to read data from text file, CSV file, Excel file and JSON file into a Dataframe. Print the overview of data and slice data using different indexing/slicing methods.
   h. Convert a Dataframe to .csv, .json, .xml, .txt and .xlsx files.

5. **Using Matplotlib package, draw the following and customize them.**
   1) Scatter Plot 2) Bar Plot 3) Pie Chart 4) Histogram 5) Box Plot

6. **Using Seaborn package, draw the following.**
   1) Scatter Plot 2) Strip Plot 3) Swarm Plot 4) Count Plot 5) Box Plot.

7. **Using Seaborn package, draw the following**.
   1) Pair Plot 2) Cat Plot 3) Count Plot 4) Implot Plot 5) DistPlot.

Text Books :
1. Wes McKinney, "Python for Data Analysis", O'Reilly, ISBN:978-1-449-31979-3, 1st edition, October 2012.
2. Rachel Schutt & O'neil, "Doing Data Science", O'Reilly, ISBN:978-1-449-35865-5, 1st edition, October 2013.
3. Problem solving and python programming fundamentals and application: NumPy, Pandas and Matplotlib. Harsha Bhasin.

References :
1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015
2. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.

DESIGN THINKING AND INNOVATION

II B. Tech. - IV Semester (24DSL402)

Lectures	1	Tutorial	0	Practical	2	Credits	2
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None

Course Objectives:

- Provide an overview of design thinking.
- Engage students to allow them to integrate these components into their own courses.
- Nurture their skills to contribute for solving community-based problems
- Provide a framework to work in teams to solve problems

Course Outcomes: At the end of this course, Students will be able to

CO1 Describe the components of design thinking
CO2 List attributes of expert designers
CO3 Employ prototyping into their design experiences
CO4 Discuss the importance of users in the design process in proposing solutions

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	2	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	2	-	-	-

UNIT-I

Introduction to Design Thinking: Characteristics of design thinking, Expert and novice design characteristics, Opportunities for student to learn skills needed for the development of expertise.
Case study for design thinking success: Creating a culture of design learning, Gathering information from users, Rapid prototyping.

UNIT-II

Users and community partners: Understanding users, identifying users, creating tools for understanding users
Requirements and specifications: Defining specifications, State of the art comparisons, Testing requirements

UNIT-III

Prototyping: Prototypes for technology, Prototypes for communication
Ideation and concept generation: Brainstorming, Concept generation, Functional decomposition.
Testing and design to prevent failures: Testing of designs, Design for Failure Modes and Effects Analysis (DFMEA), Delivery to users

UNIT-IV

Teaming concepts in design: Managing student teams, Organizing teams, Assessing teams, Mentoring and advising teams
Closure and summary: Reviewing design cycles and concepts, Putting it into action

Practical Exercises

1. Design Thinking Mind Map Exercise
2. Functional Decomposition – eg: Mechanical Pencil
3. Thirty Circle Exercise – IDEO thinking
4. Shopping Cart Design Exercise - IDEO
5. Brain storm and innovate bicycle for better urban mobility
6. Develop an Empathy Map – case study
7. The Lean Canvas Model – business model
8. Technology Readiness Assessment – to evaluate project risks
9. Prototyping Exercise – using paper/thermos coal/cardboard/recyclable material
10. Case study of any Jugaad – economic rural solution
11. Design thinking using sprint base software
12. Presentation on Idea Proposal – along with a Prototype (Domain Specific)
13. Risk Analysis – case study – DFMEA Analysis
14. Test Plan Preparation – case study
15. Interaction with Technical community- viable product delivery

Practical Exercises (Branch Specific)

16. Design and develop a prototype animation model for the need of society.
17. Design and implement a prototype web application for the need of real world.

Note: *Minimum of 10 Exercises have to be completed and documented.* Out of these 5 exercises can be tuned to branch specific if necessary.

Text Books :

1. IdrisMootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013).
2. "Change by design", Tim Brown, Harper Collins, 2009
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan 4. Engineering design by George E Dieter

References :

1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization by Vijay Kumar
2. Human-Centered Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World by IDEO

https://www.interaction-desiqn.ora/literature/topics/desiqn-th/nkinq
https://www.interaction-desiqn.prq/literature/article/how-tq-

CLIENT SIDE WEB TECHNOLOGIES LAB

II B.Tech – IV Semester (Code: 24DS403)

Lectures	0	Tutorial	0	Practical	03	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Know skills in creating standards-compliant web pages having semantic elements, Multimedia, Forms.
- Apply CSS3 and DHTML features in creating a dynamic and interactive web page design.
- Know the basics of JavaScript Objects, DOM and ES6 features.
- Understand the React.js front-end framework basics.

Course Outcomes: At the end of this course, Students will be able to

CO1 Develop basic HTML5 web applications using semantic elements, Multimedia and Forms.
CO2 Create Dynamic and Interactive web pages using CSS3 and DHTML.
CO3 Build dynamic web pages using JavaScript Objects, DOM, and ES6 features.
CO4 Develop React applications using Props, State and React Router.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	2	1	1	-	-	-	1	2	-	2	3	2
CO2	3	3	3	2	2	-	-	-	1	2	-	2	3	3
CO3	3	3	3	2	2	-	-	-	1	2	-	3	3	3
CO4	3	3	3	3	3	-	-	-	2	2	-	3	3	3

List of Experiments

1. Design an HTML5 webpage using fundamental elements, organizing text, Links, URLs and Tables.
2. Design an HTML5 webpage using Images, Colors and Forms.
3. Demonstrate applying different CSS styling techniques: - CSS styles, Box model, Font, Text, Displaying, Positioning & Floating an element.
4. Develop a JavaScript application covering Functions and Arrays.
5. Develop a JavaScript application handling Events.
6. Create a Student Registration Form using HTML, CSS and JavaScript with features Local Storage of registration details with validation and display in tabular form.
7. Develop a JavaScript application using the Window Object and Document Object.
8. Demonstrate the Document Object Model for an HTML document.
9. Write a program to demonstrate ES6 features.

10. Set up a React App using create-react-app. Create a component-based UI for a simple profile page.
11. Develop a React App to display a Counter and a dynamic list of tasks using Props and State.
12. Develop a React App using Forms and handle Events.

Text Books :

1. **HTML 5 Black Book:** Covers CSS3, JavaScript, XML, XHTML, Ajax, PHP and Jquery, Kogent Learning Solutions Inc., Wiley India 7 edition. 2011. ISBN: 9789350040959.
2. **HTML and CSS:** Design and Build Websites, Jon Duckett, Wiley, 2011.
3. **Learning React,** Alex Banks & Eve Porcello, O'Reilly, 2nd Edition, 2020.

References :

1. Harvey M. Deitel and Paul J. Deitel, "Internet & World Wide Web How to Program", 4/e, Pearson Education.
2. Jason Cranford Teague, "Visual Quick Start Guide CSS DHTML & AJAX", 4e, Pearson Education.
3. Tom Nerino Doli smith, "Java Script & AJAX for the web", Pearson Education2007.

RDBMS LAB

II B.Tech – IV Semester (Code: 24DSL404)

Lectures	0	Tutorial	0	Practical	3	Credits	1.5
Continuous Internal Evaluation			40	Semester End Examination			60

Pre-Requisite: None.

Course Objectives:

- Analyze the students on database languages.
- Interpret the Knowledge on database design.
- Determine the knowledge on key constraints and Normalization.
- Determine the knowledge on procedures and functions.

Course Outcomes: At the end of this course, Students will be able to

CO1 Design database by using ER Diagrams
CO2 Implement DDL, DML, DCL Commands using SQL.
CO3 Apply key constraints to get a normalized database.
CO4 Implement procedures and functions using PL/SQL

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	3	3	3	-	2	-	2	-	3	3	3	3
CO2	3	3	3	3	3	-	2	-	2	-	3	3	3	3
CO3	3	3	3	3	3	-	2	-	2	-	3	3	3	3
CO4	3	3	3	3	3	-	2	-	2	-	3	3	3	3

LIST OF EXPERIMENTS

Experiment I: DDL, DML, DCL

1. **Create a table EMPLOYEE with following schema:**
   (Emp_no, E_name, E_address, E_ph_no, Dept_no, Dept_name,Job_id , Salary)
   a. Add a new column; HIREDATE to the existing relation.
   b. Change the datatype of JOB_ID from char to varchar2.
   c. Change the name of column/field Emp_no to E_no.
   d. delete E_ph_no column.
2. **Create department table with the following structure.**
   Name Type Deptno Number, Deptname Varchar2(10), location Varchar2(10)
   a. Add column designation to the department table.
   b. Insert values into the table.
   c. Update the record where deptno is 9.
   d. Delete any column data from the table.
3. **Create a table called Customer table**
   Name Type Cust name Varchar2(20), Cust street Varchar2(20), Cust city Varchar2(20)
   a. Insert records into the
   b. Add salary column to the table.
   c. Alter the table column domain.
   d. Drop salary column of the customer table.
   e. Delete the rows of customer table whose cust_city is "hyd".

Experiment II: Simple Queries on Employee Table-selection, projection, sorting

Emp Table

EMPNO	ENAME	JOB	MGR	HIREDATE	SALARY	DNO
7839	KING	PRESIDENT		17-Nov-81	5000	10
7698	BLAKE	MANAGER	7839	1-May-81	2850	30
7782	CLARK	MANAGER	7839	9-Jun-81	2450	10
7566	JONES	MANAGER	7839	2-Apr-81	2975	20
7654	MARTIN	SALESMAN	7698	28-Sep-81	1250	30
7499	ALLEN	SALESMAN	7698	20-Feb-81	1600	30
7844	TURNER	SALESMAN	7698	20-Feb-81	1500	30
7900	JAMES	CLERK	7698	3-Dec-81	950	30
7521	WARD	SALESMAN	7698	22-Feb-81	1250	30
7902	FORD	ANALYST	7782	3-Dec-81	3000	20
7369	SMITH	CLERK	7788	17-Dec-80	800	20
7788	SCOTT	ANALYST	7782	9-Dec-82	3000	20
7876	ADAMS	CLERK	7788	12-Jan-83	1100	20
7934	MILLER	CLERK	7788	23-Jan-82	1300	10

Department table

DNO	DNAME	LOCATION
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

1. List empno, empname and salary.
2. List the names of all MANAGERS.
3. List all clerks in deptno. 30.
4. List the employees to who manager is 7698.
5. List jobs in dept 20.
6. List employee names whose salary is between 2000 and 3000.
7. List employees in the departments 10, 20.
8. List employee names which begin with S.
9. List employee names having ‘A’ in their names.
10. List employees who have joined in JAN.
11. List employees who have joined in the year 81.
12. List all distinct jobs.
13. List employee names in alphabetical order.
14. List employee names alphabetically department wise.
15. List employee names alphabetically job wise.
16. List employee numbers, name sal, DA(15% OF SAL) and PF (10% of sal).
17. List employee names having an experience more than 15 years.
18. List employee names whose commission is NULL.
19. List employees who do not report to anybody.
20. List maximum sal, minimum sal, average sal.
21. List the numbers of jobs.
22. List the numbers of people and average salary in deptno 30.
23. List maximum sal and minimum sal in the designations SALESMAN and CLERK.
24. List the numbers of people and average salary of employees joined in 81, 82 and 83.

25. List jobs that are unique to deptno 20 set operations (Add more problems).
26. Display today's date and present time.
27. List employee names and their joining date in the following formats
    A. SMITH 17th DEC NINETEEEN EIGHTY
    B. SMITH SEVENTEENTH DEC NINETEEN EIGHTY
    C. SMITH Week day of joining
    D. SMITH 17/12/80
28. List employee names and their experience in years
29. List employee names who joined in DEC and on Monday or Friday.
30. Display a given date as a string in different formats.

Experiment III: Advanced SQL Queries on Employee Table – Dynamic Relations, EXISTS, NOT EXISTS, Aggregate Functions (COUNT, SUM, AVG, MAX and MIN), Conversion Functions & String Functions

1. List employee names and their hire dates sorted in the order of their experience.
2. List managers names and their joining dates completely spelled in alphabetical order of names.
3. List employee names and their experience in years with names arranged in descending order.
4. List the employees' names having minimum of 2years of experience sorted on experience
5. List employee names with all capital letters, with all small letters and with first letter only as capital.
6. List employee names with length of the name sorted on length.
7. List employee names appending Sri to the beginning and Garu to the end.
8. List employee names and month names of joining.
9. List employee names and year of joining in words.
10. List employee's names, job and salary with 5 hyphens in between.
11. List employee names and position of first occurrence of I in their name.
12. List employee names and the string without first character and last character in their name.
13. List employees who joined between Apr 81 and Apr 82.
14. List max sal, min sal and average sal of depts. 10, 30.
15. List the designation in dept 30 but not in 20.
16. List the number of employees in each department along with dept numbers.
17. List number of employees joined year wise.
18. List number of employees job wise.
19. List max sal, min sal, average salary dept wise.
20. List max sal, min sal, average salary job wise.
21. List max sal, min sal for the jobs MANAGER and CLERK.
22. List max sal, min sal AND average salary of the depts. Having a minimum 3 employees.
23. List the number of employees in each job in each department.
24. MGR and the number of employees report to them in the sorted order.
25. List emp numbers of employees to whom a minimum of 3 people report.
26. List dept numbers having a minimum of 3 persons.
27. List names of jobs having a minimum of 3 persons in that job.
28. List names of months in which a minimum of 3 persons joined.
29. List hiredates of employees having 2 or more employees having the same hiredate.
30. List departments having minimum of 3 people having a minimum of 28 years of experience.

Experiment IV: Advanced queries -JOIN OPERATIONS

Structure of the database(Suppliers-Parts-Projects database):

S: (S#,SNAME,STATUS,CITY)
PRIMARY KEY (S#)

P: (P#,PNAME,COLOR,WEIGHT,CITY)
PRIMARY KEY(P#)
J: (J#,JNAME,CITY)
PRIMARY KEY(J#)
SPJ: (S#,P#,J#,QTY)
PRIMARY KEY(S#,P#,J#)
FOREIGN KEY(S#) REFERENCES S
FOREIGN KEY(P#) REFERENCES P
FOREIGN KEY(J#) REFERENCES J

Tables of the above database

S TABLE:

S	SNAME	STATUS	CITY
S1	Smith	20	London
S2	Jones	10	Paris
S3	Blake	30	Paris
S4	Clark	20	London
S5	Adams	30	Athens

P TABLE:

P	PNAME	COLOR	WEIGHT	CITY
P1	Nut	Red	18	London
P2	Bolt	Green	17	Paris
P3	Screw	Blue	17	Rome
P4	Screw	Red	14	London
P5	Cam	Blue	12	Paris
P6	Cog	Red	19	London

J TABLE:

J	JNAME	CITY
J1	Sorter	Paris
J2	Display	Rome
J3	OCR	Athens
J4	Console	Athens
J5	Raid	London
J6	EDC	Oslo
J7	Tape	London

SPJ TABLE:

S#	**P#**	**J#**	**QTY**
S1	P1	J1	200
S1	P1	J4	700
S2	P3	J1	400
S2	P3	J2	200
S2	P3	J3	200
S2	P3	J4	500
S2	P3	J5	600
S2	P3	J6	400

S2	P3	J7	800
S2	P5	J2	100
S3	P3	J1	200
S3	P4	J2	500
S4	P6	J3	300
S4	P6	J7	300
S5	P2	J2	200
S5	P2	J4	100
S5	P5	J5	500
S5	P5	J7	100
S5	P6	J2	200
S5	P1	J4	100
S5	P3	J4	200
S5	P4	J4	800

1. Get full details of all projects.
2. Get full details of all Projects in London
3. Get supplier numbers for Suppliers who supply Project J1.
4. Get all shipments where the quantity is in the range 300 to 700.
5. Get all part-color/part-city combinations.

Note: Here and in subsequent exercises, the term "all" is to be taken to mean"all currently represented in the Database", not "all possible".

6. Get all Supplier-number/part-number/Project-number triples such that the indicated Supplier part and Project are collocated.
7. Get all supplier-number/part-number/project-number triples such that the indicated supplier, part and project are not all collocated.
8. Get all supplier-number/part-number/ project-number triples such that the indicated supplier, part and project are collocated.
9. Get part numbers for parts supplied by a supplier in London.
10. Get part numbers for parts supplied by a supplier in London to a project in London.
11. Get all pairs of city names such that a supplier in the first city supplies a project in the second city.
12. Get part numbers for parts supplied to any project by a supplier in the same city as that project.
13. Get project numbers for projects supplied by atleast one supplier not in the same city.
14. Get all pairs of part numbers such that some supplier supplies both the indicated parts.
15. Get the total number of projects supplied by supplier S1.
16. Get the total quantity of part P1 supplied by suppliers S1.
17. For each part being supplied to some project get the part number, the project numbers and the corresponding total quantity.
18. Get part numbers of parts supplied to some project in an average quantity of more than 320.
19. Get project names for projects supplied by supplier S1.
20. Get colors of parts supplied by supplier S1.
21. Get parts numbers for parts supplied to any project in London.
22. Get project numbers for projects using atleast one part available from supplier S1.
23. Get supplier numbers for suppliers supplying atleast one part supplied by atleast one supplier who supplies atleast one red part.
24. Get supplier numbers for suppliers with a status lower than that of supplier S1.

25. Get project numbers for projects whose city is first in the alphabetic list

Experiment V: Working with LOOPS using PL/SQL
Program Development using WHILE LOOPS, FOR LOOPS, Nested Loops using ERROR Handling.

Experiment VI: Working with Functions Using PL/SQL
Program Development using Creation of Stored Functions, Invoke Functions in SQL Statements and Write Complex Functions.

Experiment VII: Working with Stored Procedures
Programs Development using Creation of Procedures, Passing Parameters IN and OUT of PROCEDURES

Experiment VIII: Working with CURSORS
Develop Programs using Features Parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of Clause and CURSOR Variables.

Text Books :

1. Oracle PL/SQL by Example, Benjamin Rosenzweig, Elena Silvestrova, Pearson Education 3rdEd
2. Oracle Database Logic PL/SQL Programming, ScottUrman, TataMc-Graw Hill.
3. SQL and PL/SQL for Oracle 10g, Black Book, Dr.P.S.Deshpande

NSS/ NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

II B.Tech – IV Semester (Code: 24DSL405)

Lectures	0	Tutorial	0	Practical	2	Credits	0.5
Continuous Internal Evaluation			100	Semester End Examination			---

Pre-Requisite: None.

Course Objectives:

- The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service

Course Outcomes: At the end of this course, Students will be able to

CO1	Understand the importance of discipline, character and service motto.
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3	Explore human relationships by analyzing social problems.
CO4	Determine to extend their help for the fellow beings and downtrodden people and also Leadership skills and civic responsibilities.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	2	-	3	-	-	-

UNIT-I

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting -ice breaking sessions-expectations from the course-knowing personal talents and skills

ii) Conducting orientations programs for the students -future plans-activities-releasing road map etc.

iii) Displaying success stories-motivational biopics-award winning movies on societal issues etc.

iv) Conducting talent show in singing patriotic songs-paintings-any other contribution

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UNIT-II

Nature & Care

Activities:

i) Best out of waste competition.

ii) Poster and signs making competition to spread environmental awareness.

iii) Recycling and environmental pollution article writing competition.

iv) Organising Zero-waste day.

v) Digital Environmental awareness activity via various social media platforms.

vi) Virtual demonstration of different eco-friendly approaches for sustainable living.

vii) Write a summary on any book related to environmental issues.

UNIT-III

Community Service

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders-Survey in the village, identification of problems-helping them to solve via media-authorities-experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health,
Spiritual Health, HIV/AIDS.
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes-Sexual Abuse, Adolescent Health and Population Education. v) Any other programmes in collaboration with local charities, NGOs etc.

Text Books : 1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)

References :

ENVIRONMENTAL SCIENCE

II B. Tech. – III Semester (Code: 24DS406/MC01)

Lectures	2	Tutorial	0	Practical	0	Credits	0
Continuous Internal Evaluation			40	Semester End Examination			0

Pre-Requisite: Chemistry, Physics, Geography and Earth Science

Course Objectives: To learn

- To understand and learn about ecosystem and biodiversity exist in nature.
- To know about the natural resources and sustainability
- To understand different types of pollutions present in Environment
- To know the global environmental problems with case studies

Course Outcomes: At the end of this course, Students will be able to

CO1	Students develop a strong understanding of ecosystems, biodiversity and the importance of their conservation
CO2	Students gain an understanding of the protection of natural resources for environmental protection and sustainability.
CO3	Know how to manage the harmful pollutions
CO4	Create awareness among the youth on environmental concerns important in the long-term interest of the society.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	POs											PSOs		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	-	-	-	3	3	-	-	-	-	1	-	-
CO2	3	2	-	-	-	3	3	2	-	-	-	1	-	-
CO3	3	2	-	-	-	3	3	2	-	3	-	1	-	-
CO4	3	2	-	-	-	3	3	-	-	-	-	1	-	-

UNIT-I

Ecosystems: Definition, Structure and Functions of Ecosystems, Forest Ecosystem.
Biodiversity: Definition and levels of Biodiversity; Values of Biodiversity, Threats and Conservation of Biodiversity.

UNIT-II

Natural resources: Land: Land as a resource, Causes and effects of land degradation, **Water**: floods and drought, Dams - benefits and problems.
Sustainability: Rain water harvesting and Watershed management.

UNIT-III

Pollution: Definition; Causes, effects and control of air, water pollution:
Solid Waste Management - 3R approach, composting and vermicomposting.
Environmental acts: Water and air (Prevention and Control of pollution) acts, Environmental protection act, Forest Conservation act.

UNIT-IV

Environmental issues: Global warming, Ozone layer depletion, Acid rains
Case Studies: Bhopal Tragedy, Mathura Refinery and TajMahal

Text Books :

1. "Environmental Science and Engineering" by Benny Joseph, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. "Introduction to Environmental Science", Anjaneyulu Y, B S Publications
3. "Comprehensive environmental studies"- JP Sharma, Laxmi Publications.

References :

1. "Environmental studies", R.Rajagopalan, Oxford University Press.
2. "Environmental Science", 11th Edition – Thomson Series – By Jr. G. Tyler Miller.
3. Text Book of environmental Studies – Erach Bharucha