CSE - COURSE STRUCTURE

I Year I Semester

S. No.	Course Code	Name of Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	EG4501	Communicative English	2	0	0	2
2	MA4501	Linear Algebra and Calculus	3	0	0	3
3	CH4501	Chemistry	3	0	0	3
4	CM4501	Basic Civil and Mechanical Engineering	3	0	0	3
5	CT4501	Introduction to Programming	3	0	0	3
6	EG4502	Communicative English Lab	0	0	2	1
7	CH4502	Chemistry Lab	0	0	2	1
8	CT4502	Computer Programming Lab	0	0	3	1.5
9	ME4502	Engineering Workshop	0	0	3	1.5
10	HW4501	Health and Wellness, Yoga and Sports	0	0	1	0.5
Total			**14**	**0**	**11**	**19.5**

I Year II Semester

S. No.	Course Code	Name of Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	PH4501	Engineering Physics	3	0	0	3
2	MA4502	Differential Equations and Vector Calculus	3	0	0	3
3	EE4501	Basic Electrical and Electronics Engineering	3	0	0	3
4	ME4501	Engineering Graphics	1	0	4	3
5	CT4504	Data Structures	3	0	0	3
6	PH4502	Engineering Physics Lab	0	0	2	1
7	EE4502	Electrical and Electronics Engineering Workshop	0	0	3	1.5
8	CT4505	Data Structures Lab	0	0	3	1.5
9	CT4503	IT Workshop	0	0	2	1
10	NS4501	NSS/NCC/Scouts and Guides and Community Service	0	0	1	0.5
Total			**13**	**0**	**15**	**20.5**

II Year I Semester

Sl. No.	Course Code	Name of Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	UH4501	Universal human values – understanding harmony and Ethical human conduct	2	1	0	3
2	MA4505	Discrete Mathematics and Graph Theory	3	0	0	3
3	CT4510	Digital Logic and Computer Organization	3	0	0	3
4	CT4511	Advanced Data Structures and Algorithm Analysis	3	0	0	3
5	CT4512	Object Oriented Programming Through Java	3	0	0	3
6	CT4513	Advanced Data Structures and Algorithms Lab	0	0	3	1.5
7	CT4514	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	CT4515	Python Programming	0	1	2	2
Total			**14**	**2**	**8**	**20**

II Year II Semester

Sl. No.	Course Code	Name of Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	BA4501	Managerial Economics and Financial Analysis	2	0	0	2
2	MA4506	Probability and Statistics	3	0	0	3
3	CT4518	Operating Systems	3	0	0	3
4	CT4517	Database Management Systems	3	0	0	3
5	CT4519	Software Engineering	3	0	0	3
6	CS4501	Operating Systems Lab	0	0	3	1.5
7	CT4520	Database Management Systems Lab	0	0	3	1.5
8	CT4521	Full Stack Development – 1	0	1	2	2
9	DT4501	Design Thinking and Innovation	1	0	2	2
10	EN4501	Environmental Science	2	0	0	0
Total			**17**	**1**	**10**	**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						

III Year I Semester

Sl. No.	Course Code	Name of Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	CT4523	Data Warehousing and Data Mining	3	0	0	3
2	CT4524	Computer Networks	3	0	0	3
3	CS4502	Formal Languages and Automata Theory	3	0	0	3
4		**Professional Elective – I** (see list of Professional Electives)	3	0	0	3
5		**Open Elective – I** (see list of Open Electives)	3	0	0	3
6	CS4505	Data Mining Lab	0	0	3	1.5
7	CT4531	Computer Networks Lab	0	0	3	1.5
8	EG4503	Soft Skills	0	1	2	2
9	CT4532	User Interface Design using Flutter	0	0	2	1
10	CS4506	Community Service Internship	0	0	4	2
		Total :	**15**	**1**	**14**	**23**

III Year II Semester

Sl. No.	Course Code	Name of Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	CS4507	Compiler Design	3	0	0	3
2	CT4530	Cloud Computing	3	0	0	3
3	CT4535	Cryptography and Network Security	3	0	0	3
4	-	**Professional Elective – II** (see list of Professional Electives)	3	0	0	3
5	-	**Professional Elective – III** (see list of Professional Electives)	3	0	0	3
6	-	**Open Elective – II** (see list of Open Electives)	3	0	0	3
7	CT4545	Cloud Computing Lab	0	0	3	1.5
8	CS4510	Cryptography and Network Security Lab	0	0	3	1.5
9	CT4533	Full Stack Development – 2	0	1	2	2
10	EG4504	Technical Paper Writing and IPR	2	0	0	0
		Total :	**20**	**1**	**8**	**23**

IV Year I Semester

S. No.	Course Code	Name of Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	CT4537	Deep Learning	3	0	0	3
2	BA4506	Human Resources and Project Administration	2	0	0	2
3		**Professional Elective-IV** (see list of Professional Electives)	3	0	0	3
4		**Professional Elective-V** (see list of Professional Electives)	3	0	0	3
5		**Open Elective-III** (see list of Open Electives)	3	0	0	3
6		**Open Elective-IV** (see list of Open Electives)	3	0	0	3
7	CT4550	Prompt Engineering	0	1	2	2
8	BA4507	Constitution of India	2	0	0	0
9	CS4513	Evaluation of Industry Internship	0	0	0	2
Total			**19**	**01**	**02**	**21**

IV Year II Semester

S. No.	Course Code	Name of Course / Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	CS4514	Full semester Internship &Project Work	0	0	24	12

Open Elective – I

S.No	Course Code	Name of the Course/Laboratory	Department Offering the Subject	No. of Periods per week			No. of Credits
				L	T	P	
1	CE4525	Green Buildings *(Other than CE)*	*CE*	3	0	0	3
2	CE4526	Climate Change Impact on Eco System *(Other than CE)*	*CE*	3	0	0	3
3	EE4523	Electrical Materials *(Other than EEE)*	*EEE*	3	0	0	3
4	EE4524	Electrical Safety Management *(Other than EEE)*	*EEE*	3	0	0	3
5	ME4521	Principles of Sustainable Energy Technologies *(Other than ME)*	*ME*	3	0	0	3
6	ME4522	Additive Manufacturing *(Other than ME)*	*ME*	3	0	0	3
7	EC4532	Electronic Devices and Applications *(Other than EEE, ECE & IoT)*	*ECE*	3	0	0	3
8	EC4533	Introduction to Signals and Systems *(Other than EEE, ECE & IoT)*	*ECE*	3	0	0	3
9	EC4534	Probability Theory and Random Variables *(Other than ECE & IoT)*	*ECE*	3	0	0	3
10	CS4503	Fundamentals of Data Structures *(Other than CSE, IT, CSE(AI&ML), AI&DS)*	*CSE*	3	0	0	3
11	CS4504	Ethical Hacking *(Other than CSE)*	*CSE*	3	0	0	3
12	IT4504	Principles of Operating Systems *(Other than CSE, IT, CSE(AI&ML))*	*IT*	3	0	0	3
13	IT4505	Free and Open-Source Software *(Other than IT)*	*IT*	3	0	0	3
14	AM4504	Introduction to Cloud Computing *(Other than CSE, IT, CSE(AI&ML), AI&DS, IoT)*	*CSE(AI&ML)*	3	0	0	3
15	AM4505	Principles of Information Retrieval Systems *(Other than CSE(AI&ML))*	*CSE(AI&ML)*	3	0	0	3
16	AD4508	Fundamentals of Database Management Systems *(Other than CSE, IT, CSE(AI&ML), AI&DS)*	*AI&DS*	3	0	0	3
17	AD4509	Foundations of Exploratory Data Analysis *(Other than AI&DS)*	*AI&DS*	3	0	0	3
18	IN4512	Fundamentals of IoT *(Other than IoT)*	*IoT*	3	0	0	3
19	IN4513	Introduction to Sensors & Actuators *(Other than IoT)*	*IoT*	3	0	0	3
20	BA4503	Entrepreneurship Development &Venture Creation	*MBA*	3	0	0	3

Open Elective – II

S.No	Course Code	Name of the Course/Laboratory	Department Offering the Subject	No. of Periods per week			No. of Credits
				L	T	P	
1	CE4541	Disaster Management *(Other than CE)*	*CE*	3	0	0	3
2	CE4542	Sustainability in Engineering Practices *(Other than CE)*	*CE*	3	0	0	3
3	EE4535	Fundamentals of Electrical Machines *(Other than EEE)*	*EEE*	3	0	0	3
4	EE4537	Fundamentals of Electric Vehicles *(Other than EEE)*	*EEE*	3	0	0	3
5	ME4537	Green Engineering *(Other than ME)*	*ME*	3	0	0	3
6	ME4538	Non-Destructive Evaluation *(Other than ME)*	*ME*	3	0	0	3
7	EC4552	Principles of Communications *(Other than EEE, ECE, IoT)*	*ECE*	3	0	0	3
8	EC4553	Introduction to Microprocessors & Microcontrollers *(Other than EEE, ECE, IoT)*	*ECE*	3	0	0	3
9	CS4508	Fundamentals of Java Programming *(Other than CSE, IT, CSE(AI&ML), AI&DS, IoT)*	*CSE*	3	0	0	3
10	CS4509	Scripting Languages *(Other than CSE)*	*CSE*	3	0	0	3
11	IT4508	M-Commerce *(Other than IT)*	*IT*	3	0	0	3
12	IT4509	Web Technologies *(Other than CSE, IT, CSE(AI&ML), AI&DS)*	*IT*	3	0	0	3
13	AM4510	Fundamentals of Deep Learning *(Other than CSE, IT, CSE(AI&ML), AI&DS)*	*CSE(AI&ML)*	3	0	0	3
14	AM4511	Principles of Cyber Security *(Other than CSE, CSE(AI&ML), IT)*	*CSE(AI&ML)*	3	0	0	3
15	AD4513	Foundations of NoSQL Databases *(Other than CSE(AI&ML), AI&DS)*	*AI&DS*	3	0	0	3
16	AD4514	Fundamentals of Data Science *(Other than CSE, IT, CSE(AI&ML), AI&DS)*	*AI&DS*	3	0	0	3
17	IN4525	Introduction to Smart Sensors *(Other than IoT)*	*IoT*	3	0	0	3
18	IN4526	Trends in IoT *(Other than ECE, IoT)*	*IoT*	3	0	0	3
19	EG4505	Academic Communication	*English*	3	0	0	3

Open Elective – III ----------MOOCs

Open Elective – IV

S.No	Course Code	Name of the Course/Laboratory	Department Offering the Subject	No. of Periods per week			No. of Credits
				L	T	P	
1	CE4555	Building Services *(Other than CE)*	*CE*	3	0	0	3
2	CE4556	Quality and Safety Engineering *(Other than CE)*	*CE*	3	0	0	3
3	EE4547	Battery Management Systems and Charging Stations *(Other than EEE)*	*EEE*	3	0	0	3
4	EE4548	Power Systems Engineering *(Other than EEE)*	*EEE*	3	0	0	3
5	ME4551	Total Quality Management *(Other than ME)*	*ME*	3	0	0	3
6	ME4552	Automotive Engineering *(Other than ME)*	*ME*	3	0	0	3
7	EC4564	Principles of Cellular and Mobile Communications *(Other than ECE)*	*ECE*	3	0	0	3
8	EC4565	Introduction to Embedded Systems *(Other than ECE & IoT)*	*ECE*	3	0	0	3
9	CS4511	Social Network Analysis *(Other than CSE)*	*CSE*	3	0	0	3
10	CS4512	Quantum Science and Technology *(Other than CSE, AI&DS, CSE(AI&ML))*	*CSE*	3	0	0	3
11	IT4511	Biometrics *(Other than IT)*	*IT*	3	0	0	3
12	IT4510	Information Security *(Other than CSE, IT, AI&DS, CSE(AI&ML))*	*IT*	3	0	0	3
13	AM4516	Introduction to Recommender Systems *(Other than CSE(AI&ML))*	*CSE(AI&ML)*	3	0	0	3
14	AM4517	AI Chatbots *(Other than CSE(AI&ML))*	*CSE(AI&ML)*	3	0	0	3
15	AD4523	Fundamentals of Soft Computing *(Other than AI&DS)*	*AI&DS*	3	0	0	3
16	AD4522	Fundamentals of Agentic AI *(Other than AI&DS)*	*AI&DS*	3	0	0	3
17	IN4535	Industrial IoT: Concepts and Applications *(Other than IoT & ECE)*	*IoT*	3	0	0	3
18	IN4536	Introduction to IoT System Design *(Other than IoT & ECE)*	*IoT*	3	0	0	3

Professional Electives

S.No	Course Code	Name of the Course/Laboratory	No. of Periods per week			No. of Credits
			L	T	P	
1	CT4516 CT4526 CT4527 CT4528	**Professional Elective-I** i) Artificial Intelligence ii) Object Oriented Analysis and Design iii) Distributed Operating Systems iv) Software Project Management v) MOOCS	3	0	0	3
2	CT4529 CT4539 CT4540 AM4501	**Professional Elective-II** i) Cyber Security ii) Software Testing Methodologies iii) Devops iv) Machine Learning v) MOOCS	3	0	0	3
3	CT4536 CT4538 CT4543 CT4544	**Professional Elective-III** i) Natural Language Processing ii) Principles of Big Data Analytics iii) Quantum Computing iv) Mobile Ad Hoc Networks v) MOOCS	3	0	0	3
4	CT4547 CT4546 CT4534 IN4505	**Professional Elective-IV** i) Software Architecture and Design Patterns ii) Blockchain Technology iii) Augmented Reality and Virtual Reality iv) Internet of Things v) MOOCs	3	0	0	3
5	CT4548 CT4541 CT4542 CT4549	**Professional Elective-V** i) Agile Methodologies ii) Generative AI iii) Computer Vision iv) Cyber Physical Systems v) MOOCs	3	0	0	3

Honors Degree Course Structure

Sl. No.	Course Code	Year & Sem.	Name of Course / Laboratory	No. of Periods per week			No. of Credits
				L	T	P	
1	HNCS4501	III-I	Data Science	3	0	0	3
2	HNCS4502	III-I	Data Science using Python Lab	0	0	3	1.5
3	HNCS4503	III-II	Data Visualization and Communication	3	0	0	3
4	HNCS4504	III-II	Data Visualization and Communication Lab	0	0	3	1.5
5	-	III-II	12 Week MOOC Swayam/NPTEL Course	0	0	0	3
6	HNCS4505	IV-I	Foundations of Recommender Systems	3	0	0	3
7	-	IV-I	12 Week MOOC Swayam/NPTEL Course	0	0	0	3
Total							18

SYLLABUS
COMMUNICATIVE ENGLISH
(Common to All Branches)
I Year – I Semester

Lecture : 2	Internal Marks : 30
Credits : 2	External Marks : 70

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Course Objective

The main objective of introducing this course, Communicative English, is to facilitate effective Listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

Course Outcomes

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

- Understand the context, topic, and pieces of information from social or Transactional dialogues.
- Apply grammatical structures to formulate sentences and correct word forms.
- Analyze discourse markers to speak clearly on a specific topic in informal discussions.
- Evaluate reading / listening texts and to write summaries based on global comprehension of the texts.
- Create a coherent paragraph, essay, and resume.

Course Content

UNIT – I:

Lesson : HUMAN VALUES: Gift of Magi **(Short Story)**

Listening : Identifying the topic, the context and specific pieces of information by listeningto short audio texts and answering a series of questions.

Speaking : Asking and answering general questions on familiar topics such as home,family, work, studies and interests; introducing oneself and others.

Reading : Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing : Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar : Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary : Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT – II:

Lesson : NATURE: The Brook by Alfred Tennyson (Poem)

Listening : Answering a series of questions about main ideas and supporting ideas afterlistening to audio texts.

Speaking : Discussion in pairs/small groups on specific topics followed by short structuretalks.

Reading : Identifying sequence of ideas; recognizing verbal techniques that help to linkthe ideas in a paragraph together.

Writing : Structure of a paragraph - Paragraph writing (specific topics)

Grammar : Cohesive devices - linkers, use of articles and zero article; repositions.
Vocabulary : Homonyms, Homophones, Homographs.

UNIT – III:
Lesson : **BIOGRAPHY: Elon Musk**
Listening : Listening for global comprehension and summarizing what is listened to.
Speaking : Discussing specific topics in pairs or small groups and reporting what isdiscussed

Reading : Reading a text in detail by making basic inferences -recognizing and interpretingspecific context clues; strategies to use text clues for comprehension.
Writing : Summarizing, Note-making, paraphrasing
Grammar : Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary : Compound words, Collocations

UNIT – IV:
Lesson : **INSPIRATION: The Toys of Peace by** Saki
Listening : Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking : Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading : **S**tudying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.
Writing : Letter Writing: Official Letters, Resumes
Grammar : Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary : Words often confused, Jargons

UNIT – V: The Power of Intrapersonal Communication (An Essay)
Lesson : **MOTIVATION**
Listening : Identifying key terms, understanding concepts and answering a series ofrelevant questions that test comprehension.
Speaking : Formal oral presentations on topics from academic contexts
Reading : Reading comprehension.
Writing : Writing structured essays on specific topics.
Grammar : Editing short texts identifying and correcting common errors in grammar andusage (articles, prepositions, tenses, subject verb agreement)
Vocabulary : Technical Jargons

Text Books:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, OrientBlack Swan, 2023
2. **Extensive Reading (for internal assessment only)**
   The following simplified classics, one for each mid-semester, from the series, Great Stories in Easy English, published by S. Chand & Company Limited:
   - Kidnapped by R L Stevenson
   - Little Women by Louisa May Alcott

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge,2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building aSuperior Vocabulary. Anchor, 2014.

e-Learning Resources:

Grammar:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

Vocabulary:

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

LINEAR ALGEBRA AND CALCULUS

(Common to All Branches)

I Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To equip the students with standard concepts and tools at an intermediate to advanced level of mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course Outcomes

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

- develop and use of matrix algebra techniques that are needed by engineers for practical applications.
- compute eigen values and eigenvectors of real matrices.
- utilize mean value theorems to real life problems.
- familiarize with functions of several variables, which are useful in optimization.
- measure areas and volumes using double and triple integrals.

Course Content

UNIT – I: Matrices

Rank of a matrix by Echelon form, Normal form. Cauchy–Binet formula (without proof). Inverse of non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT – II: Eigenvalues, Eigenvectors and Orthogonal Transformation

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical form by Orthogonal Transformation.

UNIT – III: 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's theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT – IV: Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT – V: Multiple Integrals (Multi variable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals)

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B.Thomas, Maurice D.Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S.R.K.Iyengar, Alpha Science International Ltd., 2021, 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th Edition
5. Higher Engineering Mathematics, H.K Das, Er.Rajnish Verma, S. Chand Publications, 2014, 3rd Edition (Reprint 2021).

CHEMISTRY

(Common to EEE, ECE, IOT, CSE, IT, CSE(AI&ML) & AI&DS)

I Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To impart the knowledge of bonding in the determination of properties of molecules.
- To impart the knowledge of principles and applications of electrochemistry and engineering materials.

Course Outcomes

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

- analyze the properties of molecules basing on fundamentals of quantum mechanics and bonding models.
- explain the properties and applications of modern materials used in electronic devices.
- solve the numerical problems on emf and identify the electrochemistry involved in sensors and batteries.
- explain the properties and applications of polymers.
- identify the applications of spectrophotometric techniques and chromatographic techniques.

Course Content

UNIT – I: Structure and Bonding Models:

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT – II: Modern Engineering materials

Semiconductors - Introduction, basic concept, application

Super conductors - Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphenes nanoparticles.

UNIT – III: Electrochemistry and Applications

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry-potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT – IV: Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT – V: Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification - HPLC: Principle, Instrumentation and Applications.

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb. 2008
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

BASIC CIVIL AND MECHANICAL ENGINEERING

(Common to All Branches)

I Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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PART A: BASIC CIVIL ENGINEERING

Course Objectives

- To get familiarized with the scope and importance of Civil Engineering sub-divisions.
- To introduce the preliminary concepts of surveying.
- To acquire preliminary knowledge on Transportation and its importance in nation's economy.
- To get familiarized with the importance of quality, conveyance and storage of water.
- To introduction to basic civil engineering materials and construction techniques.

Course Outcomes

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

- gain knowledge on various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society
- apply the concepts of surveying and to determine the distances, angles and levels
- realize the importance of Water Storage & Conveyance Structures, Transportation and Environmental Engineering in Nation's economy

Course Content

UNIT – I:

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT – II:

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

UNIT – III:

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Text Books:

1. Basic Civil Engineering, M.S.Palanisamy, Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PARTB: BASIC MECHANICAL ENGINEERING

Course Objectives

- To get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- To explain different engineering materials and different manufacturing processes.
- To provide an over view of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes

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

- select suitable material for the given application.
- apply the principles of CNC machining and 3D printing to create simple components.
- examine the working cycles of engines like Otto, Diesel, and IC engines.
- apply the knowledge of mechanical power transmission systems to solve real-world engineering problems.
- evaluate the potential applications of robotics in different industries.

Course Content

UNIT – I:

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society-Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT – II:

Manufacturing Processes: Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and smart manufacturing.

Thermal Engineering: Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, S I CI Engines, Components of Electric and Hybrid Vehicles.

UNIT – III:

Power Plants: Working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission: Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics: Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject.)

Text Books:

1. Internal Combustion Engines by V.Ganesan, By Tata Mc Graw Hill publications (India) Pvt. Ltd.
2. A text book of Theory of Machines by S. S. Rattan, Tata Mc Graw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

1. G. Shanmugamand M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata Mc Graw Hill publications (India)Pvt. Ltd.
2. Thermal Engineering by Mahesh M Rathore Tata Mc Graw Hill publications (India) Pvt. Ltd.
3. 3D printing & Additive Manufacturing Technology - L. Jyothish Kumar, Pulak M Pandey, Springer publications
4. Appuu Kuttan K K, Robotics, I. K. International Publishing House Pvt. Ltd. Volume-I

INTRODUCTION TO PROGRAMMING

(Common to All Branches)

I Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To foster logical thinking and problem – solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, arrays and files.

Course Outcomes

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

- solve problems using the concepts of algorithm and algorithmic thinking.
- use control structures in programming for solving the problems
- apply the concepts of arrays and strings in problem solving.
- use pointers and user-defined data types in developing the programs
- write functions to increase the reusability of code and use various file handling functions for efficient handling of data.

Course Content

UNIT – I: Introduction to Programming and Problem Solving

History of Computers, Basic organization of a Computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem Solving Techniques: Algorithmic approach, characteristics of algorithm,

Problem Solving Strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT – II: Control Structures

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, dowhile) Break and Continue.

UNIT – III: Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

UNIT – IV: Pointers & User Defined Data types

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT – V: Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and

Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling.

Text Books:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

COMMUNICATIVE ENGLISH LAB

(Common to All Branches)

I Year – I Semester

Practical : 2	Internal Marks : 30
Credits : 1	External Marks : 70

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Course Objectives: The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

Course Outcomes

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

- understand the different aspects of the English language proficiency with emphasis on LSRW skills.
- apply communication skills through various language learning activities.
- analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
- evaluate and exhibit professionalism in participating in debates and group discussions.
- create effective Course Objectives:

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

Walden Infotech Young India

Films

K- Van

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India,2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed),Kindle, 2013

CHEMISTRY LAB

(Common to EEE, ECE, IoT, CSE, IT, AI &DS & CSE(AI &ML))

I Year – I Semester

Practical : 2	Internal Marks : 30
Credits : 1	External Marks : 70

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Course Objectives

- To develop the skill on chemical and instrumental methods of analysis.
- To acquire the skill in preparation of synthetic materials.

Course Outcomes

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

- perform quantitative analysis by using chemical and instrumental methods.
- synthesize polymers and nanomaterials
- verify Beer-Lambert's law.
- calculate strength of an acid in Pb-acid battery.

List of Experiments:

(Any TEN of the listed experiments are to be conducted)

1. Measurement of 10Dq by spectrophotometric method.
2. Conductometric titration of strong acid vs. strong base.
3. Conductometric titration of weak acid vs. strong base.
4. Determination of cell constant and conductance of solutions.
5. Potentiometry - determination of redox potentials and emfs.
6. Determination of Strength of an acid in Pb-Acid battery.
7. Preparation of a Bakelite.
8. Verify Lambert-Beer's law.
9. Wavelength measurement of sample through UV-Visible Spectroscopy.
10. Identification of simple organic compounds by IR.
11. Preparation of nanomaterials by precipitation method.
12. Estimation of Ferrous Iron by Dichrometry.

Reference Book:

1. "Vogel's Quantitative Chemical Analysis" 6th Edition Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Siva sankar

COMPUTER PROGRAMMING LAB

(Common to All Branches)

I Year – I Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To give students hands-on experience in problem solving and train them on the concepts of C – programming language.

Course Outcomes

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

- develop and trace the execution of programs written in C language.
- select the right control structure for solving the problem.
- develop C programs using structures and unions.
- develop, debug and execute programs to demonstrate the applications of arrays, functions and basic concepts of pointers in C.
- create and access files using file handling functions.

Course Content

UNIT – I:

WEEK 1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments /Activities:

Tutorial 1: Problem-solving using Computers.

Lab 1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 2: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate

values and how arithmetic operators can be used with variables and constants.
Suggested Experiments /Activities:
Tutorial 3: Variable types and type conversions:
Lab 3: Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT – II:

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.
Suggested Experiments /Activities:
Tutorial 4: Operators and the precedence and as associativity:
Lab 4: Simple computational problems using the operator' precedence and associativity

i) Evaluate the following expressions.
   a. A+B*C+(D*E) + F*G
   b. A/B*C-B+A*D/3
   c. A+++B---A
   d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, nullelse, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".
Suggested Experiments /Activities:
Tutorial 5: Branching and logical expressions:
Lab 5: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.
Suggested Experiments /Activities:
Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.

ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT – III:

WEEK 7

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments /Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

WEEK 8

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments /Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT – IV:

WEEK 9

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.

v) Write a C program to implement realloc()

WEEK 10

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab 10 : Bitfields, linked lists Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT – V:

WEEK 11

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

Write a C program to swap two numbers using call by reference.

i) Demonstrate Dangling pointer problem using a C program.
ii) Write a C program to copy one string into another using pointer.
iii) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK 14

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File Operations

i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-line arguments.
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

Text Books:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaums Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE.

ENGINEERING WORKSHOP

(Common to All Branches)

I Year – I Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To familiarize students with wood working, sheet metal operations, fitting, electrical house wiring skills, and basic repairs of two-wheeler vehicle.

Course Outcomes

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

- demonstrate the correct use of safety equipment and procedures
- fabricate the lap joint, dovetail joint with the use of woodworking tools.
- utilize sheet metal tools to create tapered tray, conical funnel, elbow pipe and perform brazing.
- perform fitting exercises such as v-fit, dovetail fit, semicircular fit, and bicycle tire puncture and change.
- create electrical connections, including parallel and series circuits, and tube lights
- create green sand moulds for provided patterns.
- perform arc and gas welding to create lap and butt joints.
- create pipe joints with couplings for the same diameter and reducers for different diameters. perform basic repairs and maintenance on a two-wheeler vehicle

Course Content

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and too lsused in wood working and make following joints.
   a) Half Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d)Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V- fit b) Dovetail fit c)Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b)Two-way switch c) Go down lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.

8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

9. **Basic repairs of Two-wheeler vehicle** –Demonstration of working of two-wheeler vehicle and its repairs.

Text Books:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Work shop Processes, Practices and Materials; Bruce J. Black, Routl edge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghu wanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S.K. Hajra Choudhary & Others, Media Promoters and Publishers, Mumbai, 2007, 14th Edition.
2. Workshop practice by H.S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. &Upadhyay P.A; Atul Prakasham, 2022.

HEALTH AND WELLNESS, YOGA AND SPORTS

(Common to All Branches of Engineering)

I Year – I Semester

Practical : 1 Internal Marks : 100

Credits : 0.5

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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

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

- understand the importance of yoga and sports for Physical fitness and sound health
- demonstrate an understanding of health-related fitness components.
- compare and contrast various activities that help enhance their health
- assess current personal fitness levels.
- develop Positive Personality

Course Content

UNIT – I:

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

UNIT – II:

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:

i) Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT – III:

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

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 cardio respiratory fitness, treadmill, run test, 9 min walk, skipping and running.

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

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

ENGINEERING PHYSICS

(Common for all Branches)

I Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To apply principles of wave optics for Engineering Applications
- To Analyze crystal parameters to investigate crystal Structures
- To Impart the knowledge of solid state materials with characteristic utility in various engineering applications

Course Outcomes

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

- Analyze the intensity variation of light due to polarization, interference and diffraction.
- Familiarize with the basics of crystals and their structures.
- Summarize various types of polarization of dielectrics and classify the magnetic materials.
- Explore the basic concepts of Quantum Mechanics and the Free electron theory of solids.
- Identify conductivity mechanism in semiconductors

Course Content

UNIT – I: Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT – II: Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT – III: Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification

of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT – IV: Quantum Mechanics and Free electron Theory

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT – V: Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

Text Books:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

e-Learning Resources:

1. https://www.loc.gov/rr/scitech/selected-internet/physics.html

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(Common to All Branches)

I Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

Course Outcomes

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

- solve the first order differential equations related to various engineering fields.
- find the solutions of higher order linear differential equations.
- identify solution methods for partial differential equations that model physical processes.
- interpret the physical meaning of different operators such as gradient, curl and divergence.
- estimate the work done against a field, circulation and flux using vector calculus also verify the relation between line, surface and volume integrals using integral theorems.

Course Content

UNIT – I: Differential equations of first order and first degree

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT – II: Linear differential equations of higher order (Constant Coefficients)

Definitions, homogeneous and non-homogeneous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT – III: Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT – IV: Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions- Gradient, Directional derivative, Del applied to vector point functions-Divergence and Curl, vector identities.

UNIT – V: Vector integration

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to All Branches)

I Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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PART A: BASIC ELECTRICAL ENGINEERING

Course Objectives

- To expose the students to the fundamentals of dc and ac circuits, electrical machines, measuring instruments, operation of various power generation systems, electricity bill and electrical safety measures.

Course Outcomes

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

- apply fundamental laws / concepts to derive various equations related to impedance, voltage, current and power in electrical circuits.
- describe the construction and working principles of electrical machines, measuring instruments and power generation stations.
- calculate the electrical load / electrical bill for domestic premises and explain the electrical safety measures.

Course Content

UNIT – I: DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT – II: Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT – III: Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Text Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti,Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019,Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford UniversityPress, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications,2018, Second Edition.

e-Learning Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives

- To teach the fundamentals of semiconductor devices, basic electronic circuits and instrumentation and principles of digital electronics

Course Outcomes

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

- expound the operation and characteristics of various diodes, transistors and amplifiers.
- describe the working of rectifiers, regulators, amplifiers with its frequency response, and electronic instrumentation system.
- explicate the various number systems, logic gates, simple combinational circuits and sequential circuits

Course Content

UNIT – I: Semiconductor Devices

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics ofPN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT – II: Basic Electronic Circuits and Instrumentation

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT – III: Digital Electronics

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Text Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

End Examination Pattern:

i) Question paper shall be in two parts viz., Part A and Part B with equal Weightage of 35 marks each.
ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1 mark.
iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

ENGINEERING GRAPHICS

(Common to All Branches)

I Year – II Semester

Lecture : 1	Practical : 4	Internal Marks	: 30
Credits : 3		External Marks	: 70

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Course Objectives

- To impart basic knowledge and skills required to prepare engineering drawings

Course Outcomes

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

- demonstrate the ability to construct regular polygons and curves.
- develop various scales to accurately represent measurements on engineering drawings.
- prepare orthographic projections for points, lines and planes.
- create projections for solids.
- demonstrate the ability to section and develop surfaces for simple geometric shapes.
- construct orthographic views from isometric views and vice versa
- utilize computer graphics tools to create 2D and 3D drawings of objects.

Course Content

UNIT – I:

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT – II:

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT – III:

Projections of Solids: Types of solids: Poly hedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT – IV:

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT – V:

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D & 3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination).

Text Book:

1. N.D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K. L. Narayana and P. Kannaiah,Tata Mc Graw Hill, 2013.
2. Engineering Drawing, M. B. Shahand B.C.Rana, Pearson Education Inc, 2009.
3. Engineering Drawing with an Introduction to Auto CAD, Dhananjay Jolhe, Tata Mc Graw Hill, 2017.

DATA STRUCTURES

(Common to CSE, IT, AI&DS, & CSE(AI&ML))

I Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To provide the knowledge of basic data structures and their implementations.
- To expose the importance of data structures in the context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem solving.

Course Outcomes

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

- explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- design, implement, and apply linked lists for dynamic data storage.
- develop programs using stacks to handle recursive algorithms, and manage program states, and solve related problems.
- demonstrate implementations of queues and their applications.
- describe binary search trees and design hash-based solutions for specific problems.

Course Content

UNIT – I: Introduction to Linear Data Structures

Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of timeand space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, InsertionSort

UNIT – II: Linked Lists

Singly linked lists: representation and operations, doubly linked listsand circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT – III: Stacks

Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking,reversing list etc.

UNIT – IV: Queues and Deques

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications

UNIT – V: Trees and Hashing

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal

Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Text Books:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2ndEdition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum.
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick.

ENGINEERING PHYSICS LAB

(Common to All Branches)

I Year – II Semester

Practical : 2	Internal Marks : 30
Credits : 1	External Marks : 70

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Course Objectives

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes

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

- Operate optical instruments like travelling microscope and spectrometer.
- Estimate the wavelengths of different colours using diffraction grating.
- Plot the intensity of the magnetic field of circular coil carrying current with distance.
- Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
- Calculate the band gap of a given semiconductor, Identify the type of semiconductor using Hall effect.
- Identify unknown frequency and verify laws of vibrations

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non- uniform bending (or double cantilever) method.

18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

Reference Book:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

e-Learning Resources:

1. www.vlab.co.in
2. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP

(Common to All Branches)

I Year – II Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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PART A: ELECTRICAL ENGINEERING LAB

Course Objectives

- To impart knowledge on the fundamental laws & theorems of electrical circuits, characteristics of dc generator, measurement of resistance, earth resistance, power and power factor, and energy calculations.

Course Outcomes

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

- measure voltage, current, power and power factor in an electrical circuit.
- verify the superposition theorem.
- measure resistance and earth resistance using wheat stone bridge and megger respectively.
- determine critical field resistance and critical speed of dc shunt generator and compute the electrical energy for domestic premises.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   a. Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   a. Provide some exercises so that measuring instruments are learned to be used by thestudents.
3. Components:
   a. Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
   b. Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

List of Experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition

Note: Minimum Six Experiments to be performed.

PART – B ELECTRONICS ENGINEERING

Course Objectives

- To impart knowledge on the principles of digital electronics and fundamentals of Electronic devices & their applications.

Course Outcomes

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

- identify and test various electronic components and demonstrate the usage of electronic measuring instruments.
- analyse the electrical behaviour of various electronic devices and digital logic circuits.
- design and implementation of various electronic circuits for the given specifications.
- test and verify the operation of electronic circuits using modern simulation tools.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required

- DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

DATA STRUCTURES LAB

(Common to CSE, IT, AI&DS & CSE (AI&ML))

I Year – II Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To demonstrate the implementation of various sorting and searchingtechniques.
- To develop programs for the implementation of linear and non-linear datastructures.

Course Outcomes

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

- implement various sorting and searching algorithms.
- design and implement linked lists and perform various operations on them.
- develop programs for implementing stacks and queues using arrays andlinked lists and perform various operations on them.
- Write code for arithmetic expression evaluation and conversion using a stack.
- develop code for the creation of binary search trees and demonstrateoperations on them.
- create a hash table and perform insert, delete and search operations on it.

List of Experiments:

Exercise 1: Array Manipulation

a) Write a program to reverse an array.
b) C Programs to implement the Searching Techniques – Linear & Binary Search
c) C Programs to implement Sorting Techniques – Bubble, Selection and InsertionSort

Exercise 2: Linked List Implementation

a) Implement a singly linked list and perform insertion and deletion operations.
b) Develop a program to reverse a linked list iteratively and recursively.
c) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

a) Create a program to detect and remove duplicates from a linked list.
b) Implement a linked list to represent polynomials and perform addition.
c) Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

a) Implement a doubly linked list and perform various operations to understand itsproperties and applications.
b) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

a) Implement a stack using arrays and linked lists.
b) Write a program to evaluate a postfix expression using a stack.
c) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

a) Implement a queue using arrays and linked lists.
b) Develop a program to simulate a simple printer queue system

c) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

a) Use a stack to evaluate an infix expression and convert it to postfix.
b) Create a program to determine whether a given string is a palindrome or not.
c) Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Search Tree

a) Implementing a BST using Linked List.
b) Traversing of BST.

Exercise 9: Hashing

a) Implement a hash table with collision resolution techniques.
b) Write a program to implement a simple cache using hashing.

Text Books:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2ndEdition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and PeterSanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and JohnE.Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and DavidRanum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting,Searching, and Graph Algorithms by Robert Sedgewick.

IT WORKSHOP

(Common to All Branches)

I Year – II Semester

Practical : 2	Internal Marks : 30
Credits : 1	External Marks : 70

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Course Objectives

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS.
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning.
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes

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

- Perform Hardware troubleshooting.
- Safeguard computer systems from viruses/worms.
- Prepare document/ Presentation on a given topic.
- Perform calculations using spreadsheets.
- Apply AI tools/Chat GPT to do search,creative writing and language translation.

Course Content

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should

demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clip-art, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Grid-lines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP.

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting Background, textures, Design Templates, Hidden slides.

AI TOOLS ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.
Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.
Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003.
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition.
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft).
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. CISCO Press, Pearson Education, 3rd edition.
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan CISCO Press, Pearson Education, 3rd edition.

NSS/NCC/SCOUTS AND GUIDES / COMMUNITY SERVICE

(Common to All branches)

I Year – II Semester

Practical : 1 Internal Marks : 100

Credits : 0.5

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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

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

- understand the importance of discipline, character and service motto.
- solve some societal issues by applying acquired knowledge, facts, and techniques.
- **e**xplore human relationships by analyzing social problems.
- determine to extend their help for the fellow beings and downtrodden people.
- develop leadership skills and civic responsibilities.

Course Content

UNIT – I: Orientation

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.

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.

Reference 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)
2. Red Book - National Cadet Corps – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

(Common to EEE,ECE and CSE)

II Year – I Semester

Lecture : 2 Tutorial : 1	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To help understand the need, basic guidelines, content and process of value education.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
- To understand the harmony in nature and existence.
- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Course Outcomes:

Upon the successful completion of this course, the students will able to:

- analyze the essentials of human values and skills, self-exploration, happiness and prosperity.
- evaluate coexistence of the "I" with the body.
- identify and evaluate the role of harmony in family, society and universal order.
- examine the holistic perception of harmony at all levels of existence.
- develop appropriate technologies and management patterns to create harmony in professional and personal lives.

Course Content

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT - I : Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1 : Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2 : Understanding Value Education
Tutorial 1 : Practice Session PS1 Sharing about Oneself
Lecture 3 : self-exploration as the Process for Value Education
Lecture 4 : Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2 : Practice Session PS2 Exploring Human Consciousness
Lecture 5 : Happiness and Prosperity – Current Scenario
Lecture 6 : Method to Fulfill the Basic Human Aspirations
Tutorial 3 : Practice Session PS3 Exploring Natural Acceptance

UNIT - II: Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7 : Understanding Human being as the Co-existence of the self and the body.
Lecture 8 : Distinguishing between the Needs of the self and the body
Tutorial 4 : Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9 : The body as an Instrument of the self
Lecture 10 : Understanding Harmony in the self
Tutorial 5 : Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11 : Harmony of the self with the body
Lecture 12 : Programme to ensure self-regulation and Health
Tutorial 6 : Practice Session PS6 Exploring Harmony of self with the body

UNIT - III: Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13 : Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14 : 'Trust' – the Foundational Value in Relationship
Tutorial 7 : Practice Session PS7 Exploring the Feeling of Trust
Lecture 15 : 'Respect' – as the Right Evaluation
Tutorial 8 : Practice Session PS8 Exploring the Feeling of Respect
Lecture 16 : Other Feelings, Justice in Human-to-Human Relationship
Lecture 17 : Understanding Harmony in the Society
Lecture 18 : Vision for the Universal Human Order
Tutorial 9 : Practice Session PS9 Exploring Systems to fulfill Human Goal

UNIT-IV : Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19 : Understanding Harmony in the Nature
Lecture 20 : Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21 : Realizing Existence as Co-existence at All Levels
Lecture 22 : The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT - V: Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23 : Natural Acceptance of Human Values
Lecture 24 : Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25 : A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26 : Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28 : Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions:

UNIT-I – Introduction to Value Education

PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

UNIT-II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

UNIT-III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

UNIT-IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Readings:

Text Book and Teachers Manual:

a. **The Textbook**: R R Gaur, R Asthana, and G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
b. **The Teacher's Manual**: R R Gaur, R Asthana, and G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. A Nagaraj, "JeevanVidya: EkParichaya", JeevanVidya Prakashan, Amarkantak, 1999.
2. A. N. Tripathi, "Human Values", New Age International Publishers, 2004.
3. Annie Leonard, "The Story of Stuff", Free Press Publishers, 2010.
4. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth", 1st edition, Fingerprint Publishers, 2009.
5. E. F Schumacher, "Small is Beautiful", Vintage Publishers, 2010.
6. Cecile Andrews , "Slow is Beautiful", New Society Publishers, 2006.
7. J C Kumarappa, "Economy of Permanence", Sarva Seva Sangh Prakashan, 2017.
8. Pandit Sunderlal, "Bharat Mein Angreji Raj", Publications Division, M/O Information & Broadcasting, Govt. of India, 2016.
9. Dharampal,"Rediscovering India", Stosius Inc/Advent Books Division, 1983.
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule", 15th edition, Educa Books, 2011.
11. Maulana Abdul Kalam Azad, "India Wins Freedom", 1st edition, Orient BlackSwan, 1988.
12. Romain Rolland, "Life of Vivekananda", 4th Impression edition, Advaita Ashrama press, 2010.
13. Romain Rolland, "Mahatma Gandhi**",** Maple Press , 2010.

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

e-Learning Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDPSI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicteindia.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202325%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-humanvalues /chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

DISCRETE MATHEMATICS AND GRAPH THEORY

(Common to CSE and AI&DS)

II Year - I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objective

- To impart the knowledge on mathematical and combinatorial reasoning, relations, graphs and recurrence relations.

Course Outcomes

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

- verify the validity of mathematical arguments using propositional logic, predicate logic and truth tables.
- solve various problems related to principle of inclusion and exclusion of sets, relations and functions.
- apply combinatorial principles, techniques to solve counting problems and solve problems on recurrence relations.
- demonstrate various types of graphs with applications and determine the isomorphism of graphs.
- illustrate various types of trees and determine spanning / minimal spanning trees of given graphs.

Course Content

UNIT–I: Mathematical Logic

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof.

Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT-II: Set Theory

Sets: Operations on Sets, Principle of Inclusion-Exclusion.

Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagram.

Functions: Bijective, Composition, Inverse, Permutation and Recursive Functions, Lattice and its Properties.

UNIT-III: Combinatorics and Recurrence Relations

Combinatorics: Basics of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.

Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations.

UNIT-IV: Graph Theory

Basic Concepts, Graph Theory and its Applications, Subgraphs, Graph Representations:
Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs.

UNIT-V: Multi Graphs

Multigraphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

Text Books

1. J. P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill.
2. C. L.Liu and D. P. Mohapatra, "Elements of Discrete Mathematics-A Computer Oriented Approach", 3rd Edition, Tata McGraw Hill.
3. Seymour Lipschutz and Marc Lars Lipson, "Theory and Problems of Discrete Mathematics", Schaum's Outline Series, 3rd Edition, Tata McGraw Hill.

Reference Books

1. J. L.Mott, A. Kandel and T. P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", 2nd Edition, Prentice Hall of India.
2. Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, "Discrete Mathematical Structures", PHI.
3. S. K. Chakraborthy and B.K. Sarkar, "Discrete Mathematics", Oxford, 2011.
4. K. H. Rosen, "Discrete Mathematics and its Applications with Combinatorics and GraphTheory", 7th Edition, Tata McGraw Hill.

DIGITAL LOGIC AND COMPUTER ORGANIZATION

(Common to CSE and IT)

II Year - I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals.
- To describe memory hierarchy concepts.
- To explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices.

Course Outcomes

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

- represent data in Binary form, minimize logical expressions and design logic circuits using logic gates.
- design combinational and sequential logic circuits.
- demonstrate basic structure and functional units of a computer.
- perform arithmetic operations on signed and unsigned numbers.
- explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices.

Course Content

UNIT – I:

Data Representation: Binary Numbers, Fixed Point representation. Floating Point representation. Number base conversions, Octal and Hexadecimal Numbers, Complements, Signed binary numbers, Binary codes

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplifications (upto 4 variables), Combinational Circuits: Decoders, Multiplexers

UNIT – II:

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Registers, Shift Registers: Uni-directional, Bi-directional, Universal, Binary counters, Ripple counters

UNIT – III:

Basic Structure of Computers: Functional units, Basic operational concepts, Bus structures, Multi processors, Multi computers, Von- Neumann Architecture.

Computer Arithmetic : Addition and Subtraction of Signed Numbers, Design of Full Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Integer Division, Floating-Point Numbers and Operations.

UNIT – IV:

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control.

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

UNIT – V:

Input / Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses- synchronous bus, asynchronous bus.

Text Books

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", 6th Edition, McGraw Hill, 2023.
2. M. Morris Mano , "Digital Design", 6th Edition, Pearson Education, 2018.
3. William Stallings, "Computer Organization and Architecture", 11th Edition, Pearson, 2022.

Reference Books

1. M. Moris Mano, "Computer Systems Architecture", 3rd Edition, Pearson, 2017.
2. David A. Paterson, John L. Hennessy, "Computer Organization and Design", Elsevier, 2004.
3. Roth, "Fundamentals of Logic Design", 5th Edition, Thomson, 2003.

Online Learning Resources

1. https://nptel.ac.in/courses/106/103/106103068/

ADVANCED DATA STRUCTURES AND ALGORITHM ANALYSIS

(Common to CSE, IT, CSE(AI&ML) and AI&DS)

II Year - I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To provide knowledge on advance data structures frequently used in Computer Science domain.
- To develop skills in algorithm design techniques popularly used.
- To understand the use of various data structures in the algorithm design.

Course Outcomes

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

- analyze the space and time complexity of algorithms and implement operations on AVL trees.
- implement graph traversal algorithms and perform operations on heap trees.
- apply divide and conquer and greedy methods to design solutions in practical applications.
- find optimal solution to the problems using dynamic programming.
- construct solutions to the problems using backtracking or branch and bound &explain the foundational concepts of NP-hard and NP-complete problems**.**

Course Content

UNIT – I:

Introduction: Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.
AVL Trees : Creation, Insertion, Deletion operations and applications

UNIT – II:

Heap Trees (Priority Queues): Min and Max Heaps, Operations and Applications
Graphs: Terminology, Representations, Basic Search and Traversals.

UNIT – III:

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication.
Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

UNIT – IV:

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), 0/1 Knapsack, Travelling Salesperson problem.

UNIT – V:

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring.
Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem.
NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

Text Books

1. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, , "Fundamentals of Data Structures in C++", 2nd Edition, Universities Press.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Computer Algorithms/C++" 2nd Edition, University Press.

Reference Books

1. Robert Kruse, Bruce P.Leung, Clovis L. Tondo "Data Structures and program design in C", Pearson Education Asia.
2. Trembley & Sorenson, "An Introduction to Data Structures with Applications" McGraw Hill.
3. Donald E Knuth, Addison-Wesley, "The Art of Computer Programming" Vol. 1: Fundamental Algorithms, 1997.
4. Langsam, Augenstein & Tanenbaum, "Data Structures using C & C++", Pearson, 1995.
5. N.Wirth, "Algorithms + Data Structures & Programs", PHI
6. Horowitz Sahni & Mehta, "Fundamentals of Data Structures in C++", Galgottia Pub.
7. Thomas Standish, "Data structures in Java", Pearson Education Asia.

e-Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari, Introduction to Algorithms (youtube.com)

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(Common to CSE, IT, CSE(AI&ML) and AI&DS)

II Year - I Semester

Lecture : 3 Internal Marks : 30

Credits : 3 External Marks: 70

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Course Objectives

- To identify Java language components and how they work together in applications.
- To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications.
- To understand how to design applications with threads in Java.
- To understand how to use Java APIs for program development.

Course Outcomes

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

- design, write, and debug Java programs using various data types, control statements, and operators
- apply object oriented concepts to build standard java application.
- utilize arrays, implement various inheritance techniques, and work with interfaces in Java to create object-oriented programs.
- build applications using packages, exception handling, Java I/O.
- develop dynamic applications with strings, multi-threading, JDBC and JFX.

Course Content

UNIT - I: Object Oriented Programming

Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT - II: Classes and Objects

Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Passing Arguments by Value and by Reference, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Attributes Final and Static.

UNIT - III: Arrays

Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Final class and Methods.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT - IV: Packages and Java Library

Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT - V: String Handling in Java

Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Establishing JDBC Database Connections, ResultSet Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books

1. Anitha Seth, B.L.Juneja,"JAVA one step ahead",Oxford.
2. Debasis Samanta, Monalisa Sarma, "Joy with JAVA: Fundamentals of Object Oriented Programming",Cambridge, 2023.
3. Paul Deitel, Harvey Deitel, "JAVA9 for Programmers",4th Edition,Pearson.

References Books

1. Herbert Schildt, "The complete Reference Java",11th Edition, TMH.
2. Y Daniel Liang, "Introduction to Java programming", 7th Edition, Pearson.

Online Resources

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

ADVANCED DATA STRUCTURES AND ALGORITHMS LAB

(Common to CSE, IT, CSE(AI&ML) and AI&DS)

II Year - I Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To acquire practical skills in constructing and managing Data structures.
- To apply the popular algorithm design methods in problem-solving scenarios.

Course Outcomes

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

- perform operations on AVL trees, Heap Trees and Graphs.
- apply divide and conquer technique to sort the elements using Quick sort and Merge sort.
- design and analyze the time complexity of Greedy method to solve single source shortest path problem and job sequencing with deadlines.
- solve problems using dynamic programming, back tracking, branch and bound techniques.

Experiments Covering the Topics:

- Operations on AVL trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- N-Queens Problem
- Job Sequencing

List of Experiments

Perform any 10 of the following Experiments

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
3. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists
4. Implement Quick sort and observe the execution time for various input sizes (Average, Worst and Best cases).
5. Implement Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
6. Implement Knapsack problem using Greedy Method
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.

11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++", 2nd Edition, Universities Press
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Computer Algorithms/C++", 2nd Edition, University Press
3. Robert Kruse, "Data Structures and program design in C", Pearson Education Asia.
4. Trembley & Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill

e-Learning Resources:

1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

(Common to CSE,IT, CSE(AI&ML) and AI&DS)

II Year - I Semester

Practical : 3 Internal Marks: 30

Credits : 1.5 External Marks:70

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Course Objectives

- To practice object oriented programming in the Java programming language
- To implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- To illustrate inheritance, Exception handling mechanism, JDBC connectivity
- To construct Threads, Event Handling, implement packages, JavaFX GUI

Course Outcomes

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

- apply object oriented concepts in java programs.
- demonstrate inheritance and polymorphism concepts.
- implement user defined exceptions and multi-tasking applications.
- develop GUI,JDBC and event based applications.

Experiments covering the Topics:

- Object Oriented Programming fundamentals-data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

List of Experiments:

Exercise–1:

a) Write a JAVA program to display default value of all primitive data type of JAVA

b) Write a JAVA program that display the roots of a quadratic equation $ax^2+bx+c=0$.

c) Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise-2

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.

b) Write a JAVA program to sort for an element in a given list of elements using bubble sort

c) Write a JAVA program using String Buffer to delete, remove character.

Exercise-3

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.

b) Write a JAVA program implement method overloading.

c) Write a JAVA program to implement constructor.

d) Write a JAVA program to implement constructor overloading.

Exercise-4

a) Write a JAVA program to implement single Inheritance

b) Write a JAVA program to implement multilevel Inheritance

c) Write a JAVA program for abstract class to find areas of different shapes

Exercise-5

a) Write a JAVA program give example for "super" keyword.
b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
c) Write a JAVA program that implements Runtime polymorphism

Exercise-6

a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating multiple catch clauses
c) Write a JAVA program for creation of Java Built-in Exceptions
d) Write a JAVA program for creation of user defined Exception

Exercise-7

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning" every 1 sec, the second thread displays "Hello" every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable)
b) Write a program illustrating isAlive and join()

Exercise–8

a) Write a JAVA Program to illustrate Daemon Threads.
b) Write a JAVA program to implement Producer Consumer Problem

Exercise– 9

a) Write a JAVA program that import and use the user defined packages
b) Without writing any code, build a GUI that display text in label and image in an Image View (use JavaFX)
c) Build a Tip Calculator apposing several JavaFX components and learn how to respond to user interactions with the GUI

Exercise– 10

a) Write a JAVA program that connects to a database using JDBC
b) Write a JAVA program to connect to a database using JDBC and insert values into it.
c) Write a JAVA program to connect to a database using JDBC and delete values from it

References Books:

1. Herbert Schildt, "The complete Reference Java",11th Edition,TMH
2. Anitha Seth,B.L.Juneja, "JAVA one step ahead",Oxford.

PYTHON PROGRAMMING

(Common to CSE,IT, CSE(AI&ML) and AI&DS)

II Year – I Semester

Tutorial : 1	Practical : 2	Internal Marks	: 30
Credits : 2		External Marks	: 70

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Course Objectives

- To introduce core programming concepts of python programming language.
- To demonstrate about python data structures like lists, tuples, sets and dictionaries.
- To impart knowledge of implementing functions, modules, and file handling methods in python programming and analyzing data sets using python libraries.

Course Outcomes

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

- demonstrate the fundamental concepts of python and use of control flow statements to write effective and readable code.
- develop python programs including functions, strings and lists for efficient problem solving.
- make use of python data structures for efficient data handling, and apply relevant methods to manipulate and retrieve data in python programs.
- apply object-oriented concepts to develop reusable code.
- apply NumPy for numerical computations and evaluate pandas for data analysis in python.

Course Content

UNTI - I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type() Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II:

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
   i. addition ii. insertion iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

UNIT - III:

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozen set.

Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

UNIT - IV:

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices.

6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT - V:

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array() function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with atleast five keys and each key represent value as a list where this list contains atleast ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
   a) Apply head () function to the pandas data frame
   b) Perform various data selection operations on Data Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books

1. Gowri Shankar S and Veena A., "Introduction to Python Programming", CRC Press, 2018.
2. S Sridhar, J Indumathi and V M Hariharan, "Python Programming", 2nd Edition, Pearson, 2024.
3. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2017.

e-Learning Resources/Virtual Labs

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

(Common to EEE, CSE, IT, and IOT)

II Year - II Semester

Lecture : 2	Internal Marks : 30
Credits : 2	External Marks : 70

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Course Objectives

- To expose the importance of managerial economics and its role in achieving business objectives.
- To present fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes

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

- classify the concepts of Managerial Economics, Financial Accounting and Management.
- interpret the Concept of Product cost and revenues for effective Business decision.
- establish suitable business organization and analyse markets to understand their impact on pricing & output decisions.
- analyze how to invest their capital and maximize returns using capital Budgeting techniques.
- develop the accounting statements and evaluate the financial performance of business entity.

Course Content

UNIT - I: Managerial Economics

Introduction — Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity - Types - Measurement. Demand Forecasting- Factors governing Forecasting, Methods.

UNIT - II: Product and Cost Analysis

Introduction – Segmentation - Product Life cycle-Channels of Distribution- Cost & Break-Even Analysis - Cost concepts and Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT - III: Business Organizations and Markets

Introduction — Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition - Monopoly- Monopolistic Competition— Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV: Capital Budgeting

Introduction — Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting— Features, Proposals, Methods and Evaluation. Projects — Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), Internal Rate Return (IRR) Method (sample problems).

UNIT - V Financial Accounting and Analysis

Introduction — Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance-

Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Text Books:

1. Varshney & Maheswari "Managerial Economics" 22nd Edition, Sultan Chand, 2014.
2. Aryasri "Business Economics and Financial Analysis" 4th Edition, MGH, 2019.
3. Philip kotler "Marketing Management" 15th Edition, pearson, 2016.

Reference Books:

1. Ahuja Hl "Managerial economics" 3rd Edition, Schand, 2013.
2. S.A. Siddiqui and A.S. Siddiqui "Managerial Economics and Financial Analysis" New Age International, 2013.
3. Joseph G. Nellis and David Parker "Principles of Business Economics" Pearson, 2nd Edition, New Delhi.

e-Learning Resources:

1. https://www.slideshare.net/123ps/managerial-economics-ppt
2. https://www.slideshare.net/rossanz/production-and-cost-45827016
3. https://www.slideshare.net/darky1a/business-organizations-19917607
4. https://www.slideshare.net/ba1arajbl/market-and-classification-of-market
5. https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
6. https://www.slideshare.net/ashu1983/financial-accounting

PROBABILITY AND STATISTICS

II Year - II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To familiarize the students with the foundations of probability and statistical methods
- To impart probability concepts and statistical methods in various applications of engineering

Course Outcomes

Upon successful completion of this course, the student should be able to

- classify the concepts of data science and its importance
- interpret the association of characteristics through correlation and regression tools
- apply discrete and continuous probability distributions
- construct sampling distributions, confidence intervals and to find maximum error of estimates for population parameters.
- apply the inference tests when the sample data is large and/or small.

Course Content

UNIT – I: Descriptive statistics and methods for data science:

Data science – Statistics Introduction – Population vs Sample –Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables – Data visualization – Measures of Central tendency – Measures of Variability – Skewness – Kurtosis.

UNIT – II: Correlation and Regression:

Correlation – Correlation coefficient – Rank correlation.

Linear Regression: Straight line – Multiple Linear Regression - Regression coefficients and properties – Curvilinear Regression: Parabola – Exponential – Power curves.

UNIT – III: Probability and Distributions:

Probability– Conditional probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory:

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Point and Interval estimations – Maximum error of estimate – Central limit theorem (without proof) – Estimation using t, χ^2 and F-distributions.

UNIT – V: Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Test of significance for large samples and Small Samples: Single and difference of means – Single and two proportions – Student's t- test, F-test and χ^2-test.

Text Books:

1. Miller and Freund's, " Probability and Statistics for Engineers", 7th Edition, Pearson, 2008.
2. S. C. Gupta and V.K. Kapoor, " Fundamentals of Mathematical Statistics", 11th Edition, Sultan Chand & Sons Publications, 2012.

Reference Books:

1. Shron L. Myers, Keying Ye, Ronald E Walpole, "Probability and Statistics Engineers and Scientists", 8th Edition, Pearson 2007.
2. Jay l. Devore, " Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage.
3. Sheldon M. Ross, " Introduction to probability and statistics Engineers and the Scientists", 4th Edition, Academic Foundation, 2011.

OPERATING SYSTEMS

(Common to CSE and IT)

II Year - II Semester

Lecture 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- To make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- To illustrate different conditions for deadlock and their possible solutions.

Course Outcomes

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

- describe the role, functions and structures of operating systems.
- demonstrate the concept of process, thread and analyze the performance of CPU scheduling algorithms.
- develop software/hardware based solutions for critical section problems and apply deadlock handling techniques to prevent deadlocks.
- compare different memory management schemes and analyze the performance of different disk scheduling algorithms.
- outline files, directory structures and illustrate need for file protection .

Course Content

UNIT - I:

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Free and Open-Source Operating Systems.

System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, Operating system structure.

UNIT - II:

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication.

Threads and Concurrency: Multithreading models, Threading issues.

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms.

UNIT – III:

Synchronization Tools: The Critical Section Problem, Peterson’s Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.

Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT - IV:

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing

Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT - V:

File System: File System Interface: File concept, Access methods, Directory Structure;

File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; Protection: Goals of protection, Principles of protection, Access matrix.

Text Books:

1. Silberschatz A, Galvin P B, Gagne G, "Operating System Concepts", 10th Edition, Wiley, 2018.
2. Tanenbaum A S, "Modern Operating Systems", 4th Edition, Pearson , 2016

Reference Books:

1. Stallings W, "Operating Systems -Internals and Design Principles", 9th Edition, Pearson, 2018
2. D.M Dhamdhere, "Operating Systems: A Concept Based Approach", 3rd Edition, McGraw- Hill, 2013

e-Learning Resources:

1. https://nptel.ac.in/courses/106/106/106106144/
   http://peterindia.net/OperatingSystems.html

DATABASE MANAGEMENT SYSTEMS

(Common to CSE, IT and CSE (AI&ML))

II Year - II Semester

Lecture : 3 Internal Marks : 30

Credits : 3 External Marks: 70

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Course Objectives

- To introduce database management systems and to give a good formal foundation on the relational model of data and Relational Algebra
- To introduce the concepts of SQL for storage, retrieval and manipulation of data in a relational database.
- To demonstrate the conceptual design and logical database design through normalization
- To provide an overview of transaction management, concurrency control and indexing.

Course Outcomes

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

- describe the importance of DBMS and derive a model in the form of ER diagram
- develop simple queries using SQL to manipulate the data in a relational model
- develop complex queries using SQL to manipulate the data.
- apply principles of normalization for designing a good relational database.
- demonstrate different techniques used in transaction management,concurrency control, crash recovery and indexing.

Course Content

UNIT – I:

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance; Three tier schema architecture for data independence; Database system structure.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT – II:

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, Relational Algebra. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT – III:

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, relational set operations.

UNIT – IV:

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF).

UNIT - V:

Transaction Concept: Transaction States, ACID properties, Concurrent Executions, Serializability, Recoverability, Testing for Serializability.

Concurrency Controls: Lock based protocols, timestamp-based protocols, Deadlocks.

Crash Recovery and Indexing: Failure Classification, Recovery Algorithms- differed update and immediate update, checkpoints, Indexing Techniques –B Trees, B+ Trees.

Text Books:

1. Raghurama Krishnan, Johannes Gehrke, "Database Management Systems", 3rd Edition,TMH (For Chapters 2, 3, 4)
2. Silberschatz, Korth, Sudarsan, "Database System Concepts", 5th Edition, TMH.(For Chapter 1 and Chapter 5)

Reference Books:

1. C J Date, "Introduction to Database Systems",8th Edition, Pearson.
2. Ramez Elmasri, Shamkant B.Navathe, "Database Management System", 6th Edition, Pearson
3. Corlos Coronel, Steven Morris, Peter Robb, "Database Principles Fundamentals of Design Implementation and Management", Cengage Learning.

e-Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

SOFTWARE ENGINEERING

(Common to CSE and IT)

II Year - II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks: 70

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Course Objectives

- To explore the evolution of software development, including various life cycle models.
- To analyze the complexities of software project management.
- To examine coding and testing practices and methodologies.

Course Outcomes

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

- explain software engineering evolution, compare methodologies, and apply life cycle models effectively.
- develop software projects by navigating complexities using proper estimation and risk analysis techniques.
- design robust software systems with modular, cohesive, focusing on object-oriented analysis and design.
- demonstrate coding proficiency, conduct effective testing, ensure software reliability, and implement quality management systems.
- utilize CASE tools across software life cycle models for productivity and quality enhancement.

Course Content

UNIT – I:

Introduction: Evolution, Software development projects, Exploratory style of software developments.

Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, prototyping model, Agile development model, Spiral model.

UNIT – II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, COCOMO, risk management.

Requirements Analysis And Specification: Requirements gathering and analysis, Software Requirements Specification (SRS).

UNIT – III:

Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling, approaches to software design.

Function- Oriented Software Design: Structure Charts and Structure design methodology

Object Oriented Design: Basic object orientation Concepts, Unified Modeling Language, Use case Model , Class diagram, Interaction diagram, Activity Diagram, State chart Diagram, Component and Deployment diagrams.

UNIT – IV:

Coding and Testing: Coding, Testing black box testing, white box testing, integration testing, smoke testing.

Software Reliability And Quality Management: Software reliability, ISO 9000, SEI Capability maturity model.

UNIT – V:

Computer-Aided Software Engineering (CASE): CASE and its scope, CASE environment, CASE support in the software life cycle.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Text Books:

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI.
2. Roger S. Pressman, "Software Engineering A practitioner's Approach", 9th Edition, McGraw Hill International Edition.

Reference Books:

1. Ian Sommerville, "Software Engineering", 10th Edition, Pearson.
2. Deepak Jain, "Software Engineering, Principles and Practices", Oxford University Press.

e-Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105182/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01338269041100390473 5_shared/overview

OPERATING SYSTEMS LAB

II Year - II Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

==========

Course Objectives

- To provide insights into system calls, file systems and semaphores.
- To develop and debug CPU Scheduling algorithms, page replacement algorithms, thread implementation.
- To implement Bankers Algorithms to avoid the Dead Lock.

Course Outcomes

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

- make use of system call in Unix shell programs.
- evaluate the CPU scheduling, page replacement algorithms.
- analyze memory and file allocation strategies.
- demonstrate concurrent thread execution using the thread library.
- solve the producer-consumer problem with semaphore-based synchronization.
- implement the banker's algorithm to prevent and avoid deadlocks.
- install and explore the nachos operating system to gain practical OS experience.

Experiments covering the Topics:

- UNIX fundamentals, commands & system calls.
- CPU Scheduling algorithms, thread processing.
- IPC, semaphores, monitors, deadlocks.
- Page replacement algorithms, file allocation strategies.
- Memory allocation strategies.

List of Experiments

Perform any 10 of the following Experiments

1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms
   a) FCFS b) SJF c) Priority d) Round Robin
5. Control the number of ports opened by the operating system with
   a) Semaphore b) Monitors.
6. Write a program to illustrate concurrent execution of threads using pthreads library.
7. Write a program to solve producer-consumer problem using Semaphores.
8. Implement the following memory allocation methods for fixed partition
   a) First fit b) Worst fit c) Best fit
9. Simulate the following page replacement algorithms
   a) FIFO b) LRU c) LFU
10. Simulate Paging Technique of memory management.
11. Implement Bankers Algorithm for Dead Lock avoidance and prevention.

12. Simulate the following file allocation strategies
    a) Sequential b) Indexed c) Linked
13. Download and install nachos operating system and experiment with it.

Reference Books:

1. Silberschatz A, Galvin P B, Gagne G, "Operating System Concepts", 10th Edition, Wiley, 2018.
2. Tanenbaum A S, "Modern Operating Systems", 4th Edition, Pearson, 2016.
3. Stallings W, "Operating Systems -Internals and Design Principles", 9th Edition, Pearson, 2018.
4. D.M Dhamdhere, "Operating Systems: A Concept Based Approach", 3rd Edition, McGraw- Hill, 2013

e-Learning Resources:

1. https://www.cse.iitb.ac.in/~mythili/os/
2. http://peterindia.net/OperatingSystems.html
3. www.cs.washington.edu/~tom/nachos

DATABASE MANAGEMENT SYSTEMS LAB

(Common to CSE, IT and CSE(AI&ML))

II Year - II Semester

Practical : 3 Internal Marks : 30

Credits : 1.5 External Marks: 70

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Course Objectives

- To populate and query a database using SQL (DDL,DML) Commands.
- To enforce integrity constraints on a database and to write queries using the concepts of SQL and PL/SQL.

Course Outcomes

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

- develop simple and complex queries using SQL.
- write PL/SQL programs including procedures, functions, cursors and triggers.

Experiments covering the topics

- DDL, DML, DCL commands.
- Queries, nested queries, built-in functions.
- PL/SQL programming-control structures.
- Procedures, Functions, Cursors, Triggers.

List of Experiments

Perform any 10 experiments in the following

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using Select command.
2. Queries (along with sub Queries) using Any, All, In, Exists, Not Exists, Union, Intersection, Constraints. (Ex: Select the roll number and name of the student who secured fourth rank in the class).
3. Queries using Aggregate functions (Count, Sum, Avg, Max and Min), Group By and Having.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, truncate, round, to_char, to_date)
5. i) Create a simple PL/SQL program which includes declaration section, executable section and Exception-Handling section (Ex: Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
   ii) Insert data into student table and use Commit, Rollback and Savepoint in PL/SQL block.
6. Develop a program that includes the features Nested IF, Case expression. The program can be extended using the Null-IF and Coalesce functions.
7. Program development using While Loops, numeric For Loops, nested loops using Error Handling, Built-In Exceptions, User defined Exceptions, Raise- Application Error.
8. Programs development using creation of procedures, passing parameters IN and OUT of Procedures.

9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a Cursor, For Update Cursor, Where Current of clause and Cursor variables.
11. Develop Programs using Before and After Triggers, Row and Statement Triggers and Instead of Triggers.
12. Create a table and perform the search operation on table using indexing and non- indexing techniques.

Reference Books:

1. Oracle: The Complete Reference by Oracle Press.
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007.
3. Rick F Vander Lans, "Introduction to SQL", 4th Edition, Pearson Education,2007

FULL STACK DEVELOPMENT – 1

(Common to CSE, CSE(AI&ML) and AI&DS)

II Year - II Semester

Tutorial : 1	Practical : 2	Internal Marks	: 30
Credits : 2		External Marks	: 70

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Course Objectives

- To make use of HTML elements and their attributes for designing static web pages
- To build a web page by applying appropriate CSS styles to HTML elements
- To experiment with JavaScript to develop dynamic web pages and validate forms

Course Outcomes

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

- design web pages using HTML and CSS
- develop dynamic web pages and perform form validations using javascript.

Course Content

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

List of Experiments:

1. **Lists, Links and Images**
   a. Write a HTML program, to explain the working of lists.
      Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
   b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
   c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
   d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique.
2. **HTML Tables, Forms and Frames**
   a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>,<td> and attributes: border, rowspan, colspan)
   b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use

<caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).

c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).

d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>,<footer>, <header>, <main>, <nav>, <section>, , tags.

b. Write a HTML program, to embed audio and video into HTML web page.

c. Write a program to apply different types (or levels of styles or style specification formats)- inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

a. Write a program to apply different types of selector forms.

b. Simple selector (element, id, class, group, universal).

c. Combinator selector (descendant, child, adjacent sibling, general sibling)

d. Pseudo-class selector

e. Pseudo-element selector

f. Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

a. Write a program to demonstrate the various ways you can reference a color in CSS.

b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.

c. Write a program using the following terms related to CSS font and text:

i. font-size ii. font-weight iii. font-style

iv. text-decoration v. text-transformation vi. text-alignment

d. Write a program, to explain the importance of CSS Box model using

i. Content ii. Border iii. Margin iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion

a. Write a program to embed internal and external JavaScript in a web page.

b. Write a program to explain the different ways for displaying output.

c. Write a program to explain the different ways for taking input.

d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects

a. Write a program using document object properties and methods.

b. Write a program using window object properties and methods.

c. Write a program using array object properties and methods.

d. Write a program using math object properties and methods.

e. Write a program using string object properties and methods.

f. Write a program using regex object properties and methods.

g. Write a program using date object properties and methods.
h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
b. Write a program to display week days using switch case.
c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
d. Write a program to print data in object using for-in, for-each and for-of loops.
e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153]
f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. Javascript Functions and Events

a. Design a appropriate function should be called to display
   - Factorial of that number
   - Fibonacci series up to that number
   - Prime numbers up to that number
   - Is it palindrome or not
b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
   - Factorial of that number
   - Fibonacci series up to that number
   - Prime numbers up to that number
   - Is it palindrome or not
c. Write a program to validate the following fields in a registration page
   - Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
   - Mobile (only numbers and length 10 digits)
   - E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Reference Books:

1. Robet W Sebesta, "Programming the World Wide Web", 7th Edition, Pearson, 2013.
2. John Dean, Jones & Bartlett Learning, "Web Programming with HTML5, CSS and JavaScript", 2019 (Chapters 1-11).
3. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", 2nd edition, APress, O'Reilly.

e-Learning Resources:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs
5. https://www.w3schools.com/typescript

DESIGN THINKING AND INNOVATION

(Common to EEE, ECE, CSE and AI&DS)

II Year – II Semester

Lecture : 1	Practical : 2	Internal Marks	: 30
Credits : 3		External Marks	: 70

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Course Objectives

- To develop a comprehensive understanding of design thinking, its history, principles, and application in various contexts, including product development and business innovation.
- To apply the design thinking process and tools to foster creativity, drive innovation, and address real-world challenges in both social and business settings.

Course Outcomes

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

- analyse the elements and principles of design.
- implement the design thinking process (empathize, analyze, ideate, and prototype) to drive inventions and social innovations.
- analyse the difference between innovation and creativity, to foster innovation within organization.
- create a comprehensive product design by forming and solving problems, setting product strategies, values, planning, and specifications, and evaluating case studies for practical insights.
- apply design thinking principles to redefine business strategies and address business challenges.

Course Content

UNIT – I: Introduction to Design Thinking

Introduction to elements and principles of design, basics of design-dot, line, shape, form as fundamental design components - Principles of design - Introduction to design thinking, history of design thinking, new materials in industry.

UNIT – II: Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

Activity: Every student presents their idea in three minutes, every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT – III: Innovation

Art of innovation, difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to innovation. Teams for innovation, measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, flow and planning from idea to innovation, debate on value-based innovation.

UNIT – IV: Product Design

Problem formation, introduction to product design, product strategies, product value, product planning, product specifications. Innovation towards product design case studies.

Activity: Importance of modeling, how to set specifications, explaining their own product design.

UNIT – V: Design Thinking in Business Processes

Design thinking applied in business & strategic Innovation, design thinking principles that redefine business – Business challenges: growth, predictability, change, maintaining relevance, extreme competition, standardization. Design thinking to meet corporate needs. Design thinking for startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Text Books:

1. Tim Brown, "Change by Design", 1st Edition, Harper Bollins, 2009.
2. Idris Mootee, "Design Thinking for Strategic Innovation", 1st Edition, Adams Media, 2014.

Reference Books:

1. David Lee, "Design Thinking in the Classroom", Ulysses press, 2018.
2. Shrrutin N Shetty, "Design the Future", 1st Edition, Norton Press, 2018.
3. William lidwell, Kritina holden, Jill butter, "Universal principles of design", 2nd Edition, Rockport Publishers, 2010.
4. Henry W. Chesbrough, "The Era of Open Innovation", MIT Sloan Management Review, 2003.
5. Anuja Agarwal, "Design Thinking: A Framework for Applying Design Thinking in Problem Solving", 1st Edition, Cengage learning India Pvt. Ltd., 2023

e-Learning Resources:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview
4. https://onlinecourses.nptel.ac.in/noc2

ENVIRONMENTAL SCIENCE

(Common to CSE, IT and CSE(AI&ML))

II Year – II Semester

Lecture : 2	Internal Marks : 30
Credits : -	External Marks : 70

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Course Objectives

- To impart basic knowledge about the environment and natural resources.
- To develop an attitude of concern for biodiversity conservation and ecosystems.
- To acquire knowledge and skills on environmental pollution control.

Course Outcomes

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

- create awareness among the people in protection of environment and natural resources.
- analyze structure and functional attributes of an ecosystem and biodiversity conservation.
- identify the sources of environmental pollution, assess their effects and suggest suitable control measures.
- adopt sustainable management practices for various environmental issues.
- recognize the relationship between population growth and health.

Course Content

UNIT – I:

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance - Need for Public Awareness.

Natural Resources: Renewable and non-renewable resources - Natural resources and associated problems - Forest resources: Use and over - exploitation, deforestation, case studies - Timber extraction - Mining, dams and other effects on forest and tribal people - Water resources: Use and over utilization of surface and ground water - Floods, drought, conflicts over water, dams - benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources.

UNIT – II:

Ecosystems: Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation: Introduction and Definition: genetic, species and ecosystem diversity - Bio-geographical classification of India - Value of biodiversity: consumptive use, Productive use social, ethical, aesthetic and option values - Biodiversity at global, national and local levels - India as

a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III:

Environmental Pollution: Definition, causes, effects and control measures of:

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV:

Social Issues and the Environment: From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people; its problems and concerns. Case studies - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies - Wasteland reclamation - Consumerism and waste products - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and Control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation - Public awareness.

UNIT – V:

Human Population and The Environment: Population growth, variation among nations. Population explosion - Family Welfare Programmes - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health - Case studies.

Field Work: Visit to a local area to document environmental assets river/forest grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds - river, hill slopes, etc.

Text Books:

1. Erach Bharucha, “Text book of Environmental Studies for Undergraduate Courses”, Universities Press (India) Private Limited, 2019.
2. Palaniswamy, “Environmental Studies”, 2nd Edition, Pearson Education, 2014.
3. S.Azeem Unnisa, “Environmental Studies”, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses (as per UGC model syllabus)”, Scitech Publications (India) Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E. Sai Baba Reddy, "Textbook of Environmental Science", 2nd Edition, Cengage Publications, 2012.
2. M. Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
3. J. P. Sharma, "Comprehensive Environmental Studies", Laxmi Publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice Hall of India Private Limited, 1988.
5. G. R. Chatwal, "A Text Book of Environmental Studies", Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science", 1st Edition, Prentice Hall of India Private Limited, 1991.

e-Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science.
3. http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20 Files/pdf/lec07.pdf
4. https://www.youtube.com/watch?v=5QxxaVfgQ3k

DATA WAREHOUSING AND DATA MINING

(Common to CSE, IT and AI&DS)

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To introduce basic concepts and techniques of data warehousing and data mining.
- To examine the types of the data to be mined and apply pre-processing methods on raw data.
- To discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

Course Outcomes

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

- describe core data warehouse concepts and the importance of data mining.
- use data preprocessing techniques on raw data to make it appropriate for mining.
- apply classification algorithms to solve classification problems.
- apply association rule mining to identify frequent item sets in large databases.
- evaluate different clustering techniques to determine their appropriateness for the given dataset.

Course Content

UNIT – I: Data Warehousing and Online Analytical Processing

Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Cloud Data Warehouse, Data Mining and Patten Mining, Technologies, Applications, Major issues, Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. (Text Book- 1)

UNIT – II: Data Preprocessing

An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1)

UNIT – III: Classification

Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction, Bayesian Classification Methods: Bayes Theorem, Naïve Bayes Classification, Rule-Based Classification, Model Evaluation and Selection. (Text Book- 2)

UNIT – IV: Association Analysis

Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm. (Text Book- 2)

UNIT – V: Cluster Analysis

Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means, Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm

DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Text Book- 2)

Text Books:

1. Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining, Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining, Vikram Pudi and P. Radha Krishna, Oxford Publisher.
2. Data Mining Techniques, Arun K Pujari, 3rd edition, Universities Press, 2013.

e-Learning Resources:

1. NPTEL course by Prof. Pabitra Mitra, http://onlinecourses.nptel.ac.in/noc17_mg24/preview
2. http://www.saedsayad.com/data_mining_map.htm

COMPUTER NETWORKS

(Common to CSE, IT and CSE(AI&ML))
III Year - I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To know the basic concepts of network services and various network applications.

Course Outcomes

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

- differentiate the fundamental concepts of computer networks, their types, topologies, and reference models including OSI and TCP/IP.
- analyze the design issues, error control mechanisms, and flow control strategies in data link layer protocols.
- evaluate various media access control methods, LAN technologies, and channelization techniques used in wired and wireless networks.
- compare different routing algorithms, congestion control techniques, and IP addressing schemes in the network layer.
- assess reliable transport and application layer communication using protocols such as TCP, UDP, HTTP, DNS, and Email systems.

Course Content

UNIT – I:

Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP.

Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.

UNIT – II:

Data Link Layer: Design issues, **Framing**: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols**: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.

Sliding Window Protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP).

UNIT – III:

Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token

Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).
Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.

UNIT – IV:
The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connection less Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks,
Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.
Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6.

UNIT – V:
The Transport Layer: Transport layer protocols: Introduction-services- port number-User datagram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services-TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.
Application Layer: World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System.

Text Books:

1. Computer Networks, Andrew S Tanenbaum, Fifth Edition, Pearson Education/PHI.
2. Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

References Books:

1. Data Communications and Networks- Achut S Godbole, AtulKahate.
2. Computer Networks, Mayank Dave, CENGAGE.

e-Learning Resources:

1. https://onlinecourses.swayam2.ac.in/cec19_cs07/preview.
2. https://www.coursera.org/courses?query=computer%20network.

FORMAL LANGUAGES AND AUTOMATA THEORY

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To learn fundamentals of Regular and Context Free Grammars and Languages.
- To understand the relation between Regular Language and Finite Automata and machines.
- To learn how to design Automata's and machines as Acceptors, Verifiers and Translators.
- To understand the relation between Contexts free Languages, PDA and TM.
- To learn how to design PDA as acceptor and TM as Calculators.

Course Outcomes

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

- design finite automata for regular languages.
- apply arden's theorem to derive regular expressions.
- illustrate derivations of the context free grammar.
- design PDA for context free languages.
- design Turing Machine for the phrase-structured languages.

Course Content

UNIT – I:

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNIT – II:

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

UNIT – III:

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, Є-Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

UNIT – IV:

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non –

Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

UNIT – V:

Turing Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

Text Books:

1. Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008.
2. Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3rd Edition, PHI, 2007.

Reference Books:

1. Elements of Theory of Computation, Lewis H.P. & Papadimition C.H., Pearson /PHI.
2. Theory of Computation, V. Kulkarni, Oxford University Press, 2013.
3. Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill, 2014.

e-Learning Resources:

1. https://nptel.ac.in/courses/106104028

Professional Elective – I

ARTIFICIAL INTELLIGENCE

(Common to CSE & IT)
III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To learn the methods of solving problems using Artificial Intelligence.
- To introduce the concepts of Expert Systems.

Course Outcomes

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

- formulate problems using Artificial Intelligence representations.
- evaluate the effectiveness of heuristic search and game playing algorithms in different domains.
- design and implement knowledge bases that combine logical, semantic, and probabilistic representations.
- apply resolution and explanation-based learning techniques to derive conclusions from logical premises.
- analyze case studies of prominent expert systems like MYCIN, DART, and XCON.

Course Content

UNIT – I:

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT – II:

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT – III:

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, representing knowledge using rules. Reasoning under uncertainty, review of probability, Bayes' probabilistic interferences and dempster shafer theory.

UNIT – IV:

Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Reinforcement Learning.

UNIT – V:

Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

Text Books:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", 2nd Edition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical Approach", Oxford University Press.
2. G.Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", 4th Edition, Pearson.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
4. Saroj Kaushik , "Artificial Intelligence", CENGAGE Learning.
5. Donald A. Waterman, "A Guide to Expert Systems", Pearson Education.

e-Learning Resources:

1. https://ai.google/
2. https://swayam.gov.in/nd1_noc19_me71/preview

Professional Elective – I

OBJECT ORIENTED ANALYSIS AND DESIGN

(Common to CSE, IT and AI&DS)
III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To become familiar with all phases of OOAD.
- To master the main features of UML.
- To master the main concepts of object technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains.
- To learn the object design principles and understand how to apply them towards implementation.

Course Outcomes

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

- design complex software systems by understanding their complexity and using a structured approach.
- apply UML concepts to model the basic structure of object-oriented systems using class and relationship diagrams.
- analyze and design advanced class and object diagrams including interfaces, packages, and relationships.
- use behavioral diagrams like use case, interaction, and activity diagrams to model user behavior and system flow.
- create complete system architecture using state, component, and deployment diagrams for real-world.

Course Content

UNIT – I:

Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems.

Case Study: System Architecture: Satellite-Based Navigation.

UNIT – II:

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle.

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams.

Case Study: Control System: Traffic Management.

UNIT – III:

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages.

Case Study: AI: Cryptanalysis.

UNIT – IV:

Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams.

Case Study: Web Application: Vacation Tracking System

UNIT – V:

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

Case Study: Weather Forecasting

Text Books:

1. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, "Object- Oriented Analysis and Design with Applications", 3rd edition, 2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

Reference Books:

1. Meilir Page-Jones, Fundamentals of Object-Oriented Design in UML, Pearson Education.
2. Pascal Roques, Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3. Atul Kahate, Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Appling UML and Patterns, An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

Professional Elective – I

DISTRIBUTED OPERATING SYSTEMS

(Common to CSE and IT)
III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To introduce design issues and different message passing techniques in DOS, distributed systems, RPC implementation and its performance in DOS.
- To gain knowledge on distributed shared memory and resource management, distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors.

Course Outcomes

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

- explain the evolution, models, and components of Distributed Computing and describe the characteristics of good message passing systems.
- analyze the design issues in Distributed Operating Systems and examine failure handling and group communication techniques in message passing.
- apply clock synchronization and mutual exclusion algorithms to coordinate processes in a distributed environment.
- assess the efficiency of global scheduling algorithms and explain how task assignment, load balancing and load sharing influence system performance.
- analyze file replication methods and evaluate the impact of different file-sharing semantics on consistency.

Course Content

UNIT – I:

Fundamentals: What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment (DCE).

Message Passing: Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

UNIT – II:

Remote Procedure Calls: Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC.

UNIT – III:

Distributed Shared Memory: Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms

UNIT – IV:

Resource Management: Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach, Process Management: Introduction, Process Migration, Threads.

UNIT V: Distributed File Systems:

Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.

Text Books:

1. Pradeep. K. Sinha ,"Distributed Operating Systems: Concepts and Design", PHI, 2007.

Reference Books:

1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education, 2013.
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008.
3. Sunita Mahajan, Seema Shan, "Distributed Computing", Oxford University Press, 2015.

e-Learning Resource:

1. https://www.coursera.org/courses?query=distributed%20systems.

Professional Elective – I

SOFTWARE PROJECT MANAGEMENT

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project.
- To compare and differentiate organization structures and project structures.
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools.

Course Outcomes

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

- explain the limitations of conventional software management and describe the evolution and improvement of software economics through modern practices.
- identify and differentiate the phases of the software lifecycle and various process artifacts associated with software development.
- apply iterative process planning techniques such as work breakdown structures, estimation, and iteration workflows to manage software projects.
- analyze organizational structures, project responsibilities, and assess the role of automation and metrics in software project control.
- develop Agile and DevOps-based solutions for modern software project execution by integrating tools, processes, and team dynamics.

Course Content

UNIT – I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT – II:

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT – III:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT – IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation: Automation Building blocks, The Project Environment.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

UNIT – V:

Agile Methodology: ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

DevOps Adoption in Projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.

Reference Books:

1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.
5. Project Management in IT, Kathy Schwalbe, Cengage

DATA MINING LAB

III Year – I Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.
- To design a data warehouse or data mart to present information needed by management in a form that is usable.
- To emphasize hands-on experience working with all real data sets.
- To test real data sets using popular data mining tools such as WEKA, ORANGE, Python Libraries.
- To develop ability to design various algorithms based on data mining tools.

Course Outcomes

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

- build a data warehouse and perform OLAP operations on it.
- demonstrate data pre-processing and data mining functionalities on the given data using WEKA / ORANGE tool.
- develop python/R code to implement Apriori algorithm.
- apply data mining algorithms with appropriate data sets to solve real world problems.

List of Experiments:

(Peform any 10 of the following experiments)

1. Creation of a Data Warehouse.
   - Build Data Warehouse/Data Mart (using open-source tools like Pentaho Data Integration Tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.,)
   - Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc).
   - Write ETL scripts and implement using data warehouse tools.
   - Perform Various OLAP operations such slice, dice, roll up, drill up and pivot
2. Explore machine learning tool "WEKA"
   - Explore WEKA Data Mining/Machine Learning Toolkit.
   - Downloading and/or installation of WEKA data mining toolkit.
   - Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface.
   - Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel)
   - Study the arff file format Explore the available data sets in WEKA. Load a data set (ex. Weather dataset, Iris dataset, etc.)
   - Load each dataset and observe the following:
     1. List the attribute names and they types

2. Number of records in each dataset
3. Identify the class attribute (if any)
4. Plot Histogram
5. Determine the number of records for each class.
6. Visualize the data in various dimensions

3. Perform data preprocessing tasks and Demonstrate performing association rule mining on datasets
   - Explore various options available in Weka for preprocessing data and apply Unsupervised filters like Discretization, Resample filter, etc. on each dataset
   - Load weather. nominal, Iris, Glass datasets into Weka and run Apriori Algorithm with different support and confidence values.
   - Study the rules generated. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated.
   - Derive interesting insights and observe the effect of discretization in the rule generation process.
4. Demonstrate performing classification on data sets Weka/R
   - Load each dataset and run 1d3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic.
   - Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix.
   - Load each dataset into Weka/R and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained.
   - Plot RoC Curves
   - Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.
5. Demonstrate performing clustering of data sets
   - Load each dataset into Weka/R and run simple k-means clustering algorithm with different values of k (number of desired clusters).
   - Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.
   - Explore other clustering techniques available in Weka/R.
   - Explore visualization features of Weka/R to visualize the clusters. Derive interesting insights and explain.
6. Demonstrate knowledge flow application on data sets into Weka/R
   - Develop a knowledge flow layout for finding strong association rules by using Apriori, FP Growth algorithms
   - Set up the knowledge flow to load an ARFF (batch mode) and perform a cross validation using J48 algorithm
   - Demonstrate plotting multiple ROC curves in the same plot window by using j48 and Random forest tree
7. Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations
8. Write a java program to prepare a simulated data set with unique instances.
9. Write a Python program to generate frequent item sets / association rules using Apriori algorithm
10. Write a program to calculate chi-square value using Python/R. Report your observation.
11. Write a program of Naive Bayesian classification using Python/R programming language.
12. Implement a Java/R program to perform Apriori algorithm

13. Write a R program to cluster your choice of data using simple k-means algorithm using JDK
14. Write a program of cluster analysis using simple k-means algorithm Python/R programming language.
15. Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python
16. Visualize the datasets using matplotlib in python/R. (Histogram, Box plot, Bar chart, Pie chart etc.,)

Reference Books:

1. Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

e-Learning Resources:

1. (NPTEL course by Prof. Pabitra Mitra) http://onlinecourses.nptel.ac.in/noc17_mg24/preview
2. http://www.saedsayad.com/data_mining_map.htm

COMPUTER NETWORKS LAB

(Common to CSE, IT and CSE(AI&ML))
III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To learn the connectivity of network devices and implementation of layered protocols.
- To gain hands-on experience with network simulation tools such as Wireshark, Nmap and NS2.

Course Outcomes

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

- implement datalink and network layer protocols in TCP/IP.
- analyze packet-level data using Wireshark, and apply filters to study specific protocols and traffic behavior.
- perform port scanning and vulnerability detection using Nmap and interpret scan results for security assessment.
- simulate network performance in NS2 to explore packet loss, congestion, throughput and protocol behavior.

List of Experiments:

(Perform any 10 of the following experiments)

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a program to implement the data link layer farming methods such as
   i) Character stuffing ii) Bit stuffing.
3. Write a program to implement data link layer farming method Checksum.
4. Write a program for Hamming code generation for error detection and correction.
5. Write a program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a program to implement sliding window protocol for Go back N.
7. Write a program to implement sliding window protocol for Selective Repeat.
8. Write a program to implement Stop and Wait protocol.
9. Write a program for congestion control using Leaky Bucket algorithm
10. Write a program to implement Dijkstra‘s algorithm to compute the shortest path through a graph.
11. Write a program to implement Distance Vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Write a program to implement Broadcast tree by taking subnet of hosts.
13. Wireshark
    i. Packet capture using Wireshark.
    ii. Starting Wireshark.
    iii. Viewing captured traffic.
    iv. Analysis and statistics & filters.
14. How to run Nmap scan?
15. Operating System Detection using Nmap.
16. Do the following using NS2 Simulator:

i. NS2 Simulator-Introduction.
ii. Simulate to find the number of packets dropped.
iii. Simulate to find the number of packets dropped by TCP/UDP.
iv. Simulate to find the number of packets dropped due to congestion.
v. Simulate to compare data rate & throughput.

Reference Books:

1. Computer Networks, Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks, Behrouz A. Forouzan, Fifth Edition TMH.

e-Learning Resources:

1. https://www.isi.edu/nsnam/ns/
2. https://www.wireshark.org/
3. https://nmap.org/

SOFT SKILLS

(Common to CSE, IT and AI&DS)

III Year – I Semester

Tutorial : 1	Practical : 2	Internal Marks	: 30
Credits : 2		External Marks	: 70

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Course Objectives

- To equip the students with the skills to effectively communicate in English.
- To train the students in interview skills, group discussions and presentation skills.
- To motivate the students to develop confidence.
- To enhance the students' interpersonal skills.
- To improve the students' writing skills.

Course Outcomes

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

- communicate effectively in English across various professional contexts, including interviews, group discussions, and presentations.
- demonstrate increased intrapersonal skills and improved interpersonal skills necessary for collaborative environments.
- write about their ideas clearly, using facts and organizing their thoughts well.
- use soft skills successfully both for securing employment and for successfully performing in their careers.

Course Content

UNIT – I:

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non-Verbal Communication (Body Language)

UNIT – II:

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III:

Standard Operation Methods: Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

UNIT – IV:

Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT – V:

Interpersonal relationships: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Text Books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

Reference Books:

1. R. S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand & Company Ltd., 2018.
2. Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

e-Learning Resource:

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01

USER INTERFACE DESIGN USING FLUTTER

(Common to CSE, IT, CSE(AI&ML) and AI&DS)
III Year – I Semester

Practical : 2	Internal Marks : 30
Credits : 1	External Marks : 70

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Course Objectives

- To implement Flutter widgets and layouts, including responsive UI design, navigation, and customized themed components.
- To integrate animations and data fetching to create dynamic and interactive Flutter applications.

Course Outcomes

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

- design responsive Flutter UIs using core widgets, layouts, and media queries.
- implement navigation and manage state with Navigator, named routes, and Provider.
- create custom widgets and styled forms with themes and validation.
- integrate animations and fetch data from REST APIs for dynamic UI updates.

List of Experiments:

1. a) Install Flutter and Dart SDK.
   b) Write a simple Dart program to understand the language basics.
2. a) Explore various Flutter widgets (Text, Image, Container, etc.).
   b) Implement different layout structures using Row, Column, and Stack widgets.
3. a) Design a responsive UI that adapts to different screen sizes.
   b) Implement media queries and breakpoints for responsiveness.
4. a) Set up navigation between different screens using Navigator.
   b) Implement navigation with named routes.
5. a) Learn about stateful and stateless widgets.
   b) Implement state management using set State and Provider.
6. a) Create custom widgets for specific UI elements.
   b) Apply styling using themes and custom styles.
7. a) Design a form with various input fields.
   b) Implement form validation and error handling.
8. a) Add animations to UI elements using Flutter's animation framework.
   b) Experiment with different types of animations (fade, slide, etc.).
9. a) Fetch data from a REST API.
   b) Display the fetched data in a meaningful way in the UI.
10. a) Write unit tests for UI components.
    b) Use Flutter's debugging tools to identify and fix issues.

Reference Books:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, 1st Edition, Apress.
3. Richard Rose, Flutter & Dart Cookbook, Developing Full stack Applications for the Cloud, Oreilly.

COMPILER DESIGN

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc.

Course Outcomes

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

- list compilation process steps of a language and represent tokens using regular expressions.
- design a parser to verify the syntax of a programming language.
- analyze synthesized, inherited attributes, syntax directed translation schemes and generate three address code.
- apply code optimization techniques to enhance the efficiency of the intermediate code.
- explore various run-time environments and apply code generator algorithm to generate target code.

Course Content

UNIT – I:

Lexical Analysis: Language Processors, Structure of a Compiler, Lexical Analysis, The Role of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator.

Syntax Analysis: The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring,

UNIT – II:

Top-Down Parsing: Pre Processing Steps of Top-Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing.

Bottom-Up Parsing: Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parses, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers.

UNIT – III:

Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate Code Generation:** Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Intermediate Code for Procedures.

UNIT – IV:

Code Optimization: The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization

UNIT – V:

Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays

Code Generation: Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

Text Books:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson, 2007.

Reference Books:

1. Compiler Construction, Principles and Practice, Kenneth C Louden, Cengage Learning, 2006.
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
3. Optimizing Compilers for Modern Architectures, Randy Allen, Ken Kennedy, Morgan Kauffmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, Lex and Yacc, edition, O'Reilly & Associates, 1990.

CLOUD COMPUTING

(Common to CSE, IT and AI&DS)
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To explain the evolving utility computing model called cloud computing.
- To emphasize the security and other challenges in cloud computing.

Course Outcomes

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

- understand the fundamental concepts, architecture, models, and service providers of cloud computing.
- analyze efficient and scalable distributed computing services suitable for cloud environments.
- apply virtualization and containerization concepts using appropriate tools to manage and optimize cloud resources.
- implement and evaluate various security mechanisms and architectures to ensure secure cloud computing environments.
- demonstrate and explore advanced paradigms in cloud computing.

Course Content

UNIT – I: Introduction to Cloud Computing Fundamentals

Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).

UNIT – II: Cloud Enabling Technologies

Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT – III: Virtualization and Containers

Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT – IV: Cloud Computing Challenges

Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT – V: Advanced Concepts in Cloud Computing

Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

e-Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc25_cs107/preview.
2. https://www.coursera.org/courses?query=cloud%20computing&skills=Cloud%20Computing.

CRYPTOGRAPHY AND NETWORK SECURITY

(Common to CSE, IT, CSE (AI&ML) and AI&DS)
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To explore the working principles and utilities of various cryptographic algorithms.
- To familiarize with working principles of various authentication protocols and standards.

Course Outcomes

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

- describe the key cryptographic services, including authentication, non-repudiation, and data integrity, and explain the mechanisms that implement these services.
- implement modern block cipher techniques, such as the Data Encryption Standard (DES) and Advanced Encryption Standard (AES), to achieve data confidentiality.
- compare the structural differences and similarities among RSA, Rabin, ElGamal, and Elliptic Curve Cryptography (ECC) systems.
- apply cryptographic hash functions, such as Whirlpool and SHA-512, to ensure message integrity and authentication.
- examine system security measures, including user authentication, trusted systems, and buffer overflow protections, to determine their effectiveness against potential threats.

Course Content

UNIT – I: Basic Principles

Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography- integer arithmetic, modular arithmetic, matrices, linear congruence.

UNIT – II: Symmetric Encryption

Mathematics of Symmetric Key Cryptography-algebraic structures, GF(2^n) Fields, Introduction to Modern Symmetric Key Ciphers-modern block ciphers, modern stream ciphers, Data Encryption Standard- DES structure, DES analysis, Security of DES, Multiple DES, Advanced Encryption Standard-transformations, key expansions, AES ciphers, Analysis of AES.

UNIT – III: Asymmetric Encryption

Mathematics of Asymmetric Key Cryptography-primes, primality testing, factorization, CRT, Asymmetric Key Cryptography- RSA crypto system, Rabin cryptosystem, Elgamal Crypto system, ECC

UNIT – IV: Data Integrity, Digital Signature Schemes & Key Management

Message Integrity and Message Authentication-message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions-whirlpool, SHA-512, Digital Signature- process, services, attacks, schemes, applications, Key Management-symmetric key distribution, Kerberos.

UNIT – V: Network Security

Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, Network Security-II**:** Security at the Network Layer: IPSec-two modes, two security protocols, security association, IKE, ISAKMP, System Security-users, trust, trusted systems, buffer overflow, malicious software, worms, viruses, IDS, Firewalls.

Text Books:

1. Cryptography and Network Security, Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill, 3rd Edition, 2015
2. Cryptography and Network Security, William Stallings, Pearson, 4th Edition, 2006
3. Everyday Cryptography, Keith M.Martin, Oxford, 1st Edition, 2016

Reference Book:

1. Network Security and Cryptography, Bernard Meneges, Cengage Learning, 1st Edition, 2018.

e-Learning Resource:

1. https://www.coursera.org/learn/crypto.

Professional Elective – II

CYBER SECURITY

(Common to CSE and IT)
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To identify security risks and take preventive steps.
- To understand the forensics fundamentals, evidence capturing process and preservation of digital evidence.

Course Outcomes

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

- describe the fundamental concepts of cybercrime and network environments.
- analyze different types of malicious activities using cyber security tools.
- apply appropriate methods for cybercrime investigation.
- conduct investigation using computer forensic principles and tools.
- apply legal frameworks to analyze cybercrimes in real-world contexts.

Course Content

UNIT – I: Introduction to Cyber crime:

Introduction, Cyber crime: Definition and Origins of the Word, Cybercrime and Information Security, Cyber criminals, Clasifications of Cyber crime, Cyber stalking, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

UNIT – II: Tools and Methods

Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering.

UNIT – III: Cyber Crime Investigation

Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences.

UNIT – IV: Computer Forensics and Investigations

Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, Cell Phone and Mobile Device Forensics.

UNIT – V: Cyber Crime Legal Perspectives

Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyber law, Technology and Students: Indian Scenario.

Text Books:

1. Sunit Belapure Nina Godbole "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", WILEY, 2011.
2. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

Reference Books:

1. Michael T. Simpson, Kent Backman and James E. Corley, "Hands on Ethical Hacking and Network Defence", Cengage, 2019.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Alfred Basta, Nadine Basta, Mary Brown and Ravinder Kumar "Cyber Security and Cyber Laws" , Cengage,2018.

e-Learning Resources:

1. CERT-In Guidelines- http://www.cert-in.org.in/
2. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks [Online Course]
3. https://computersecurity.stanford.edu/free-online-videos [Free Online Videos]
4. Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.edu License: Creative Commons BY-NC-SA.

Professional Elective – II

SOFTWARE TESTING METHODOLOGIES

(Common to CSE, IT and CSE(AI&ML))
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.
- To develop skills in software test automation and management using the latest tools.

Course Outcomes

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

- describe the core concepts of software testing.
- apply transaction and data flow testing techniques.
- evaluate and perform domain-based and interface testing.
- construct and validate test cases using regular expressions and logic-based testing.
- design and analyze state-based testing models.
- utilize graph-based models and tools for automated testing.

Course Content

UNIT – I:

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs.

Flow graphs and Path Testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT – II:

Transaction Flow Testing: Transaction flows, transaction flow testing techniques.

Data Flow Testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: Domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT – III:

Paths, Path Products and Regular Expressions: Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: Overview, decision tables, path expressions, kv charts, specifications.

UNIT – IV:

State, State Graphs and Transition Testing: State graphs, good & bad state graphs, state testing, Testability tips.

UNIT – V:

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like Jmeter/ selenium/ soapUI/Catalon).

Text Books:

1. Software Testing techniques, Baris Beizer, Dreamtech, 2nd edition.
2. Software Testing Tools, Dr. K. V. K. K. Prasad, Dreamtech.

Reference Books:

1. The craft of software testing, Brian Marick, Pearson Education.
2. Software Testing Techniques, SPD (Oreille)
3. Software Testing in the Real World, Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing, Meyers, John Wiley.

e-Learning Resource:

1. https://onlinecourses.nptel.ac.in/noc22_cs61/preview

Professional Elective – II

DEVOPS

(Common to CSE, IT and CSE(AI&ML))
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To describe the agile relationship between development and IT operations.
- To understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- To implement automated system update and DevOps lifecycle.

Course Outcomes

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

- explain the principles of Agile methodologies, and DevOps architecture, including CI/CD workflows.
- apply GIT for version control and implement testing tools to maintain code quality.
- implement CI using Jenkins with pipelines and master-slave build automation.
- design and deploy containerized applications using Docker, implement continuous delivery workflows through automated testing.
- implement configuration management using Ansible, orchestrate containerized applications using Kubernetes / OpenShift, and compare tools like Puppet and Chef.

Course Content

UNIT – I:

Introduction to DevOps: Introduction to SDLC, Agile Model. Introduction to Devops. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI / CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.

UNIT – II:

Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. Unit Testing - Code Coverage: Junit, nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

UNIT – III:

Build Automation - Continuous Integration (CI): Build Automation, What is CI Why Cl is Required, CI tools, Introduction to Jenkins (With Architecture), jenkins workflow, jenkins master slave architecture, Jenkins Pipelines, Pipeline Basics - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

UNIT – IV:

Continuous Delivery (CD): Importance of Continuous Delivery, Continuous Deployment CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub.

Testing Tools: Introduction to Selenium and its features, JavaScript testing.

UNIT – V:

Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks, Roles, Jinja templating, Vaults, Deployments using Ansible.

Containerization Using Kubernetes (Openshift): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on Openshift Container Pods. Introduction to Puppet master and Chef.

Text Books:

1. Joyner, Joseph., Devops for Beginners: Devops Software Development Method Guide for Software Developers and It Professionals, 1st Edition Mihails Konoplows, 2015.
2. Alisson Machado de Menezes., Hands-on DevOps with Linux,1st Edition, BPB Publications, India, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu. DevOps, A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona, Joakim Practical DevOps, 1st Edition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Ingram short title, 2nd edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952.

e-Learning Resources:

1. https://learn.microsoft.com/en-us/devops/what-is-devops
2. https://www.atlassian.com/devops
3. https://kubernetes.io/docs/home/
4. https://www.jenkins.io/doc/

Professional Elective – II

MACHINE LEARNING

(Common to CSE and IT)
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To familiarize with machine learning techniques and its different types (supervised and unsupervised) and understand their applications.

Course Outcomes

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

- demonstrate the strategies for deploying and operationalizing ML models in real-world applications.
- compare the performance of KNN and Radius Distance Nearest Neighbor algorithms with other classification and regression techniques.
- implement decision tree algorithms and Bayes classifier for classification and regression tasks.
- analyze the convergence properties of SVM and perceptron algorithm.
- evaluate the challenges and considerations in clustering large-scale and high-dimensional data.

Course Content

UNIT – I: Introduction to Machine Learning

Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT – II: Nearest Neighbor-Based Models

Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT – III: Models Based on Decision Trees

Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, the Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT – IV: Linear Discriminants for Machine Learning

Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear

SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT – V: Clustering

Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Text Books:

1. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
2. "Machine Learning in Action",Peter Harrington, DreamTech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

e-Learning Resource:

1. https://onlinecourses.nptel.ac.in/noc24_cs81/

Professional Elective – III

NATURAL LANGUAGE PROCESSING

(Common to CSE, IT, CSE(AI&ML) and AI&DS)
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To familiarize with the fundamental concepts and techniques of natural language processing (NLP).
- To examine NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.

Course Outcomes

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

- explain NLP fundamentals like language modeling, morphology, and error correction.
- apply N-gram models, smoothing, pos tagging, and probabilistic models in NLP for text prediction and auto-completion.
- analyze grammar rules, parsing strategies, and probabilistic approaches in syntactic analysis.
- implement word sense disambiguation and similarity techniques for text documents in NLP.
- outline discourse processing techniques and relevant linguistic tools in NLP.

Course Content

UNIT – I: Introduction

Phases of NLP, Origins and challenges of NLP, Language Modeling: Grammar-based LM, Statistical LM, Regular Expressions, Words and Transducers-English Morphology, Finite-State Transducers, FST lexicon and rules, Word and Sentence Tokenization, Detection and Correction of Spelling Errors, Minimum Edit Distance.

UNIT – II: Word Level Analysis

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation, Backoff, Part-of-Speech Tagging-Word Classes, Rule-based, HMM and Transformation-based tagging, Issues in PoS tagging.

UNIT – III: Syntactic Analysis

Context-Free Grammars, Grammar rules for English, Treebanks, Grammar Equivalence and Normal Form, Dependency Grammar, Syntactic Parsing- Ambiguity, Dynamic Programming parsing methods-CKY parsing, Statistical Parsing-Probabilistic CFG, Probabilistic CKY parsing of PCFGs.

UNIT – IV: Semantics and Pragmatics

Syntax-Driven Semantic analysis, Semantic Augmentations to syntactic rules, Word Senses, Relations between Senses, Thematic Roles, Word Sense Disambiguation, and WSD using Supervised, Dictionary and Thesaurus, Minimally Supervised WSD: Bootstrapping method, Word Similarity using Thesaurus and Distributional methods.

UNIT – V: Discourse Analysis and Lexical Resources

Discourse segmentation, Text, Coherence, Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm.

Resources - Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet.

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin -Pearson Publication, 2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media, 2009.

Reference Books:

1. Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M Reese, OReilly Media, 2015.
3. Handbook of Natural Language Processing, Second Edition, Nitin Indurkhya and Fred J. Damerau, Chapman and Hall/CRC Press, 2010.
4. Natural Language Processing and Information Retrieval, 3rd Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008.

e-Learning Resources:

1. Swayam NPTEL: Natural Language Processing Prof. Pushpak Bhattacharyya (IIT Bombay)https://nptel.ac.in/courses/106101007
2. Swayam NPTEL: Natural Language Processing By Prof. Pawan Goyal IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc23_cs45/preview.

Professional Elective – III

PRINCIPLES OF BIG DATA ANALYTICS

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- To optimize business decisions and create competitive advantage with Big Data analytics.

Course Outcomes

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

- apply collections, generics, and serialization in Java for efficient data handling.
- apply knowledge of distributed file systems to configure and manage a Hadoop environment for large-scale data storage and processing.
- analyse data with Hadoop map reduce framework.
- apply stream processing concepts and Spark RDD operations for real-time data analysis.
- develop Pig scripts and Hive queries to manage large datasets in Hadoop.

Course Content

UNIT – I:

Big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT – II:

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra, Table creation, loading and reading data.

UNIT – III:

Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance, with data replication, High availability, Data locality, Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT – IV:

Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames, RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN, Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT – V:

Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, 1st edition ,2013
2. SPARK: The Definitive Guide, Bill Chambers &Matei Zaharia, O'Reilley, 2018-first Edition.
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, First edition-2013.
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer, First Edition -2012.
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012.
3. "HBase: The Definitive Guide", O'Reilley, Lars George, September 2011: First Edition.
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt, 2010.
5. "Programming Pig", O'Reilley, Alan Gates, October 2011, 1st edition.

Professional Elective – III

QUANTUM COMPUTING

(Common to CSE and AI&DS)
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To introduce the fundamentals of quantum computing, the problem-solving approach using finite dimensional mathematics.

Course Outcomes

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

- interpret the interdisciplinary foundations of quantum computing.
- apply basic concepts from math, physics, and biology to explain qubits, quantum operations, and measurements in quantum computing.
- analyze the representation and physical implementation of qubits, and their use in quantum circuits involving quantum gates and bell states.
- apply fundamental quantum algorithms to solve computational problems and demonstrate their advantages over classical methods..
- explore quantum computing fundamentals in cryptography.

Course Content

UNIT – I:

History of Quantum Computing: Importance of Mathematics, Physics and Biology.
Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT – II:

Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements.
Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.
Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT – III:

Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information.
The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT – IV:

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT – V:

Noise and Error Correction: Graph states and codes, Quantum error correction, fault-tolerant computation.

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

Text Books:

1. Quantum Computation and Quantum Information, Nielsen M. A., Cambridge
2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, Nic Harrigan, Mercedes Ginemo, Segovia, Oreilly

Reference Books:

1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci.
2. Principles of Quantum Computation and Information, Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II.
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

Professional Elective – III

MOBILE AD HOC NETWORKS

(Common to CSE and IT)
III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To understand the fundamental concepts of wireless sensor networks and has a basic knowledge of the various protocols at various layers.

Course Outcomes

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

- explain MANETs' characteristics, applications, and MAC protocol classifications.
- compare and contrast routing and transport layer protocols for Ad Hoc networks.
- evaluate secure routing and key management in Ad Hoc networks based on defined security requirements.
- analyze the design, energy consumption, clustering, and protocol layers of wireless sensor networks.
- evaluate security protocols, key management, and simulation tools in sensor networks.

Course Content

UNIT – I: Introduction to Ad Hoc Wireless Networks

Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad Hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT – II: Routing Protocols for Ad Hoc Wireless Networks

Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position-based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

UNIT – III: Security protocols for Ad Hoc Wireless Networks

Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT – IV: Basics of Wireless Sensors and Applications

The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT – V: Security in WSNs

Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems–TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language-nesC, **Dataflow Style Language-**TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Text Books:

1. Ad Hoc Wireless Networks, Architectures and Protocols, 1st edition, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004
2. Ad Hoc and Sensor Networks, Theory and Applications, 2nd edition Carlos Corderio Dharma P.Aggarwal, World Scientific Publications / Cambridge University Press, March 2006

Reference Books:

1. Wireless Sensor Networks, An Information Processing Approach, 1st edition, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009.
2. Wireless Ad hoc Mobile Wireless Networks, Principles, Protocols and Applications, 1st edition, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3. Ad hoc Networking, 1st edition, Charles E.Perkins, Pearson Education, 2001.
4. Wireless Ad hoc Networking, 1st edition, Shih-Lin Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007.
5. Wireless Sensor Networks, Principles and Practice, 1st edition, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010.

e-Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc25_cs74/preview.
2. https://www.udemy.com/course/wireless-and-mobile-communication-advanced-level-i/?srsltid=AfmBOop6GvDgbpp9vUWlmRF-YDqBCb3I3WK1_HliY7FdIsksm1nbsD6T.

CLOUD COMPUTING LAB

(Common to CSE and IT)

III Year – II Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To learn and use version control systems and work with virtual machine
- To develop web applications in cloud and implement and use parallel programming using Hadoop.

Course Outcomes

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

- demonstrate various service types, delivery models and technologies of a cloud computing environment.
- distinguish the services based on virtual machines and containers in the cloud offerings.
- assess the challenges associated with a cloud-based application.
- discuss advanced cloud concepts such as serverless computing and cloud simulation.
- examine various programming paradigms suitable to solve real world and scientific problems using cloud services.

List of Experiments:

(Perform any 10 of the following experiments)

1. Lab on web services
2. Lab on IPC, messaging, publish/subscribe
3. Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows8 or above.
4. Install a C compiler in the virtual machine created using VirtualBox and execute Simple Programs.
5. Create an Amazon EC2/ OpenStack instance and set up a web-server on the instance and associate an IP address with the instance. In the process, create a security group allowing access to port 80 on the instance.
6. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
7. Start a Docker container and set up a web-server (e.g. apache2 or Python based Flask micro web framework) on the instance. Map the host directory as a data volume for the container.
8. Find a procedure to transfer the files from one virtual machine to another virtual machine. Similarly, from one container to another container.
9. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
10. Install Hadoop single node cluster and run simple applications like word count.
11. Utilize OpenFaaS – Serverless computing framework and demonstrate basic event driven function invocation.
12. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Reference Books:

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, McGraw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Online documentation and tutorials from cloud service providers (e.g. AWS, Google App Engine)
4. Docker, Reference documentation, https://docs.docker.com/reference/
5. OpenFaaS, Serverless Functions Made Simple, https://docs.openfaas.com/

e-Learning Resources:

1. https://www.javatpoint.com/cloud-computing-tutorial
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.digimat.in/nptel/courses/video/106105167/L01.html(Video Lectures)

CRYPTOGRAPHY AND NETWORK SECURITY LAB

III Year – II Semester

Practical : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To understand and implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

Course Outcomes

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

- perform bitwise logical operations on given data to scrable the data.
- demonstrate the basic substitution and transformation ciphers on plain text.
- implement block cipher algorithms to secure the data.
- develop public key crypto system to Secure and authenticate the data.

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
   a) Ceaser Cipher b) Substitution Cipher c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a C/JAVA program to implement the BlowFish algorithm logic
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java key tool.
8. Write a Java program to implement RSA Algorithm
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

Reference Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson, 2006.

FULL STACK DEVELOPMENT – 2

(Common to CSE and AI&DS)

III Year – II Semester

Tutorial : 1	Practical : 2	Internal Marks	: 30
Credits : 2		External Marks	: 70

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Course Objectives

- To develop server-side script to handle the given form data using JSP and JDBC.
- To perform CRUD operations on MySql database using PHP.
- To make use of MongoDB queries to perform CRUD operations on document database.
- To make use of router, template engine and authentication using sessions to develop application in ExpressJS.
- To build a single page application using RESTful APIs in ExpressJS
- To apply router and hooksin designing ReactJS application

Course Outcomes

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

- develop a database application and perform various operations on database using JSP.
- design a database application and perform various operations on database using PHP.
- implement Basic CRUD operations using MongoDB.
- use Express.js for Web Application Development and Apply Web Services concepts using Restful API.
- apply React.js constructs in Application Development.

Experiments covering the Topics:

- JSP and JDBC – Form creation, validation, store and retrieve form data from database.
- PHP and MYSQL – Installation, Configuration, CRUD operations
- MongoDB – Installation, Configuration, CRUD operations, Databases, Collections and Records
- ExpressJS – Routing, HTTP Methods, Middleware, Templating, Form Data
- ExpressJS – Cookies, Sessions, Authentication, Database, RESTful APIs
- ReactJS –JSX, Components – function & Class, Props and States, Styles, Respond to Events
- ReactJS – Conditional Rendering, Rendering Lists, React Forms, React Router, Updating the Screen
- ReactJS – Hooks, Sharing data between Components, Applications – To-do list and Quiz

List of Experiments:

1. **Typescript**
   a. Write a program to understand simple and special types.
   b. Write a program to understand function parameter and return types.
   c. Write a program to show the importance with Arrow function. Use optional, default and REST parameters.
   d. Write a program to understand the working of typescript with class, constructor, properties, methods and access specifiers.
   e. Write a program to understand the working of namespaces and modules.
   f. Write a program to understand generics with variables, functions and constraints.

2. **Express JS – Routing, HTTP Methods, Middleware.**
   a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
   b. Write a program to accept data, retrieve data and delete a specified resource using http methods.
   c. Write a program to show the working of middleware.
3. **Express JS – Templating, Form Data**
   a. Write a program using templating engine.
   b. Write a program to work with form data.
4. **Express JS – Cookies, Sessions, Authentication**
   a. Write a program for session management using cookies and sessions.
   b. Write a program for user authentication.
5. **ExpressJS – Database, RESTful APIs**
   a. Write a program to connect MongoDB database using Mangoose and perform CRUD operations.
   b. Write a program to develop a single page application using RESTful APIs.
6. **ReactJS – Render HTML, JSX, Components – function & Class**
   a. Write a program to render HTML to a web page.
   b. Write a program for writing markup with JSX.
   c. Write a program for creating and nesting components (function and class).
7. **ReactJS – Props and States, Styles, Respond to Events**
   a. Write a program to work with props and states.
   b. Write a program to add styles (CSS & Sass Styling) and display data.
   c. Write a program for responding to events.
8. **ReactJS – Conditional Rendering, Rendering Lists, React Forms**
   a. Write a program for conditional rendering.
   b. Write a program for rendering lists.
   c. Write a program for working with different form fields using react forms.
9. **ReactJS – React Router, Updating the Screen**
   a. Write a program for routing to different pages using react router.
   b. Write a program for updating the screen.
10. **ReactJS – Hooks, Sharing data between Components**
    a. Write a program to understand the importance of using hooks.
    b. Write a program for sharing data between components.
11. **ReactJS Applications – To-do list and Quiz**
    a. Design to-do list application.
12. **MongoDB – Installation, Configuration, CRUD operations**
    a. Install MongoDB and configure ATLAS
    b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()
13. **MongoDB – Databases, Collections and Records**
    a. Write MongoDB queries to Create and drop databases and collections.
    b. Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().

14. Augmented Programs: (Any 2 must be completed)

a. Design a to-do list application using NodeJS and ExpressJS.
b. Design a Quiz app using ReactJS.
c. Complete the MongoDB certification from MongoDB University website.

Reference Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.

e-Learning Resources:

1. ExpressJS - https://www.tutorialspoint.com/expressjs
2. ReactJS - https://www.w3schools.com/REACT (and) https://react.dev/learn#
3. MongoDB - https://learn.mongodb.com/learning-paths/introduction-to-mongodb

TECHNICAL PAPER WRITING AND IPR

(Common to CE, ME, CSE, IT, CSE(AI&ML), AI&DS, IoT)

III Year – II Semester

Lecture : 2	Internal Marks : 30
Credits : -	External Marks : 70

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Course Objectives

- To equip students with advanced academic writing and publishing skills.
- To provide a thorough understanding of Intellectual Property Rights.X

Course Outcomes

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

- compose well-structured, concise, and unambiguous abstracts and introductions.
- critique and synthesize existing scholarly work to write a compelling Literature Review.
- explain the fundamental nature and distinction between different types of Intellectual Property.
- analyze the scope of Patent Rights and the procedures involved in licensing and technology transfer.
- evaluate the legal and administrative challenges posed by new developments in IPR.

Course Content

UNIT – I:

Planning and Preparation: Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness. Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

UNIT – II:

Literature Review: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Key skills needed when writing a Title, Abstract, Introduction, a Review of the Literature, the Methods, the Results, the Discussion, and the Conclusions. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

UNIT – III:

Process and Development: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, patenting under PCT.

UNIT – IV:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology, Patent information and databases, Geographical Indications.

UNIT – V:

New Developments In IPR: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies.

Text Books:

1. Day, R. How to Write and Publish a Scientific Paper. Cambridge University Press, 2006.
2. Halbert. Resisting Intellectual Property. Taylor & Francis Ltd, 2007.

Reference Books:

1. Goldbort, R. Writing for Science. Yale University Press, 2006.
2. Highman, N. Handbook of Writing for the Mathematical Sciences. SIAM, 1998.
3. Wallwork, Adrian. English for Writing Research Papers. Springer New York Dordrecht Heidelberg London, 2011.
4. Mayall. Industrial Design. McGraw Hill, 1992.
5. Merges, Robert P., Peter S. Menell, and Mark A. Lemley. Intellectual Property in New Technological Age. Year Unknown, 2016. (The publisher is missing in the original source.)
6. Ramappa, T. Intellectual Property Rights Under WTO. S. Chand, 2008.

DEEP LEARNING

IV Year – I Semester

Lecture: 3 Internal Marks: 30
Credits: 3 External Marks: 70

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Course Objectives

- To introduce the concepts and recent trends in deep learning.

Course Outcomes

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

- analyze different basic neural networks.
- apply optimization and regularization techniques to train neural networks.
- apply deep learning models using convolution techniques for feature extraction.
- describe sequence based models with their architectures.
- outline recent deep learning approaches and their practical relevance.

Course Content

UNIT – I: Basics of Neural Networks

Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Activation Functions. Multilayer Perceptron.

UNIT – II: Better Training of Neural Networks

Risk Minimization, Loss functions, Gradient Descent, Back propagation, Optimization methods for neural networks - Adagrad, adadelta, rmsprop, adam, Nesterov Accelerated Gradient, second order methods for training – Newton method, Quasi Newton Method, Saddle point problem in neural networks, Regularization methods – L1/L2 regularisation, early stopping, dropout, batch normalization. Difficulty of training deep neural networks, Greedy layer wise training.

UNIT – III: Convolutional Neural Networks

Introduction, Convolution fundamentals – kernel or filter, stride, padding; pooling, CNN architecture, Standard CNN models - AlexNet, VGGNet 16, GoogLeNet, ResNet, U Net.

Object Detection: Bounding Box, sliding window based object detection, YOLO algorithm.

UNIT – IV: Sequence Based Models

Recurrent Neural Networks: Introduction, sequence data, Back propagation through time, Vanishing and Exploding Gradients, bidirectional RNN, Long Short-Term Memory (LSTM)-Architecture, Gated Recurrent Units (GRU)-Architecture, comparison of GRU, LSTM and RNN.

UNIT – V: Recent Trends in Deep Learning

Auto-encoders - Architecture, Types of auto-encoders, Transformers - Attention Mechanism (self attention), Multi Head attention, positional encoding, architecture, Boltzmann Machines, Restrictive Boltzmann Machines (RBMs), Markov Chain Monte Carlo and Gibbs Sampling, Deep Boltzmann Machines, gradient computations in RBMs.

Text Book:

1. Deep Learning, Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.
2. Deep Learning, Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti, Pearson India Education, 2021.

Reference Books:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, Springer-Verlag, 1996.
2. Pattern Recognition and Machine Learning, Christopher Bishop, Springer International Edition, 2007.
3. Deep Learning with Python, François Chollet, Manning Publications, 2017.

e-Learning Resources:

Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview.

HUMAN RESOURCES AND PROJECT ADMINISTRATION

IV Year – I Semester

Lecture: 2 Internal Marks: 30

Credits: 2 External Marks: 70

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Course Objectives

- To provide students with a foundational understanding of Human Resource Management concepts and functions relevant to organizational effectiveness.
- To develop knowledge of human resource development practices, performance appraisal, and compensation systems in organizations.
- To familiarize students with basic principles, tools, and techniques of Project Management for planning, implementation, and evaluation of projects.

Course Outcomes

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

- understand and explain the nature, scope, functions, and planning processes of Human Resource Management in organizations.
- apply Human Resource Development practices including training, performance appraisal, and career development in organizational settings.
- analyze performance appraisal systems and compensation structures for effective employee management.
- identify different types of projects and explain basic project planning concepts, project environment, and project life cycle.
- demonstrate understanding of project implementation, control, appraisal, and review techniques for evaluating project success.

Course Content

UNIT - I: Human Resource Management

Nature, scope, and concept of Human Resource Management - Functions of HRM and role of the HR Manager - Emerging trends in HRM and E-HRM - Human Resource Planning: demand and supply forecasting - Job design, job analysis - Recruitment: sources of recruitment - Selection: selection procedure.

UNIT - II: Human Resource Development

Concept of Human Resource Development (HRD) - Training and Development: concept, objectives, and methods of training - Career development and counselling - Human Resource Accounting: concept and models.

UNIT - III: Performance Appraisal and Compensation

Performance Appraisal: process, and methods - Compensation: concept and importance. Components of compensation, Concept and importance of employee relations.

UNIT - IV: Basics of Project Administration

Concept and importance of Project Administration - Project environment and types of projects -Project Life Cycle - Project proposals and Detailed Project Report (DPR) - Pareto Principle (80-20 rule) -Project networks: types.

UNIT - V: Project Implementation and Review

Project implementation: forms of project organization - Project planning and control-Project review, performance evaluation and abandonment analysis - Prerequisites for successful project implementation.

Textbooks

1. Aswathappa, K. Human Resource Management: Text and Cases. McGraw-Hill Education, India.
2. Prasanna Chandra, Projects: Planning, Analysis, Selection, Financing, Implementation, and Review. McGraw-Hill Education, India.
3. V.S.P. Rao. Human Resource Management: Text and Cases. Excel Books, New Delhi.

Reference Books

1. P. Subba Rao, Essentials of Human Resource Management and Industrial Relations. Himalaya Publishing House, Mumbai.
2. Vasanth Desai, Project Management, 4th edition, Himalaya Publications, 2018.
3. Lalitha Balakrishnan, Gowri, Project Management, Himalaya publishing house, New Delhi, 2022.

Professional Elective-IV

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

IV Year – I Semester

Lecture: 3 Internal Marks: 30

Credits: 3 External Marks: 70

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Course Objectives

- Understand the basic concepts to identify state behavior of real world objects.
- Apply Object Oriented Analysis and Design concepts to solve complex problems.
- Construct various UML models using the appropriate notation for specific problem context.
- Design models to Show the importance of systems analysis and design in solving complex problems using case studies.
- Study of Pattern Oriented approach for real world problems.

Course Outcomes

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

- explain fundamental design patterns and object-oriented concepts, including their benefits and drawbacks.
- analyze requirements and construct conceptual class diagrams for problem domains.
- apply structural patterns to improve object oriented software design.
- design MVC-based interactive systems with features like drawing and undo operations.
- develop distributed OO solutions using client-server, Java RMI, SOAP/RESTful services, and ESB.

Course Content

UNIT – I: Introduction

Design pattern, describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern What is object oriented development? key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm

UNIT – II: Analysis a System

Overview of the analysis phase, stage 1 gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain Design and Implementation, discussions and further reading

UNIT – III: Design Pattern Catalog

Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

UNIT – IV: Interactive systems and the MVC architecture

Introduction The MVC architectural pattern, analyzing a simple drawing program designing the system, designing of the subsystems, getting into implementation, implementing undo operation drawing incomplete items, adding a new feature pattern based solutions.

UNIT – V: Designing with Distributed Objects

Client server system, java remote method invocation, implementing an object oriented system on the web, Web services (SOAP, Restful), Enterprise Service Bus

Text Books:

1. Object oriented analysis, design and implementation, brahma dathan, sarnath rammath , universities press, 2013
2. Design patterns, Erich Gamma, Richard helan , Ralph johman , john vlissides, PEARSON Publication, 2013.

Reference Books:

1. Frank Bachmann, Regine Meunier, Hans Rohnert “Pattern Oriented Software Architecture” Volume 1, 1996.
2. William J Brown et al., "Anti Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

Professional Elective-IV

BLOCKCHAIN TECHNOLOGY

IV Year – I Semester

Lecture: 3 Internal Marks: 30
Credits: 3 External Marks: 70

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Course Objectives:

- To learn the fundamentals of Block Chain and various types of block chain and consensus mechanism.
- To understand public block chain system, Private block chain system and consortium block chain.
- To know the security issues of blockchain technology.

Course Outcomes:

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

- describe the key components of a blockchain system, such as blocks, nodes, transactions, and consensus mechanisms.
- apply foundational knowledge of cryptocurrencies to real-world scenarios by demonstrating the use of Bitcoin and Altcoins in various financial transactions.
- discuss various consensus algorithms used in permissioned blockchains, including their operational principles and suitability for different use cases.
- apply knowledge of Hyperledger, Ripple, and Corda platforms to demonstrate their functionalities in enterprise blockchain solutions.
- apply blockchain solutions in the banking and finance sector, such as implementing decentralized ledgers for transparent transactions.

Course Content

UNIT – I:

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol.

UNIT – II:

Cryptocurrency: Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.

UNIT – III:

Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private

Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

UNIT – IV:

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Need of Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda.

Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT – V:

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

Text Book:

1. "Block chain Technology", Chandramouli Subramanian, Asha A.George, Abhilasj K A and Meena Karthikeyan, Universities Press.

Reference Books:

1. Smart Contracts and Comparative Law, Andrea Stazi, 1st edition, Springer International Publishing, 2021
2. Blockchain Blue print for Economy, Melanie Swan, SPD Oreilly.
3. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gauar, Pearson Addition Wesley

Professional Elective-IV

AUGMENTED REALITY AND VIRTUAL REALITY

IV Year – I Semester

Lecture: 3 Internal Marks: 30

Credits: 3 External Marks: 70

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Course Objectives

- To provide a foundation to the fast growing field of AR and make the students aware of the various AR devices.
- To describe the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

Course Outcomes

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

- apply principles of augmented reality, display systems, and tracking technologies in real-world contexts.
- implement computer vision, interaction techniques, and software architectures for augmented reality applications.
- explain the fundamentals of virtual reality, geometric modeling, and optical systems for influencing visualization.
- analyze human visual perception and rendering techniques for improving virtual reality experiences.
- examine motion, interaction, and auditory perception to enhance immersion in virtual environments.

Course Content

UNIT – I:

Introduction to Augmented Reality: Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields.
Displays: Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays.
Tracking: Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors.

UNIT – II:

Computer Vision for Augmented Reality: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.
Interaction: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction.
Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs.

UNIT – III:

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception.

The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations.
Light and Optics: Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays.

UNIT – IV:
The Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR.
Visual Perception: Visual Perception - Perception of Depth, Perception of Motion, **Perception of Color Visual Rendering:** Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

UNIT – V:
Motion in Real and Virtual Worlds: Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection.
Interaction: Motor Programs and Remapping, Locomotion, Social Interaction.
Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Text Books:

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494.
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.

Reference Books:

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178.
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

e-Learning Resources:

1. https://www.coursera.org/courses?query=augmented%20reality.
2. https://www.coursera.org/courses?query=augmented%20reality&productDifficultyLevel= Begi nner.

Professional Elective-IV

INTERNET OF THINGS

IV Year – I Semester

Lecture: 3 Internal Marks: 30

Credits: 3 External Marks: 70

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Course Objectives

- To explore the application areas of IoT.
- To examine the revolution of the Internet in Mobile Devices, Cloud & Sensor Networks
- To learn about the building blocks of the Internet of Things and its characteristics

Course Outcomes

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

- explain IoT's evolution, key components, and the interdependencies of IoT technologies like Wireless Sensor Networks and Cyber Physical Systems.
- analyze IoT sensing and actuation systems, sensor/actuator characteristics, and IoT device design considerations.
- evaluate IoT connectivity and communication technologies, standards, and protocols for network and device interoperability.
- explain IoT interoperability, standards, frameworks, and the applications of Fog Computing in IoT systems.
- identify emerging IoT paradigms, challenges, and apply knowledge to real-world IoT case studies like agriculture and vehicular IoT.

Course Content

UNIT – I:

Predecessors of IoT: Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems.

Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT.

UNIT – II:

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

UNIT – III:

IoT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IT, Wi-Fi, Bluetooth.

IoT Communication Technologies: Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols, Device Management, Semantic Protocols.

UNIT – IV:

IoT Interoperability: Introduction, Standards, Frameworks.

Fog Computing and Its Applications: Introduction, View of Fog Computing Architecture, Fog Computing in IoT, Selected Applications of Fog Computing.

UNIT – V:

Paradigms, Challenges, and the Future: Introduction, Evolution of New IoT Paradigms, Challenges Associated with IoT, Emerging Pillars of IoT.

IoT Case Studies: Agricultural IoT, Vehicular IoT.

Text Books:

1. Introduction to IoT, Sudip Misra, Anandarup Mukhaerjee, Arjit Roy, Cambridge University Press, 2021.
2. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education.

Reference Books:

1. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish narayana Srirama (Editor), ISBN: 978-1-119-52498-4, January 2019.
2. Getting Started with the Internet of Things, CunoPfister, Oreilly.

Professional Elective-V

AGILE METHODOLOGIES

IV Year – I Semester

Lecture: 3 Internal Marks: 30

Credits: 3 External Marks: 70

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Course Objectives:

- To introduce the important concepts of Agile software development Process, emphasize the role of stand-up meetings in software collaboration, impart the knowledge on values and principles in understanding agility.

Course Outcomes

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

- define agile values, principles, and methods that drive organizational agility.
- explain Extreme Programming (XP) concepts, lifecycle, and team roles in agile development.
- apply Scrum practices such as pair programming, continuous integration, and iteration demos in software projects.
- analyze agile planning and development practices to manage risk, quality, and performance.
- evaluate agile values and principles to improve process efficiency and value delivery.

Course Content

UNIT-I:

Learning Agile: What Is Agile?, Getting Agile into Your Brain by Any Means Necessary,
Understanding Agile Values: A Team Lead, Architect, and Project Manager Walk into a Bar, No Silver Bullet, Agile to the Rescue! (Right?), A Fractured Perspective, The Agile Manifesto Helps Teams See the Purpose Behind Each Practice, Understanding the Elephant, Where to Start with a New Methodology.

UNIT-II:

The Agile Principles: The 12 Principles of Agile Software, The Customer Is Always Right, Delivering the Project, Communicating and Working Together, Project Execution—Moving the Project Along, Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together.

UNIT-III:

SCRUM and Self-Organizing Teams: The Rules of Scrum, Act I: I Can Haz Scrum?, Everyone on a Scrum Team owns the Project, Act II: Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Act III: Sprinting into a Wall, Sprints, Planning, and Retrospectives, Act IV: Dog Catches Car
Scrum Planning And Collective Commitment: Act V: Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Act VI: Victory Lap, Scrum Values Revisited.

UNIT-IV:

XP and Embracing Change: Act I: Going into Overtime, The Primary Practices of XP, Act II: The Game Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, An

Effective Mindset Starts with the XP Values, Act III: The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change.

XP, Simplicity, and Incremental Design: Act IV: Going into Overtime, Part 2: Second Overtime, Code and Design, Make Code and Design Decisions at the Last Responsible Moment, Incremental Design and the Holistic XP Practices, Act V: Final Score.

UNIT V:

Lean, Eliminating Waste, and Seeing the whole: Lean Thinking, Act I: Just One More Thing, Creating Heroes and Magical Thinking, Eliminate Waste, Gain a Deeper Understanding of the Product, Deliver As Fast As Possible.

Kanban, Flow, and Constantly Improving: Act II: Playing Catch-Up, The Principles of Kanban, Improving Your Process with Kanban, Measure and Manage Flow, Emergent Behavior with Kanban.

The Agile Coach: Act III: Just One More Thing (Again?!), Coaches Understand Why People Don't Always Want to Change, Coaches Understand How People Learn, Coaches Understand What Makes a Methodology Work, The Principles of Coaching.

Text Books:

1. Andrew Stellman, Jennifer Green, Learning Agile, O'Reilly, 2015.

Reference Books:

1. Andrew stellman, Jennifer Green, Head first Agile, O'Reilly, 2017.
2. Rubin K , Essential Scrum : A practical guide to the most popular Agile process, Addison-Wesley, 2013

Professional Elective-V

GENERATIVE AI

IV Year – I Semester

Lecture: 3 Internal Marks: 30

Credits: 3 External Marks: 70

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Course Objectives

- To understand the basics of Generative AI.
- To know the basics of Text Generation.
- To understand the process of generating videos.
- To know about GAN and its variants.

Course Outcomes

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

- analyze generative modelling techniques to design ethical, responsible AI solutions using modern architectures like GANs, VAEs and diffusion models.
- apply foundational concepts of language models and prompt engineering to generate text using transformer-based architectures and large language models.
- apply different image generation models like GANs, VAEs and transformers to create AI-generated images.
- implement generative models such as GANs, style transfer and reinforcement learning techniques to create paintings, music and game strategies.
- design generative AI applications using open-source models and programming frameworks such as LangChain, LLaMA and Hugging Face.

Course Content

UNIT – I: Introduction to Gen AI

Historical overview of generative modeling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI, Types of Generative models, GANs, VAEs, probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI.

UNIT – II: Generative Models For Text& Prompt Engineering

Generative Models For Text: Basic concepts of generative text models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Generation of Text, Auto encoding, Regression Models.

Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation.

UNIT – III: Generation of Images

Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Stable Diffusion Models, Introduction to Transformer-based Image Generation, Visual Transformers ViT, Issues of Image Generation models like Mode Collapse and Stability.

UNIT – IV: Generation of Painting, Music, and Play

Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor- critic Network.

UNIT – V: Open Source Models And Programming Frameworks

Training and Fine tuning of Generative models, GPT 4 All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, Open Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.

Text Books:

1. Denis Rothman, "Transformers for Natural Language Processing and Computer Vision", Third Edition, Packt Books, 2024

Reference Books:

1. David Foster, "Generative Deep Learning", O'Reily Books, 2024.
2. Altaf Rehmani, "Generative AI for Everyone", BlueRose One, 2024.

e-Learning Resources:

1. https://www.coursera.org/learn/generative-ai-introduction-and-applications.
2. https://onlinecourses.nptel.ac.in/noc25_cs137/preview

Professional Elective-V

COMPUTER VISION

IV Year – I Semester

Lecture: 3 Internal Marks: 30

Credits: 3 External Marks: 70

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Course Objectives

- To understand the fundamental concepts related to sources, shadows and shading.
- To understand the geometry of multiple views.

Course Outcomes

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

- apply camera models, radiometry, shading, and color concepts in image analysis
- evaluate filtering and texture methods for edge and shape detection
- analyze multi-view geometry and clustering methods for image segmentation
- design a fitting model to do segmentation and tracking
- classify camera models, calibration methods, and vision approaches in robotics and medical imaging.

Course Content

UNIT – I:

Radiometry –Measuring Light: Light in Space, Light at Surfaces, Important Special Cases.

Sources, Shadows and Shading: Qualitative Radiometry, Sources and their effects, Local Shading Models, Application: Photometric Stereo, Inter reflections**:** Global Shading Models.

Colour: The Physics of Colour, Human Colour Perception, Representing Colour, Surface Colour from Image Colour.

UNIT – II:

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing.

Edge Detection: Estimating Derivatives with finite differences, Noise.

Texture: Representing Texture, Analysis (and Synthesis) using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT – III:

The Geometry of Multiple Views: Two Views.

Stereopsis: Human vision Stereopsis, Binocular Fusion, Using more cameras.

Segmentation by Clustering: What is Segmentation? Human Vision: Grouping and Gestalt, Applications-Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering.

UNIT – IV:

Fitting: The Hough Transform, Fitting Lines, Fitting Curves.

Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation-The EM algorithm.

Tracking: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.

UNIT – V:

Analytical Image Features: Elements of Analytical Euclidean Geometry, Parameters and the Perspective Projection, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry.

Correspondence and Pose Consistency: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses using Invariants, Verification, Application-Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:

1. Computer Vision – A Modern Approach, David A. Forsyth and Jean Ponce, PHI Learning (Indian Edition), 2009.

Reference Books:

1. Computer and Machine Vision – Theory, Algorithms and Practicalities, E. R. Davies, 4th Edition, Elsevier (Academic Press), 2013.
2. Digital Image Processing, R. C. Gonzalez and R. E. Woods, Addison Wesley, 2008.
3. Computer Vision: Algorithms and Applications, Richard Szeliski, Springer-Verlag London Limited 2011.

e- Learning Resource:

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview

Professional Elective-V

CYBER PHYSICAL SYSTEMS

IV Year – I Semester

Lecture: 3 Internal Marks: 30

Credits: 3 External Marks: 70

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Course Objectives:

- To understand the core principles behind Cyber Physical Systems, Identify Security mechanisms of Cyber physical system, Understand Synchronization in Distributed Cyber-Physical Systems.

Course Outcomes

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

- analyze and construct symbolic models for Cyber-Physical Systems using symbolic synthesis techniques and software tools.
- identify, analyze, and evaluate security requirements, attack models, and countermeasures in Cyber-Physical Systems using system-theoretic security approaches.
- apply synchronization and distributed consensus techniques to address coordination challenges in distributed Cyber-Physical Systems.
- design and analyze real-time scheduling strategies for Cyber-Physical Systems considering timing constraints, multiprocessor platforms, and system variability.
- interpret and integrate models and semantic frameworks for Cyber-Physical Systems using DSMLs, formal semantics, and language integration techniques.

Course Content

UNIT-I:

Symbolic Synthesis for Cyber-Physical Systems: Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools

UNIT-II:

Security of Cyber-Physical Systems: Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches

UNIT-III:

Synchronization in Distributed Cyber-Physical Systems: Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques

UNIT-IV:

Real-Time Scheduling for Cyber-Physical Systems: Introduction and Motivation, Basic Techniques - Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty

UNIT-V:

Model Integration in Cyber-Physical Systems: Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, ForSpec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

Text Books:

1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2016
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press

Reference Books:

1. E.A.Lee, Sanjit Seshia, Introduction to Embedded Systems: A Cyber-Physical Systems Approach, MIT Press
2. Andre Platzer, Logical Foundations of Cyber-Physical Systems, 2nd edition, Springer Publishing, 2018

PROMPT ENGINEERING

IV Year – I Semester

Practical: 2 Tutorial: 1 Internal Marks: 30

Credits: 2 External Marks: 70

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Course Objectives

- To apply iterative prompting for clarity and context.
- To create varied prompts to steer model outputs.
- To construct chain-of-thought and structured prompts.
- To develop retrieval-augmented pipelines to ground outputs.
- To evaluate LLM agents and multimodal apps for ethics and robustness.

Course Outcomes

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

- understand and explain the fundamentals of prompt engineering and LLM behavior.
- design effective prompts using appropriate prompting techniques.
- apply advanced prompting strategies to improve AI responses.
- evaluate and refine prompts based on response quality and performance.
- apply prompt engineering in real-world scenarios while considering ethical implications.

Course Content

UNIT-I: Foundations of Prompt Engineering

Definition of prompt engineering, Distinction between prompt engineering and model fine-tuning, Motivation and benefits of prompt engineering, Core principles of effective prompt design, Anatomy of a prompt, Setting up the Python environment for LLM interaction, Iterative prompting lifecycle, Common prompt pitfalls and remediation

Lab Experiments:

1. Environment & Connectivity: Install required packages (e.g., transformers, openAI); securely configure the API key; run a simple "Hello, world" prompt to verify model access.
2. Baseline vs. Enhanced Prompts: Execute a naïve prompt ("Write a one-paragraph bio of Ada Lovelace.") and an enhanced prompt that adds role framing, specificity, and explicit format instructions; compare both outputs for relevance, completeness, and style.
3. Iterative Refinement on a Simple Task: Summarize the plot of the Shakespearean play Romeo and Juliet in two sentences through three rounds of prompt tweaking:
    a. Minimal instruction.
    b. Addition of length and style constraints
    c. Specification of key content elements (setting and theme)

    Document how each iteration changes and improves the result.
4. Diagnosing Prompt Failures & Edge Cases: Craft a vague or contradictory prompt; analyze the failure mode (ambiguity, missing context, or format errors); refine the prompt by adding examples or clarifying instructions.

UNIT-II: Advanced Prompt Patterns & Techniques: Enhanced prompt anatomy
contextual detail and explicit output specifications, Few-shot in-context prompting, Prompt structuring and template design, Role-based prompting to establish personas or system behavior, Negative prompting to filter or suppress undesired content, Constraint specification and instruction enforcement (e.g., length, format), Iterative prompt refinement and optimization.

Lab Experiments:

1. Few-Shot vs. Zero-Shot Comparison: Design and execute a zero-shot prompt and a few-shot prompt (with 2–3 exemplar input-output pairs) for a chosen text task (e.g., sentiment classification or translation); compare outputs for accuracy, consistency, and adherence to examples.
2. Role-Based & Negative Prompting: Craft a role-based prompt to establish a specific persona (e.g., "You are a financial advisor…"); then create a negative prompt to suppress undesired content (e.g., "Do not mention any brand names"); evaluate how each influences the model's response.
3. Constraint Specification & Iterative Refinement: Select an open-ended task (e.g., summarizing a technical article); issue a basic prompt; identify failures in length or format; refine the prompt by adding explicit constraints (word count, bullet format, etc.); document improvements over two refinement cycles.

UNIT-III: Structured Output & Reasoning Techniques
Importance of structured outputs for real-world applications, Prompting for specific formats (lists, tables, Markdown), Generating valid JSON and YAML via explicit instructions, Eliciting chain-ofthought reasoning in zero-shot prompts, Decomposing complex tasks into manageable subtasks

Lab Experiments:

1. Structured Format Prompting: Instruct the model to output information as bullet lists and Markdown tables (e.g., "List three benefits of daily exercise in a Markdown table with columns 'Benefit' and 'Description.'"); verify the output matches the requested structure.
2. JSON/YAML Generation: Provide a brief dataset description (e.g., three books withtitle, author, publication year) and prompt the model to produce valid JSON or YAML; use a parser to validate syntax and refine the prompt if errors occur.
3. Chain-of-Thought & Task Decomposition: Present a multi-step problem (e.g., a logic puzzle) and apply zero-shot CoT prompting (e.g., "Let's think step by step. Explain your reasoning before the final answer."); separately, decompose the problem into sequential sub-questions, collect partial answers, combine them, and compare accuracy against a direct-answer baseline.

UNIT-IV: Retrieval-Augmented Generation & LangChain Workflows
Limitations of LLM internal knowledge, Need for external data sources, Introduction to Retrieval-Augmented Generation (RAG), Overview of RAG architecture (indexing vs. retrieval + generation), Getting started with Lang Chain for LLM applications, Basics of LangChain Expression Language (LCEL), Simplified indexing pipeline: document loading & text splitting, Fundamentals of embeddings and vector stores, Building a basic retrieval generation pipeline with an LCEL chain.

Lab Experiments:

1. Building a Simple LCEL Chain: Create a minimal LCEL script that accepts a fixed instruction (e.g., "Summarize this text: …"), passes it to an LLM, and prints the result; verify end-to-end execution.

2. Basic Data Indexing for RAG: Load a small collection of documents; split into uniform chunks (e.g., 200 tokens); generate embeddings for each chunk; store them in an in-memory vector store; inspect for consistency.
3. Constructing & Running a Basic RAG Chain: Build a pipeline that:
    a. Receives a user query
    b. Retrieves the top-k relevant chunks
    c. Constructs a combined prompt with context + query
    d. Send it to the LLM
    e. Returns the answer

   Test with sample queries and compare factual accuracy against a prompt without retrieval.

UNIT - V: Agents, Multimodal AI & Ethical Evaluation

Introduction to LLM agents and their basic architecture, Overview of multimodal AI models (VLMs), Prompting for text-to image generation and image understanding, Importance of prompt evaluation beyond subjective judgment, Manual evaluation techniques (heuristic checks for accuracy, relevance, format), Introduction to "LLM-as-Judge" for automated evaluation, Security considerations (prompt injection, sensitive-information risks), Prompt-based mitigation strategies for safety and robustness, Ethical concerns (bias, misinformation, data privacy), Brief exploration of UI frameworks (Streamlit/Gradio) for deploying prompt-driven apps, Adapting to the evolving nature of prompt engineering through continuous learning.

Lab Experiments:

1. Building a Simple LLM Agent: Register a tool (e.g., a calculator function) and craft prompts that instruct the agent to invoke it when required; implement using LangChain or a function-calling API; test on queries requiring tool execution.
2. Multimodal Prompting Exploration: Generate images from detailed text prompts; feed one generated image into an image-understanding model or API with an appropriate prompt; compare the returned caption to the original prompt to evaluate alignment.
3. Prompt Evaluation & Ethics Workshop:
    a. Select two existing prompts and generate multiple outputs; apply manual heuristic checks for accuracy, relevance, and format compliance.
    b. Use an "LLM-as-Judge" prompt (e.g., "Rate these outputs on a scale of 1–5 for clarity and correctness.") to automate evaluation.
    c. Design a prompt- injection test (e.g., "Ignore previous instructions…"), observe the response, then refine system prompts to mitigate the vulnerability.

Reference Books:

1. Prompt Engineering for Generative AI by James Phoenix, Mike Taylor, O'reilly
2. Prompt Engineering for Beginners (2025 Edition): Master the Art of Talking to AI by Angel Talamantes.
3. Introduction to Prompt Engineering: Concepts and Applications - Mr. Sachin Jain, Mr. Rohit Singh Rajput, Mr. Rohit Chhabra, Mr. Shubham Patel.

e-Learning Resource:

1. https://www.promptingguide.ai

CONSTITUTION OF INDIA

IV Year – I Semester

Lecture : 2 Internal Marks: 30
Credits : 0

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Course Objectives

- To introduce the fundamental concepts, structure, and features of the Constitution of India.
- To familiarize with the functioning of Union, State, and Local Governments along with electoral processes, emergency provisions, and constitutional amendments.

Course Outcomes

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

- explain the basic features of the Constitution, including fundamental rights, duties, directive principles, and federal structure.
- describe the structure and functions of the Union Government, including executive, legislature, judiciary, and constitutional authorities.
- describe the organization and functions of the State Government, including executive, legislature, and judiciary.
- examine the structure and significance of local self-government institutions, including Panchayati Raj and urban bodies.
- analyze the role of the Election Commission, electoral process, emergency provisions, and amendment procedure of the Constitution.

Course Content

Unit - I: Introduction to Constitution

Meaning and Importance, Salient features and its Sources, Schedules and Parts, Preamble, Fundamental Rights and Duties, Directive principles of State Policy. Features of Parliamentary System, Federal and Unitary Features of Constitution.

Unit – II: Union Government

Union Executive: President, Vice-President, Prime Minister, Council of Ministers and Attorney General of India. Union Legislature: Composition of Parliament. Union Judiciary: Supreme Court of India – Composition, Powers and Functions. Comptroller and Auditor General of India (CAG) - Appointment, Powers and Functions.

Unit – III: State Government

State Executive: Governor, Chief Minister, Council of Ministers and Advocate General of State. State Legislature: Composition of State Legislative Assembly and State Legislative Council. State Judiciary: High court – Composition, Powers and Functions.

Unit - IV: Local Government

Importance of grass root democracy. Evolution of Panchayat Raj, 73rd Amendment Act, Compulsory and Voluntary Provisions.Evolution of Urban Bodies, 74th Amendment Act of 1992. Types of Urban Governments, State Election Commission, Powers and Functions.

Unit – V: Election Commission of India

Election provisions, Election Commission of India Composition, Powers and Functions, Electoral process.Emergency provisions, Types of Emergency-grounds, procedure, duration and effects. Amendment of the constitution- Meaning, procedure and limitations.

Text Books

1. M. Laxmikanth, “Indian Polity”, McGraw Hill Education (India) Pvt. Ltd., Noida, 7th Edition.
2. D. D. Basu, “Introduction to the Constitution of India”, LexisNexis, Chennai, 24th Edition.
3. M. V. Pylee, “India’s Constitution”, S. Chand & Company, New Delhi, 16th Edition.

Reference Books

1. Granville Austin, “The Indian Constitution: Cornerstone of a Nation”, Oxford University Press, Noida.
2. Subhash Kashyap, “Our Constitution”, National Book Trust, New Delhi, 2021 Edition.
3. Subhash Kashyap, “Our Parliament”, National Book Trust, New Delhi, 2021 Edition.
4. Subhash Kashyap, “Our Political System”, National Book Trust, New Delhi.

Online Learning Resources

1. https://www.constitutionofindia.net
2. www.hss.iitb.ac.in/en/lecture-details.

Honors Degree

DATA SCIENCE

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To demonstrate concepts of machine learning, data handling and visualizations that is vital for data science.
- To familiarize with Suitability and limitations of tools and techniques related to data science process.

Course Outcomes

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

- describe the importance of data science and pre-processing of data.
- demonstrate the use of machine learning in data science and in the handling of large data.
- use NoSQL database for handling the bigdata.
- apply Neo4j, cipher, nltk and SQLite on data to extract useful patterns from the data.
- perform graphical analysis of data using data visualization techniques.

Course Content

UNIT – I:

Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science.

Data Science Process: Overview, defining goals and creating project charter, retrieving data, cleaning, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT – II:

Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning.

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT – III:

NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT – IV:

Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts.

UNIT – V:

Data Visualization and Prototype Application Development: Data Visualization options, Crossfilter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools.

Applying the Data Science process for real world problem solving scenarios as a detailed case study.

Text Books:

1. Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, Introducing to Data Science using Python tools‖, Manning Publications Co, Dreamtech press, 2016
2. Prateek Gupta, Data Science with Jupyter‖ BPB publishers, 2019 for basics

Reference Books:

1. Joel Grus, Data Science From Scratch‖, OReilly, 2019.
2. Doing Data Science, Straight Talk From The Frontline, 1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

Honors Degree

DATA SCIENCE USING PYTHON LAB

III Year – I Semester

Practical : 3 | Internal Marks : 30

Credits : 1.5 | External Marks : 70

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Course Objectives

- To familiarize the concepts of Data Science and its practical implementation using python.

Course Outcomes

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

- apply Numpy package in python.
- perform operations using Pandas and PIL package in python.
- perform Webscraping and pre-processing on data.
- visualize data using matplotlib.
- implement programs with python NLTK, Sci kit-Learn.

List of Experiments:

(Perform any 10 of the following experiments)

1. Creating a NumPy Array
   a) Basic ndarray b) Array of zeros c) Array of ones
   d) Random numbers in ndarray e) An array of your choice f) Imatrix in NumPy
   g) Evenly spaced ndarray
2. The Shape and Reshaping of NumPy Array
   a) Dimensions of NumPy array b) Shape of NumPy array c) Size of NumPy array
   d) Reshaping a NumPy array e) Flattening a NumPy array f) Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
   a) Expanding a NumPy array b) Squeezing a NumPy array c) Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array
   a) Slicing 1-D NumPy arrays b) Slicing 2-D NumPy arrays
   c) Slicing 3-D NumPy arrays d) Negative slicing of NumPy arrays
5. Stacking and Concatenating Numpy Arrays
   a) Stacking ndarrays b) Concatenating ndarrays c) Broadcasting in Numpy Arrays
6. Perform following operations using pandas
   a). Creating dataframe b) concat() c) Setting conditions d) Adding a new column
7. Perform following operations using pandas
   a) Filling NaN with string b) Sorting based on column values c) groupby()
8. Read the following file formats using pandas
   a) Text files b) CSV files c) Excel files d) JSON files
9. Read the following file formats
   a) Pickle files b) Image files using PIL c) Multiple files using Glob
   d) Importing data from database
10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset

a) Feature Scaling b) Feature Standardization c) Label Encoding d) One Hot Encoding

12. Perform following visualizations using matplotlib
    a) Bar Graph b) Pie Chart c) Box Plot
    d Histogram e) Line Chart and Subplots f) Scatter Plot
13. Getting started with NLTK, install NLTK using PIP
14. Python program to implement with Python Sci Kit-Learn & NLTK
15. Python program to implement with Python NLTK/Spicy/Py NLPI.

e-Learning Resources:

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-datascience beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutesguide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formatspython/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessingpython-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-datavisualization-exploration-python/
6. https://www.nltk.org/book/ch01.html

Honors Degree

DATA VISUALIZATION AND COMMUNICATION

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

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Course Objectives

- To introduce the fundamental principles and importance of data visualization in analytics and decision making.
- To equip students with the skills to choose appropriate visualization methods for different types of data.
- To enable learners to utilize modern visualization tools and libraries for data exploration and presentation.
- To develop students' ability to communicate insights effectively using data storytelling techniques.
- To apply design thinking and ethical practices in developing clear, accurate, and compelling visual representations of data.

Course Outcomes

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

- understand the basic concepts, types, and significance of data visualization.
- apply effective design principles and appropriate chart types to visualize data accurately.
- utilize tools such as Excel, Tableau, Power BI, and Python libraries (Matplotlib, Seaborn, Plotly) to create visualizations.
- construct coherent data stories and present insights tailored to different audience types.
- evaluate and apply advanced visualization techniques with a focus on ethics and clarity in communication

Course Content

UNIT – I: Introduction to Data Visualization

Importance and purpose of data visualization; Types of data: categorical, ordinal, quantitative, time series; Visual perception and cognitive principles; Chart types overview: bar, line, scatter, pie, histogram; Data-Ink ratio and Tufte's principles.

UNIT – II: Principles of Effective Visualization Design

Choosing the right graph; Design for clarity: scale, axis, and labels; Visual hierarchy and Pre attentive attributes; Color theory in visualization; Avoiding misleading visuals and chartjunk.

UNIT – III: Tools and Technologies for Visualization

Overview of popular visualization tools: Python (Matplotlib, Seaborn, Plotly);
Visualization inPython: basic usage and examples; Creating and customizing visualizations using open-source tools.

UNIT – IV: Data Storytelling and Communication

Data narrative techniques; Framing your story: beginning, middle, end; Annotating for insight; Audience-centric communication; Presentation dos and don'ts.

UNIT – V: Advanced Visualization & Real-World Applications

Complex visualizations: maps, heatmaps, treemaps, network graphs; Visualizing uncertainty and variability; Ethics in data visualization; Case studies from business, journalism, healthcare, etc.

Text Books:

1. Storytelling with Data: A Data Visualization Guide for Business Professionals, Cole Nussbaumer Knaflic, Wiley, 2015.

References Books:

1. Data Points: Visualization That Means Something, Nathan Yau, Wiley, 2013.
2. The Visual Display of Quantitative Information, Edward R. Tufte, Graphics Press, 2001.
3. The Truthful Art: Data, Charts, and Maps for Communication, Alberto Cairo, New Riders, 2016.
4. Visualizing Data: Exploring and Explaining Data with the Processing Environment, Ben Fry, O'Reilly, 2008.

Honors Degree

DATA VISUALIZATION AND COMMUNICATION LAB

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 1.5	External Marks : 70

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Course Objectives

- To introduce various types of data visualizations using open-source tools.
- To implement clear, well-labeled visualizations using Python libraries.
- To develop skills in interpreting and customizing visual plots.
- To apply visual communication principles for presenting insights effectively.

Course Outcomes

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

- understand and apply different types of data visualizations using open-source libraries.
- create clear and well-structured visualizations using Matplotlib and Seaborn.
- develop interactive and advanced plots using Plotly.
- demonstrate effective communication of insights through labeled, customized, and annotated plots.

List of Experiments:

(Perform any 10 of the following experiments)

1. Introduction to Python visualization stack: Matplotlib, Seaborn, Plotly
2. Creating basic plots with Matplotlib: line, bar, pie, histogram
3. Customizing plots: titles, labels, legends, colors, gridlines, figure size
4. Subplots and figure layout adjustments in Matplotlib
5. Introduction to Seaborn: statistical plots (countplot, distplot, boxplot, violin plot)
6. Multivariate and categorical visualization using Seaborn: scatterplot, pairplot, heatmap
7. Customizing Seaborn plots: palettes, styles, themes, and annotations
8. Introduction to interactive visualizations using Plotly (bar, line, scatter)
9. Advanced Plotly visualizations: bubble chart, area chart, subplots, and multiple axes
10. Time series visualization using Matplotlib and Plotly
11. Creating and visualizing grouped and stacked charts
12. Annotating visualizations: highlighting key data points, trends, and narratives
13. Comparative visualizations: combining plots to compare variables or categories
14. Mini-project: Visualize a real-world dataset using multiple chart types
15. Project Presentation & Viva.

References Books:

1. Data Points: Visualization That Means Something, Nathan Yau, Wiley, 2013.
2. The Visual Display of Quantitative Information, Edward R. Tufte, Graphics Press, 2001.
3. The Truthful Art: Data, Charts, and Maps for Communication, Alberto Cairo, New Riders, 2016.

4. Visualizing Data: Exploring and Explaining Data with the Processing Environment, Ben Fry, O'Reilly, 2008.
5. Storytelling with Data: A Data Visualization Guide for Business Professionals, Cole Nussbaumer Knaflic, Wiley, 2015.

Honors Degree

FOUNDATIONS OF RECOMMENDER SYSTEMS

IV Year – I Semester

Lecture: 3 Internal Marks: 30
Credits: 3 External Marks: 70

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Course Objectives

- To cover the basic concepts of recommender systems, including personalization algorithms, evaluation tools, and user experiences.

Course Outcomes

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

- Understand the fundamentals, mathematical notations, and applications of recommender systems along with associated challenges.
- Evaluate different collaborative filtering approaches and assess the impact of attacks on recommender systems to improve their robustness and performance.
- Develop content-based and knowledge-based recommendation models using item profiles, feature extraction, and classification algorithms.
- Design and implement hybrid recommender systems by exploring various hybridization strategies.
- Evaluate recommender systems, and explore the integration of social tagging, trust, and community-driven recommendations for personalized web search.

Course Content

UNIT-I:

Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

UNIT-II:

Collaborative Filtering: User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, Model based and pre- processing based approaches, Attacks on collaborative recommender systems.

UNIT-III:

Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content-based filtering, Item profiles, discovering features of documents, obtaining item features from tags, representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms. Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

UNIT-IV:

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta- level, Limitations of hybridization strategies.

UNIT-V:

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centered metrics. Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, social tagging recommender systems, Trust and recommendations.

Text Books:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
2. RicciF., Rokach L.,Shapira D., Kantor B.P., Recommender Systems Handbook, Springer (2011), 1st ed.

Reference Books:

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems for Learning, Springer (2013), 1st ed.