SCHEME OF INSTRUCTION AND SYLLABUS

B.Tech in Artificial Intelligence and Data Science

Regulation:VR23

w.e.f.2023-24

Department of Computer Science and Engineering

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE

(An Autonomous, ISO 9001:2015 Certified Institution)

(Approved by AICTE, Accredited by NAAC with 'A+' Grade,
Affiliated to JNTUK, Kakinada)

(Sponsored by Siddhartha Academy of General & Technical Education)

Vijayawada, Andhra Pradesh - 520007, INDIA.

www.vrsiddhartha.ac.in

Institute Vision

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

Institute Mission

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and proactive nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

Department Vision

The department vision is clearly defined and is in line with the college's vision. The vision of the department is:
"To evolve as a centre of academic excellence, advanced research and innovation in the field of Artificial Intelligence and Data Science discipline."

Department Mission

This mission of the Department is concise and supports the College's mission. The mission of Artificial Intelligence and Data Science Department is:
"To inculcate students with congnitive skills to perform intelligent data analysis, their application in solving data driven problems, with an inclination towards societal issues, research, professional career and higher studies ."

Program Educational Objectives
(Undergraduate)

We have program educational objectives for our Artificial Intelligence and Data Science Program. Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

Our program educational objectives are:

The graduates of the program will

1. The graduates of the Program will have knowledge and skills for data analysis, including mathematics, science and basic engineering.

2. The graduates of the Program will have in-depth learning skills to function as members of multi-disciplinary teams and to communicate effectively using modern tools.

3. The graduates of the Program will have extensive knowledge in state-ofthe- art frameworks in Artificial Intelligence and be prepared for their careers in the software industry or pursue higher studies and continue to develop their professional knowledge.

4. The graduates of the program will practice the profession with ethics, integrity, leadership and social responsibility.

Program Outcomes

On successful completion of the B.Tech (AI&DS) programme the student will be able to:

PO1 - *Engineering knowledge:* Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - *Problem analysis:* Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 - *Design/development of solutions:* Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 - *Conduct investigations of complex problems:* Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - *Modern tool usage:* Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 - *The engineer and society:* Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 - *Environment and sustainability:* Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 - *Ethics:* Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 - *Individual and team work:* Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 - *Communication:* Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 - *Project management and finance:* Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 - *Lifelong learning:* Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Develop AI based software applications/solutions as per the needs of Industry and society.

PSO2: Adopt new and fast emerging technologies in Artificial Intelligence and Data Science.

COURSE CATEGORY ABBREVIATIONS

1. Humanities and Sciences-HS

2. Basic Sciences-BS

3. Engineering Science-ES

4. Program Core-PC

5. Soft Skills-SS

6. Skill Enhancement Course-SEC

7. Audit Course-AC

8. Mandatory Course-MC

9. Program Elective-PE

10. Open Elective-OE

11. Humanities and Social Sciences-HSS

12. Humanities Elective-HE

13. Advanced Skill Course

SCHEME OF INSTRUCTION

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

Semester I

				Contact Hours			27
S. No.	Course Code	Course Category	Course Name	L	T	P	C
1	23BS1101	BS	Linear Algebra and Calculus	3	0	0	3
2	23BS1102	BS	Engineering Physics	3	0	0	3
3	23ES1103A	ES	Basic Civil and Mechanical Engineering	3	0	0	3
4	23ES1104	ES	Introduction to Programming	3	0	0	3
5	23HS1105	HSS	Communicative English	2	0	0	2
6	23BS1151	BS	Engineering Physics Lab	0	0	2	1
7	23ES1152	ES	Computer Programming Lab	0	0	3	1.5
8	23HS1153	HSS	Communicative English Lab	0	0	2	1
9	23ES1154	ES	Engineering Workshop	0	0	3	1.5
10	23ES1155	ES	IT Workshop	0	0	2	1
11	23BS1156	BS	NSS/NCC/Community Service	0	0	1	0.5
			Total	14	0	13	20.5
12	23MC1106	MC	Induction Program				-

[L - Lecture, T - Tutorial, P - Practical, C - Credits]

Category	Credits
Basic Science Courses	3 + 3 + 1 + 0.5 = 7.5
Engineering Science Courses	3 + 3 + 1.5 + 1.5 + 1 = 10
Humanities and Social Science Courses	2 + 1 = 3
Mandatory Courses	0
Total Credits	**20.5**

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

Semester II

				Contact Hours			28
S. No.	Course Code	Course Category	Course Name	L	T	P	C
1	23BS2101	BS	Differential Equations & Vector Calculus	3	0	0	3
2	23BS2102B	BS	Chemistry	3	0	0	3
3	23ES2103B	ES	Basic Electrical and Electronics Engineering	3	0	0	3
4	23PC2104A	PC	Data Structures	3	0	0	3
5	23ES2105	ES	Engineering Graphics	1	0	4	3
6	23BS2151B	BS	Chemistry Laboratory	0	0	2	1
7	23PC2152A	PC	Data Structures Lab	0	0	3	1.5
8	23ES2153	ES	Basic Electrical and Electronics Workshop	0	0	3	1.5
9	23BS2154B	BS	Health and wellness, Yoga and Sports	0	0	1	0.5
10	23MC2106	MC	Introduction to Design Thinking	2	0	0	-
			Total	15	0	13	19.5

[L - Lecture, T - Tutorial, P - Practical, C - Credits]

Category	Credits
Basic Science Courses	3 + 3 + 1 + 0.5 = 7.5
Engineering Science Courses	3+3+1.5 = 7.5
Professional Courses	3+1.5 = 4.5
Humanities and Social Science Courses	0
Mandatory Courses	0
Total Credits	**19.5**

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

Semester III

				Contact Hours				28
S. No.	Course Code	Course Category	Course Name	L	T	P	C
1	23HS3101	HS	Engineering Economics & Management	2	0	0	2
2	23HS3102	BSH	Universal Human Values 2 -Understanding Harmony	2	1	0	3
3	23BS3103B	BS	Discrete Mathematics	3	0	0	3
4	23ES3304	ES	Database Management Systems	2	0	2	3
5	23AI&DS3305	PC	Advanced Data Structures & Algorithms Analysis	2	1	0	3
6	23TP3106	SS-1	Logic & Reasoning	0	0	2	1
7	23AI&DS3307	PC	Object Oriented Programming Through Java	2	1	0	3
8	23AI&DS3651	SEC	Python Programming Lab	0	0	2	1
9	23AI&DS3352	PC Lab 1	Advanced Data Structures and Algorithms Lab	0	0	3	1.5
10	23AI&DS3353	PC Lab 2	Object Oriented Programming Through Java Lab	0	0	3	1.5
			Total	13	3	12	22

[L - Lecture, T - Tutorial, P - Practical, C - Credits]

Category	Credits
Basic Science Courses	3
Engineering Science Courses	3+3=6
Program Core	3+3+1.5+1.5=9
Skill courses	1+1=2
Humanities Courses	2
Total Credits	**22**

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

Semester IV

				Contact Hours			27
S. No.	Course Code	Course Category	Course Name	L	T	P	C
1	23BS4101A	ES	Statistical methods for Data science	3	0	0	3
2	23AI&DS4302	PC	Artificial Intelligence	3	0	0	3
3	23AI&DS4303	PC	Introduction to Data Science	3	0	0	3
3	23AI&DS4304	PC	Digital Logic & Computer Organization	3	0	0	3
5	23TP4106	SS-2	English for Professionals	0	0	2	1
6	23MC4107	AC	Environmental Science	2	0	0	-
7	23AI&DS4651	SEC	Full Stack Development-1	0	0	2	1
8	23ES4152	ES	Design Thinking & Innovation	1	0	2	2
9	23AI&DS4353	PC Lab-1	Artificial Intelligence Lab	0	0	3	1.5
10	23AI&DS4354	PC Lab-2	Data Science using Python Lab	0	0	3	1.5
			Total	15	0	12	19
Summer Internship 8 weeks (Mandatory) during summer vacation (EPICS)							
Honors/ Minor Courses (the hours distribution can be 3-0-0, 2-0-2 or 2-1-0 also)				**3**	**0**	**0**	**3**

[*L - Lecture, T - Tutorial, P - Practical, C - Credits*]

Category	Credits
Engineering Science Courses	3
Program Core	3+3+3+1.5+1.5=12
Skill courses	1+1=2
Audit course	0
ES	2
Total Credits	**19**

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

Semester V

				Contact Hours			29
S. No.	Course Code	Course Category	Course Name	L	T	P	C
1	23AI&DS5301	PC	Data Warehousing and Data Mining	3	0	0	3
2	23AI&DS5302	PC	Principles of Machine Learning	3	0	0	3
3	23AI&DS5303	PC	Operating Systems	3	0	0	3
4	23AI&DS5404	PE I	A. Software Engineering B. Recommender Systems C. Information Retrieval Systems D. Exploratory Data Analysis with Python	3	0	0	3
5	23AI&DS5205	OE-I	A. Web Programming (For Non CSE/IT allied branches only) B. Internet of Things (For Non CSE/IT allied branches only) C. Mobile Application Development (For CSE students)	3	0	0	3
6	23AI&DS5351	PC Lab-1	Data Warehousing and Machine Learning Lab	0	0	2	1
7	23AI&DS5352	PC Lab-2	Operating Systems Lab	0	0	2	1
8	23HS5153	HSS	Advanced Communication Skills Laboratory	0	0	2	1
9	23AI&DS5651	SEC	Full Stack Development -II	0	0	2	1
10	23TP5106	SS-3	Personality Development	0	0	2	1
11		ES	User Interface Design using Flutter / SWAYAM Plus - Android Application Development (with Flutter)	0	0	2	1
12	23AI&DS5354		Evaluation of Community Service Internship	0	0	0	2
13			IPR	2	0	0	0
			Total	17	0	12	23
Honors/ Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)				4	0	0	4

[*L - Lecture, T - Tutorial, P - Practical, C - Credits*]

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

Semester VI

				Contact Hours			26
S. No	Course Code	Course Category	Course Name	L	T	P	C
1	23AI&DS6301	PC	Big Data Analytics	3	0	0	3
2	23AI&DS6302	PC	Deep Learning and NLP	3	0	0	3
3	23AI&DS6303	PC	Computer Networks	3	0	0	3
4	23AI&DS6404	PE 2	1. AI for Industrial Applications 2. Business Intelligence & Data Visualization 3. Soft Computing 4. Computer Vision 5. Automata Theory & Compiler Design	3	0	0	3
5	23AI&DS6405	PE 3	1. Quantum Computing 2. NoSQL databases 3. Cloud Computing 4. Social Media Analytics 5. Any of the 12-Week SWAYAM /NPTEL Course suggested by the BoS	3	0	0	3
6	23AI&DS6206	OE 2	Database Management Systems	3	0	0	3
7	23AI&DS6351	PC Lab-1	Deep Learning & Natural Language Processing Lab	0	0	3	1.5
8	23AI&DS6352	PC Lab-2	Big Data Analytics Lab	0	0	3	1.5
9		SS-4	Quantitative Aptitude	0	0	2	1
			Total	18	0	8	22
Industrial/Research Internship eight weeks (Mandatory) during summer vacation							
Honors/ Minor Courses (the hours distribution can be 3-0-0, 2-0-2 or 2-1-0 also)				3	0	0	3

[L - Lecture, T - Tutorial, P - Practical, C - Credits]

Note: Open Elective courses 2 and 4 are self-learning. Students may opt from any MOOCs platform. They have to submit the certificate before the last instruction day of VII semester. Course selection for MOOCs is subject to approval by the Head of the Department.

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

Semester VII

				Contact Hours			25
S. No.	Course Code	Course Category	Course Name	L	T	P	C
1	23AI&DS7101	PC	Generative A.I.	3	0	0	3
2	23HS7103	MC-II	Human Resource & Project Management	2	0	0	2
3	23AI&DS7404	PE 4	1. Cryptography and Network Security 2. Blockchain Technology 3. DevOps 4. Robotic Process Automation	3	0	0	3
4	23AI&DS7405	PE 5	A. Explainable AI B. Cyber Security C. Reinforcement Learning D. High Performance Computing 5. 12-Week SWAYAM / NPTEL Course suggested by the BoS	3	0	0	3
5	23AI&DS7206	OE 3	Object Oriented Programming Through Java	3	0	0	3
6	23AI&DS7207	OE 4	A. Computer Networks B. Software Engineering C. IOT Based Smart Systems	3	0	0	3
7	23AI&DS7607	SEC	Prompt Engineering	0	0	2	1
8	23AI&DS7552	SEC	Capstone Project – II	0	0	4	2
9	23MC7108	AC	Constitution of India	2	0	0	-
10	23AI&DS7553	Internship/ Project	Industrial / Research Internship	0	0	0	2
			Total	19	0	6	22
Honors/ Minor Courses (the hours distribution can be 3-0-0, 2-0-2 or 2-1-0 also)				3	0	0	3

L - Lecture, T - Tutorial, P - Practical, C - Credits

Note: Open Elective 2 and Open Elective 4 are self-learning. Students may opt from any MOOCs platforms. They have to submit the certificate before the last instruction day of 7th semester. Course selection for MOOCs is subject to approval by the Head of the Department.

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR23]

Semester VIII

				Contact Hours			24
S. No.	Course Code	Course Category	Course Name	L	T	P	C
1	23AI&DS8551	**Internship & Project Work	Full semester Internship and Project Work	0	0	24	12
			Total	0	0	24	12

[L - Lecture, T - Tutorial, P - Practical, C - Credits]

** The student should undergo internship and simultaneously heshe should work on a project with well-defined objectives. At the end of the semester the student should submit an internship completion certificate and a project report.

**If any of our associated company comes forward to offer an emerging course that will be offered as an industry offered course in V, VI or VII semesters under program elective with the approval of BoS. This is incorporated to enhance student skills and employability in cutting edge technologies.

SEMESTER I

23BS1101
LINEAR ALGEBRA & CALCULUS
(COMMON TO ALL BRANCHES)

Course Category	Basic Science	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	10+2 level Mathematics	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Solve the system of homogeneous and non-homogeneous linear equations
2. Examine the nature of a quadratic form by transforming into a canonical form
3. Determine maxima and minima of multivariable functions
4. Evaluate areas and volumes using double, triple integrals

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	2			1											
2	3	2			1											
3	3	2			1											
4	3	2			1											

COURSE CONTENT

UNIT I-Matrices
Rank of a matrix by Echelon form, Normal form, Cauchy–Binet formulae (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 forms by Orthogonal Transformation.

UNIT III-Differential Calculus
Mean Value Theorems: Rolle's theorem, Lagrange's mean value theorem with

their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof), Problems and applications on the above theorems.

Functions of Several Variables: Continuity and Differentiability, Partial derivatives, Total derivatives, Chain rule, Directional derivative, 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 IV-Multiple Integrals (Multivariable 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

REFERENCE BOOKS

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley Sons, 2018, 10th E dition.
2. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018,14th Edition
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition(9th reprint)
4. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition
5. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th Edition
6. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, 3rd Edition (Reprint 2021)

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. Prof.S. K. Gupta & Prof. Sanjeev Kumar ,IIT Roorkee, Matrix Analysis with Applications[English], Available:https://onlinecourses.nptel.ac.in/noc19_ma28/preview
2. Prof. Jitendra Kumar , IIT Kharagpur, Engineering Mathematics – I[English], Available:https://onlinecourses.nptel.ac.in/noc20_ma37/preview
3. Prof. Jitendra Kumar & Prof. Somesh Kumar, IIT Kharagpur, Advanced Calculus For Engineers[English],
Available:https://onlinecourses.nptel.ac.in/noc22_ma75/preview
4. Prof. Denis Auroux, Massachusetts Institute of Technology: MIT Open Courseware,Multivariable Calculus,Available:https://ocw.mit.edu.

23BS1102
ENGINEERING PHYSICS
(Common to all Programmes)

Course Category	Institutional Core	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	-	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OBJECTIVES:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the modern optical devices such as Lasers and optical fibers, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Elaborate different types of lasers, optical fibers and their applications
2. Familiarize with the basics of crystals and their structures
3. Summarize various types of polarization of dielectrics and classify the magnetic materials
4. Explain the basic concepts of Quantum Mechanics and types of semiconductors using Hall Effect.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	1														
2	3	2														
3	3															
4	3															

COURSE CONTENT

UNIT I-Lasers and Fiber Optics
Lasers: Introduction, Characteristics of laser, Basic Principles of lasers (absorption, spontaneous emission and stimulated emission), Requirements of lasers (pumping, population inversion and cavity resonance), Einstein's coefficients, different types of lasers: solid-state lasers (Ruby), gas lasers, (He-Ne), Semiconductor laser, applications of lasers in science, engineering and medicine.

Fibre Optics: Introduction, Fundamentals of optic fibre, Propagation of light through optical fiber, Types of optical fibers, Numerical aperture, Fractional Refractive Index change, Fiber optics in communication and its advantages.

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 - Frequency dependence of polarization – complex dielectric constant (Qualitative) – dielectric loss (Qualitative).
Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, Para and Ferro magnetic materials - Domain concept for Ferromagnetism Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV-Quantum Mechanics and Semiconductors
Quantum Mechanics: Dual nature of light, Matter waves,Properties and Debroglie's hypothesis, G.P.Thomson experiment,Heisenberg's Uncertainty Principle and its applications (Non existence of electron in nucleus) and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.
Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors- Fermi level-Extrinsic semiconductors-Fermi level - Drift and diffusion currents – Einstein's equation – Hall effect and its applications, Photodiode,Light Emitting Diode,Solar cell 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-RESOURCES AND OTHER DIGITAL MATERIALS:

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

23ES1103A
BASICS OF CIVIL &
MECHANICAL ENGINEERING

Course Category	Institutional Core	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	10+2	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:

1. Understand various Civil Engineering sub-divisions thereby appreciate their role in ensuring a better society and understand the basic building components along with attaining knowledge of Civil Engineering Materials and prefabricated technology
2. Know the basic concepts, uses and classification of surveying and realize the importance of Transportation in the nation's economy and the engineering measures related to Transportation and understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated
3. Understand the scope of Mechanical Engineering in different sectors and industries and know about different manufacturing processes
4. Explain the basics of thermal engineering, Power plants , power transmission and robotics

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

| CO | PO | | | | | | | | | | | | PSO | | BTL | POI |
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2				1	3	2									
2	1				2	2	3									
3	2				1	2	3									
4	2				1	2	3									

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 and Transportation Engineering: Objectives of Surveying- Principles of Surveying-Classification based on function and instruments, Importance of Transportation in Nation's Economic Development- Basics components of Road-Classification of Highways.
Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Simple introduction to Dams and Reservoirs.

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

UNIT IV
Thermal Engineering: IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Otto cycle,Diesel cycle,Components of Electric and Hybrid Vehicles., Refrigeration and air conditioning Working principle of Boilers: classification of Boilers Power plants – Working principle of Steam, Nuclear power plants. Mechanical Power Transmission - Belt and Gear Drives, Introduction to Robotics.

TEXT BOOKS

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition. (UNITS I & II)
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition (UNITS I & II)
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition (UNITS I & II)
4. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd. (UNITS III & IV)
5. A text book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd. (UNITS III & IV)
6. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd. (UNITS III & IV)

REFERENCE BOOKS

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019.

Fifth Edition. (UNITS I & II)

2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016. (UNITS I & II)

3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition. (UNITS I & II)

4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition. (UNITS I & II)

5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012 (UNITS I & II)

6. Advances in Civil Engineering (Volume - 5), S. Sathish, AkiNik Publications,2021. (UNITS I & II)

7. Advances in Civil Engineering (Volume - 5), S. Sathish, AkiNik Publications,2021. (UNITS I & II)

8. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd. (UNITS III & IV)

9. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd. (UNITS III & IV)

10. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications. (UNITS III & IV)

11. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I. (UNITS III & IV)

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. http://nptel.iitm.ac.in/video.php?subjectId=10810607
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/em/index.htm
3. http://www.mike-willis.com/Tutorial/PF2.htm
4. https://www.scribd.com/document/680441639/Basic-Civil-and-Mechanical-Engineering
5. https://www.imeche.org/careers-education/careers-information/what-is-mechanical- engineering/where-do-mechanical-engineers-work

23ES1104
Introduction To Programming
(Common to All Branches)

Course Category	Engineering Science	Credits	3
Theory	Theory	L-T-P	3-0-0
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. To introduce students to the fundamentals of computer programming
2. To provide hands-on experience with coding and debugging on control structures and arrays
3. To foster logical thinking and problem-solving skills on strings and ponters
4. To familiarize students with programming concepts such as functions, structures and files

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	1														
2		2	3													
3		2	3													
4		2	3													

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 and Arrays
Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for,

while, do- while) Break and Continue, Arrays indexing, memory model, programs with array of integers, two dimensional arrays.

UNIT III-Strings and pointers
Introduction to Strings. Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers.

UNIT IV-Functions, User Defined Data types and 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, User-defined data types-Structures and Unions, 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.W. H. Hayt and J. A. Buck, "Engineering Electromagnetics", 7th edition, Tata McGraw Hill, New Delhi, 2006.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition.
3. C Programming,A Problem Solving Approach,Forouzan,Gilberg,Prasad, CEN-GAGE, 3rd edition.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. http://nptel.iitm.ac.in/video.php?subjectId=10810607
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/em/index.htm
3. http://www.mike-willis.com/Tutorial/PF2.htm

23HS1105
COMMUNICATIVE ENGLSIH

Course Category	Institutional Core/ Humanities and Social Science	Credits	2
Theory	Theory	L-T-P	2-0-0
Prerequisites	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	Continuous Eval Semester End Eval Total Marks	30 70 100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the context, topic, and pieces of specific information from social or Transactional dialogues
2. Apply grammatical structures to formulate sentences and correct word forms
3. Analyze discourse markers to speak clearly on a specific topic in informal discussions
4. Evaluate reading texts / listening to write summaries based on global comprehension and create a coherent paragraph, essay and résumé

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2									3		2				
2	2	2								3		2				
3	2									3		2				
4	2	2								3		2				

COURSE CONTENT UNIT I

Lesson: HUMAN VALUES: Gift of Magi (Short Story)
Listening: Identifying the topic, the context and specific pieces of information by listening to 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 after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics).
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
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 is discussed.
Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing, Essay Writing, (The Power of Intrapersonal Communication).
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: Studying 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 & Report Writing.
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice.
Vocabulary: Words often confused, Jargons & Technical Jargons.

TEXT BOOKS

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5).
3. English: Language, Context and Culture, 1st Edition, Orient Black Swan, 2023 (Units5)

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 a Superior Vocabulary. Anchor, 2014.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

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

23BS1151
ENGINEERING PHYSICS LAB
(Common to All Branches)

Course Category	Institutional Core/ Basic Sciences	Credits	1
Theory	Lab	L-T-P	0-0-2
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Test optical components using principles of interference and diffraction of light
2. Use spectrometer, travelling microscope and function generator in various experiments
3. Determine the V-I characteristics of photo cells and appreciate the accuracy in measurements

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1				3												
2				3												
3	2			3												

COURSE CONTENT

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
3. Determination of wavelength of Laser light using diffraction grating
4. Estimation of stopping potential and work function of a photo material using photoelectric effect. 4. Estimation of stopping potential and work function of a photo material using photoelectric effect.
5. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
6. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.

7. Determination of Acceleration due to Gravity and radius of Gyration by using a compound pendulum.
8. Sonometer: Verification of laws of stretched string.
9. Determination of Dielectric constant of different solid materials.
10. Determination of Numerical Aperture of a given optical fiber.
11. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.
12. Determination of Rigidity Modulus of the material of the given wire using Torsional pendulum.
13. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
14. Determination of Energy Gap of a semiconductor using p-n junction diode.
15. Determination of thickness of a thin foil by Wedge Method.
16. Estimation of Fill Factor of a given Solar Cell.
17. Study the frequency response and determination of resonating frequency of LCR Circuit.
18. Determination of Figure of merit of a Galvanometer.

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

TEXT BOOKS

1. Madhusudhan Rao, "Engineering Physics Lab Manual", Ist ed., Scitech Publications, 2015.
2. Ramarao Sri, Choudary Nityanand and Prasad Daruka, "Lab Manual of Engineering Physics"., Vth ed., Excell Books, 2010.

E-RESOURCES

1. http://plato.stanford.edu/entries/physics-experiment
2. http://www.physicsclassroom.com/The-Laboratory
3. http://facstaff.cbu.edu/ jvarrian/physlabs.html.

VIRTUAL LAB REFERENCES

1. http://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1
2. http://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1
3. http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1

23ES1152
COMPUTER PROGRAMMING LAB
(Common to All Branches)

Course Category	Engineering Science	Credits	1
Theory	Lab	L-T-P	0-0-2
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Read, understand, and trace the execution of programs written in C language
2. Select the right control structure for solving the problem
3. Develop C programs which utilize memory efficiently using programming constructs like pointers
4. Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	1														
2		2	3													
3	2	2	3													
4		2	3													

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.
Lab1: 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.
Lab2: 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.
Lab3: 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.
Lab4: 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, null- else, 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
Lab5: 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 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
Lab6: 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.
Lab7: 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.
Lab8: 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 amp; value initialization, resizing changing and reordering the contents of an array 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.
Lab9: 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
Lab10: 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
Lab11: 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

Lab12: 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

Lab13: Simple functions using Call by reference, Dangling pointers

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

   ii. Demonstrate Dangling pointer problem using a C program

   iii. Write a C program to copy one string into another using pointer

   iv. 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

Lab14: 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, Schaum39; s Outline of Programming with C, McGraw Hill.

E-RESOURCES

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

23HS1153/23HS2153
Communicative English Lab
(Common to All Branches)

Course Category	Institutional Core	Credits	1
Theory	Practical	L-T-P	0-0-2
Prerequisites	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities.	Continuous Eval Semester End Eval Total Marks	30 70 100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the different aspects of the English language proficiency with emphasis on LSRW skills
2. Apply communication skills through various language learning activities
3. Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension
4. Evaluate and exhibit professionalism in participating in debates and group discussions

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1		2								3		2				
2										3		2				
3										3		2				
4										3		2				

COURSE CONTENT

List of Topics
1. Vowels and Consonants
2. Neutralizaton/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 Presentations
10. Interview Skills

SUGGESTED SOFTWARE
1. WALDEN
2. SOFTX
3. VISIONET

23ES1154
CENGINEERING WORKSHOP

Course Category	Engineering Sciences	Credits	1.5
Theory	Laboratory	L-T-P	0-0-3
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the basic joints using wood and familiarize with various fundamental aspects of house wiring, fitting and foundry.
2. Prepare basic models using sheet metal and practice joining of metals using various types of welding.
3. Familiarize with various advanced manufacturing processes such as injection moulding and 3D printing.
4. Understand the preparation of PCB and simple IOT applications using Arduino.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1			2		3											
1			2		3											
2			2		3											
3			2		1											

COURSE CONTENT

PART-A
1. **Demonstration:** Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints. (**2 classes**)

   (a) Half–Lap joint

   (b) Bridle joint

   (c) Demonstration of power tools.

3. **Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, developmentsof following sheet metal job from GI sheets. (**2 classes**)

(a) Tapered tray

(b) Conical funnel

4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises. (**2 classes**)

(a) V-fit

(b) Semi-circular fit

(c) 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. (**1 class**)

(a) Parallel and series

(b) Two-way switch

(c) Godown lighting

(d) Tube light

6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sandmoulds for given Patterns. (**1 class**)

7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint. (**1 class**)

8. **Advanced manufacturing processes:** Demonstration of injection moulding and 3 D printing processes.(**1 class**)

9. **Electronic Circuits:** Demonstration of preparation of simple electronic circuit (PCB) and testing its operation. (**1 class**)

10. **Basic IOT:** Demonstration of different components & pin configuration of Arduino board (**1 class**)

(a) Measure Temperature & Humidity

(b) Measure Distance

PART-B

GROUP ACTIVITY (2 classes)

- Students must prepare a Working model / Assembly using the knowledge gained from the above trades.

TEXT BOOKS

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.

2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, DhanpathRai& Co., 2015 & 2017.

REFERENCE BOOKS

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & 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.; AtulPrakashan, 2021-22.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual-2016-17-1.pdf
2. https://www.protosystech.com/rapid-prototyping.htm
3. https://www.arduino.cc/en/Tutorial/Foundations
4. https://www.tutorialspoint.com/arduino/

23ES1155
IT WORKSHOP

Course Category	Engineering Sciences	Credits	1
Theory	Laboratory	L-T-P	0-0-2
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Perform Hardware troubleshooting
2. Understand Hardware components and inter dependencies
3. Safeguard computer systems from viruses/worms
4. Document/ Presentation preparation
5. Perform calculations using spreadsheets

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1			2		3											
1			2		3											
2			2		3											
3			2		1											

COURSE CONTENT

- **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 and 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

- **Task1-Word Orientation:** The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX 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 La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

- **Task 2-Using La TeX 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 La TeX 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 clipart, 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:** Gridlines, 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.

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

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

SEMESTER II

23BS2101
DIFFERENTIAL EQUATIONS AND
VECTOR CALCULUS

Course Category	Basic Science	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	23BS1101 Linear Algebra & Calculus	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:

1. Solve first order linear differential equations
2. Solve higher order linear differential equations with constant coefficients
3. Solve Partial differential equations
4. Evaluate the work done against field, circulation and flux using vector calculus

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	2			1											
2	3	2			1											
3	3	2			1											
4	3	2			1											

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,homogenous and non-homogenous, 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 Calculus

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.

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

REFERENCE BOOKS

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley Sons, 2018, 10th E dition.
2. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018,14th Edition
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition(9th reprint)
4. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition
5. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th Edition
6. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, 3rd Edition (Reprint 2021)

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. Prof. Srinivas Rao Manam, IIT Madras,Differential equations for engineers [English], Available: https://onlinecourses.nptel.ac.in/noc22_ma72/preview
2. Prof. Jitendra Kumar , IIT Kharagpur, Engineering Mathematics – I[English], Available:https://onlinecourses.nptel.ac.in/noc20_ma37/preview
3. Prof. Jitendra Kumar , IIT Kharagpur, Engineering Mathematics – II[English], Available: https://onlinecourses.nptel.ac.in/noc22_ma08/preview
4. Prof. Jitendra Kumar & Prof. Somesh Kumar, IIT Kharagpur, Advanced Calculus For Engineers[English], Available:https://onlinecourses.nptel.ac.in/noc22_ma75/preview
5. Prof. Denis Auroux, Massachusetts Institute of Technology: MIT Open Courseware,Multivariable Calculus,Available:https://ocw.mit.edu

23BS2102B
CHEMISTRY

Course Category	Institutional Core	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	10 + 2 level Chemistry	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Apply the principles of quantum mechanics for determining structure and bonding of molecules
2. Apply the principles electrochemistry for its applications in chemical analysis, electrodes, electrochemical sensors and energy sources
3. Explain the mechanistic aspects of polymerisation and conduction, types, preparation, properties and applications of polymers
4. Compare different spectroscopic and chromatographic techniques for their application in qualitative and quantitative analysis
5. Choose engineering materials including nanomaterials based on their properties for their applications in various industrial fields

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	1														
2	2		3													
3	2				3											
4	2	3														
5	2				3		1									

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,N2, NOand CO,calculation of bond order, - molecular orbitals of butadiene and benzene.
Engineering Materials: Semiconductors - Introduction, basic concept, applications, Superconductors - Introduction, basic concept, applications, Supercapacitors - Introduction, basic concept, classification, applications.

UNIT II
Electrochemistry:
Electrochemical cell, Nernst equation, potential and emfcalculations and numerical problems, potentiometry – potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, cell constant and specific conductance, conductometrictitrations (acid-base titrations), Electrochemical sensors – potentiometric sensors andamperometric sensors-principle with examples.

Electrochemical Energy Systems:
Types of electrochemical energy systems - Primary cells – Zinc-air battery, Secondary cells – lithium-ion batteries – working of the batteries including cell reactions, Fuel cells – hydrogen–oxygen fuel cell- working of the cells, Polymer Electrolyte Membrane fuel cells(PEMFC).

UNIT III
Polymer Chemistry:
Introduction to polymers, functionality of monomers, addition and condensation polymerization, mechanism of chain growth and step growth polymerization, coordination polymerization with specific examples.Plastics – Thermo and thermosetting plastics, preparation, properties and applications of PVC, Teflon, Bakelite, Nylon-6,6.Elastomers – Buna-S, Buna-N –Preparation, properties and applications. Conducting Polymers – Principle and examples, mechanism of conduction in undoped, doped polyacetylene and applications, Biodegradable polymers – polyglycolic acid (PGA), Polylacticacid(PLA).

UNIT IV
Instrumental Methods of Analysis:
Electromagnetic spectrum, Interaction of radiation with matter, UV Visible Spectroscopy-principle, electronic transitions, Lambert-Beer's law, Instrumentation, applications,IR spectroscopy-principle, types of vibrations, selection rule, Instrumentation, Chromatography- basic principle and classification.

Nano materials:
Introduction, classification of nanomaterials. Properties and applications of fullerenes, carbon nanotubes, graphene and nanoparticles.

TEXT BOOKS

1. Engineering Chemistry, Jain and Jain, 17th Edition, DhanpatRai, 2018.
2. Engineering Chemistry, PrasanthaRath S. ArunaKumari, Cengage Publishers, 2023.

REFERENCE BOOKS

1. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. J.D.Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb 2008

4. Textbook of polymer Science,Fred W.BillmayerJr, 3rd Edition.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. https://onlinecourses.nptel.ac.in/noc24_ph02/preview
2. https://onlinecourses.nptel.ac.in/noc24_cy10/preview
3. https://www.youtube.com/watch?v=LMSTMBX_2F4
4. https://www.youtube.com/watch?v=7jOSbtR8mTs&list=PLzPro5owUhRSV-ezegDDfuNpuJ2uU6jZ0
5. https://onlinecourses.swayam2.ac.in/cec24_cy02/preview

23ES2103B
BASIC ELECTRICAL &
ELECTRONICS ENGINEERING

Course Category	Program Core	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	10 + 2 physics	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

1. Apply different techniques to solve DC circuits
2. Understand the magnetic circuit concepts
3. Analyze the steady-state response, series, parallel AC circuits, mesh & nodal analysis, and resonance
4. Apply network theorems for AC & DC circuits
5. Demonstrate the working principles of basic Electronic devices, circuits and instrumentation System
6. Implementation of simple Combinational and Sequential circuits using Logic gates

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	3			2											
2	3	3														
3	2	3			2											
4	2	3														
5	2	1	3	2												
6	2	1	3	2												

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).

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

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 Voltage, Current, temperature sensors, basic block diagram of multimeter.

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

UNIT III-SEMICONDUCTOR DEVICES
Introduction: Evolution of electronics, Vacuum tubes to nano electronics, Characteristics of PN 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.

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.

Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT IV-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 Flip flops, Registers and counters (Elementary Treatment only).

TEXT BOOKS (for UNITS I & II)

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 University Press, 2017.
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

REFERENCE BOOKS (for UNITS I & II

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 University Press, 2017.
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

E-RESOURCES AND OTHER DIGITAL MATERIALS (for UNITS I & II)

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/10810807

TEXT BOOKS (for UNITS III & IV)

1. R. L. Boylestad amp; Louis Nashlesky, Electronic Devices amp; Circuit Theory, Pearson Education, 2021.
2. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009. Resnick, Halliday and Krane, "Physics", 5th edition, Wiley India Pvt. Ltd, New Delhi, 2016.

REFERENCE BOOKS (for UNITS III & IV)

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

E-RESOURCES AND OTHER DIGITAL MATERIALS (for UNITS III & IV)

1. https://embeddedengineers.files.wordpress.com/2015/09/electronic-devices-and-circuits-by-salivahanan.pdf
2. http://www.nptelvideos.in/2012/12/basic-electronics-drchitralekha-mahanta.html
3. https://en.wikipedia.org/wiki/Digital_electronics

23PC2104A
DATA STRUCTURES

Course Category	Professional Core	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	23ES1104 Introduction to Programming	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Demonstrate the role of data structures in organizing and accessing data efficiently
2. Understand various techniques for searching, sorting and hashing algorithms used to solve complex problems
3. Demonstrate the operations on linear data structures like stack, queue and linked list
4. Analyze various operations on nonlinear data structures – binary tree, and binary search tree

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2			2												
2	3	2	1	2												
3	2	2	1	2												
4	2	2	1	2												

COURSE CONTENT

UNIT I
Basic Concepts: Overview: System life cycle. Algorithm Specification, Data Abstraction, Performance Analysis, the Abstract Data Type.
Searching: Introduction to searching, Linear Search and Binary Search.
Sorting: Bubble Sort, Insertion Sort, Selection Sort.

UNIT II
Linked Lists: Linked lists, programming details, doubly linked lists, circularly linked lists, Examples: polynomial addition.
Stacks: Stack Model, Implementation of Stacks (arays), Linked Stacks Applications: balancing the symbols, postfix expressions, infix to postfix conversionr.

UNIT III
Queues: Queue Model, Array implementation of Queues, Applications of Queues: DFS, linked Queues, Types of Queues: Circular Queues, Dequeues.
Trees: Introduction, Binary Trees, Binary Tree traversals, Binary Search Tree – Definition, Search, Insertion, & Deletion.

UNIT IV
Graphs: Graph Abstract Datatype, Elementary Graph Operations- DFS, BFS.
Hashing: General idea, Hash Functions, separate chaining, open addressing, rehashing, extendable hashing.

TEXT BOOKS

1. BMark Allen Weiss , "Data Structures and algorithm analysis in C", Pearson, 2nd Edition, 2016.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed , "Fundamentals of data structures in C", University Press, 2020

REFERENCE BOOKS

1. Reema Thareja , " Data Structures Using C ", Second Edition, 2014, Oxford University Press.
2. Brad Miller and David Ranum , "Problem Solving with Algorithms and Data Structures" , 2013.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms" , 3rd Edition, Mitpress.
4. YedidyahLangsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data Structures using C and C++", 2nd edition, Pearson Education, 1999.
5. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd edition, McGraw Hill, 2008.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. SudarshanIyengar: IIT Ropar, Data Structures and Algorithms, [NPTEL], (26, May, 2021) Available: http://nptel.ac.in/
2. Erik Demaine, Advanced Data Structures [MIT- OpenCourseWare], (26, May, 2021) Available: http://ocw.mit.edu/
3. Prof. Naveen Garg, IIT Delhi, Introduction to Data Structures and Algorithms, https://nptel.ac.in/courses/106102064

23ES2105
ENGINEERING GRAPHICS

Course Category	Institutional Core	Credits	3
Course Type	Theory & Practice	L-T-P	1-0-4
Prerequisites	NIL	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the principles of engineering drawing, including engineering curves and scales
2. Draw and interpret orthographic projections of points, lines and planes in front, top and side views
3. Understand and draw projection of solids in various positions in first quadrant and Explain principles behind development of surfaces
4. Explain principles behind the Sections of solids, Prepare isometric views and conversion of simple solids

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3		3				3									
2	3		3				3									
3	2		2				2									
4	1		1				1									

COURSE CONTENT

UNIT I
Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions of regular polygons by general methods.
Curves: Construction of ellipse, parabola and hyperbola by general method and Involutes. Draw normal and tangent to Curves.
Scales: Plain scales and diagonal scales.

UNIT II
Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in first quadrant only.
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: Projections of solids(Prisms and Pyramids only) in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Projection of Solids with axis inclined to one reference plane and parallel to another plane.
Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.
Computer graphics: Creating 2D & 3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination).

UNIT IV

Sections of Solids: Section planes perpendicular to VP and inclined to HP only, Sectional views (Front View and Top View only) and Sections of solids in simple position only.
Isometric Views: Draw an Isometric views of Simple solids.
Conversion of Views: Conversion of isometric views to orthographic views of Simple solids.

TEXT BOOKS

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

REFERENCE BOOKS

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

23BS1151
CHEMISTRY LAB

Course Category	Institutional Core	Credits	1
Laboratory	Lab	L-T-P	0-0-2
Prerequisites	Knowledge of chemistry practicals at Intermediate level	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Analyze acids from batteries and metal ions in solutions based on volumetric method
2. Apply standard procedures for preparation of nanomaterials, polymers and blueprinting
3. Analyze different solutions by applying various instrumental methods like conductometry, potentiometry, colorimetry, and chromatography

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	3														
2	3															
3	2	3			2											

COURSE CONTENT

List of Experiments
1. Determination of strength of acid in Lead-acid battery
2. Determination of ferrous iron by dichrometry
3. Determination of ferrous iron by permanganometry
4. Conductometric titration of a strong acid vs. strong base
5. Verification of Lambert-Beer's law
6. Potentiometric titration of a redox reaction
7. Chemistry of blueprinting
8. Conductometric titration of a weak acid vs. strong base
9. Determination of cell constant and conductance of solutions
10. Preparation of nanomaterials – Precipitation method
11. Preparation of urea-formaldehyde resin
12. Separation of ions by paper chromatography

REFERENCE BOOKS

1. "Vogel's quantitative chemical analysis", 6th Edition, by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar, Pearson Publications.

23PC2152A
DATA STRUCTURES LAB

Course Category	Professional core	Credits	1.5
Theory	Lab	L-T-P	0-0-3
Prerequisites	23ES1152-Computer Programming Lab	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Analyze the role of linear data structures in organizing and accessing data efficiently in algorithms
2. Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation
3. Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems
4. Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues and apply them appropriately to solve data management challenges

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2	1													
2	2	2	1													
3	2	1	1													
4	2	2	2													

COURSE CONTENT

Week 1: Programs on Searching operation
Objective: Able to perform array manipulations like reversing the elements in an array and applying searching techniques like linear search and binary search.
  i. Write a program to reverse an array.
  ii. Write C Programs to implement the Searching Techniques – Linear & Binary Search

Week 2: Sorting Techniques Implementation
Objective: Able to apply various sorting techniques like bubble sort, selection sort and insertion sort on an array of elements.
  i. Write a C Program to implement sorting using Bubble sort.

ii. Write a C Program to implement sorting using Selection sort

iii. Write a C Program to implement sorting using Insertion sort

Week 3: Linked List Implementation

Objective: Able to implement basic linked list operations like inserting a node, deleting a node, displaying data in the nodes of a linked list.

  i. Implement a singly linked list and perform insertion, deletion and traversal operations

Week 4: Linked List Applications

Objective: Able to implement Linked list applications like polynomial addition, removal of duplicates.

  i. Create a program to detect and remove duplicates from a linked list

  ii. Implement a linked list to represent polynomials and perform addition

Week 5: Double Linked List and Circular Linked list Implementation

Objective: Able to implement various operations on doubly linked list and circular linked list.

  i. Implement a doubly linked list and perform various operations to insert, delete, and traverse to understand its properties and applications

  ii. Implement a circular linked list and perform insertion, deletion, and traversal

Week 6: Stack Operations

Objective: Able to implement various stack operations using arrays and linked lists.

  i. Implement a stack using arrays and implement push, pop and traversal

  ii. Implement a stack using linked lists and implement push, pop and traversal

Week 7: Queue Operations

Objective: Able to implement various queue operations using arrays and linked lists.

  i. Implement a queue using arrays to perform the insertion, deletion and traversal

  ii. Implement a queue using linked lists to perform the insertion, deletion and traversal

Week 8: Stack and Queue Applications

Objective: Able to implement stack and queue applications.

  i. Use a stack to evaluate an infix expression and convert it to postfix

  ii. Create a program to determine whether a given string is a palindrome or not

  iii. Implement a stack or queue to perform comparison and check for symmetry

Week 9: Binary Search Tree Implementation

Objective: Able to construct a BST, and perform operations on it.

  i. Implementing a BST using Linked List to create, insert and delete nodes

  ii. Implement BST Traversal techniques in-order, pre-order, and post-order

Week 10: Programs on hashing

Objective: Able to implement hash tables and various collision resolution techniques.

  i. Implement a hash table with collision resolution techniques

  ii. Write a program to implement a simple cache using hashing

Week 11: Programs on Graph data structures

Objective: Able to perform operations on graph.

i. Describe the operations on graph ADT and implement algorithm for Depth first search

ii. Describe the operations on graph ADT and implement algorithm for Breath first search

TEXT BOOKS

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
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

E-RESOURCES

1. SudarshanIyengar: IIT Ropar, Data Structures and Algorithms, [NPTEL], (26, May, 2021) Available: http://nptel.ac.in/
2. Erik Demaine, Advanced Data Structures [MIT- OpenCourseWare], (26, May, 2021) Available: http://ocw.mit.edu/
3. Prof. Naveen Garg, IIT Delhi, Introduction to Data Structures and Algorithms, https://nptel.ac.in/courses/106102064
4. Data Structures and applications on, [Geeksforgeeks], (25, May, 2021) Available: https://www.geeksforgeeks.org/data-structures/

23BS2154B
HEALTH AND WELLNESS,
YOGA AND SPORTS

Course Category	Basic Science	Credits	0.5
Theory	Theory	L-T-P	0-0-1
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the importance of yoga and sports for Physical fitness and sound health
2. Demonstrate an understanding of health-related fitness components
3. Compare and contrast various activities that help enhance their health
4. Assess current personal fitness levels
5. Develop Positive Personality

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1																
2																
3																
4																

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 cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running

Guidelines

General Guidelines

Objective: Able to apply various sorting techniques like bubble sort, selection sort and insertion sort on an array of elements.

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.

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.

23MC2106
DESIGN THINKING
(MANDATORY NON-CREDIT COURSE)

Course Category	Mandatory Course	Credits	0
Theory	Practice	L-T-P	2-0-0
Prerequisites	10+2 or Intermediate	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the concepts of Design Thinking
2. Investigate a problem to determine its root cause
3. Able to develop design thinking skills and experiment with different solutions
4. Able to develop prototypes and can test

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1		3	3			2			3	3						
1		3	3			2			3	3						
3		3	3	3	3	2			3	3		3				
4	3	3	3	3	3			2	3	3	2	3				

COURSE CONTENT

Unit I
Introduction to Design Thinking: Introduction to Design Thinking: Design Thinking Overview, Defining Design Thinking, Features and principles of Design thinking, Applications of Design Thinking.

Unit II
Modules of Design Thinking: Inspiration, methods & tools used in Explore and Empathize phases of Design Thinking, Case study-activity.

Unit III
Modules of Design Thinking: Inspiration, methods & tools used in Explore and Empathize phases of Design Thinking, Case study-activity.

Unit IV
Prototype and Test Techniques: Types of Prototypes, Exercise: Revise Franken

Prototype to Refined Prototype, Forms of Testing in Design Thinking, Prepare and Test of the Prototype.

TEXT BOOKS

1. Design Thinking: A guide to creative problem solving for everyone, Andrew Pressman, Routledge Taylor and Francis group, 2019, 1st edition.
2. "Design Thinking for Entrepreneurs and Small Businesses" by Beverly Rudkin Ingle, Apress.
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil Service Commission, Bhutan.
4. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013).

REFERENCE BOOKS

1. Karmic Design Thinking - A Buddhism-Inspired Method to Help Create Human-Centered Products & Services, Dr Bala Ramadurai.
2. Design Thinking: A Beginners Perspective EB is written by Balagurusamy and published by Mc Graw-Hill Education India.
3. Design Thinking: A framework for applying Design Thinking in Problem Solving, Anujuna Agarwal Edition : 1st,2024.

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. https://www.arvindguptatoys.com/
2. https://honeybee.org/
3. https://dschool.stanford.edu/resources/getting-started-with-design-thinking
4. https://designthinking.ideo.com/

SEMESTER III

23HS3101
ENGINEERING ECONOMICS AND
& MANAGEMENT

Course Category	Humanities and Social Sciences	Credits	2
Course Type	Theory	L-T-P	2-0-0
Prerequisites	-	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

1. Understand various forms of organizations and principles of management
2. Understand the various aspects of business economics.
3. Perceive the knowledge on Human resources and Marketing functions
4. Evaluate various alternatives economically.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3											3		3	2	1.2.1, 1.7.1,2.8.1
2	3				3							3		3	2	1.2.1,1.7.1,2.8.1, 3.6.2 ,4.6.1,5.4.1
3	3											3		3	2	1.2.1,1.7.1, 2.5.2, 5.5.2
4	3				3							3		3	4	1.2.1,1.7.1, 2.5.2, 5.5.2

COURSE CONTENT

UNIT I

Forms of Business Organization: Salient Features of Sole Proprietorship, Partnership, Joint Stock Company, Co-operative Society and Public Sector.

Management: Introduction to Management, Functions of Management, Principles of Scientific Management, Modern Principles of Management.

UNIT II

Introduction to Economics: Introduction to Basic Economic Concepts, Utility Analysis: Marginal Utility and Total Utility, Law of Diminishing Marginal Utility, Law of Equi Marginal Utility.

Demand Analysis: Theory of Demand: Demand Function, Factors Influencing Demand, Demand Schedule and Demand Curve, Shift in Demand, Elasticity of Demand: Elastic and Inelastic Demand, Types of Elasticity.

Supply Analysis: Supply Schedule and Supply Curve, Factors Influencing Supply, Supply Function.

UNIT III
Human Resource Management: Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management.
Marketing Management: Concept of Selling And Marketing – Differences, Functions of Marketing, Product Life Cycle, Concept of Advertising, Sales Promotion, Types of Distribution Channels, Marketing Research, Break-Even Analysis.

UNIT IV
Financial Management: Functions of Financial Management, Time value of money with cash flow diagrams, Concept of Simple and Compound Interest.
Depreciation: Causes of depreciation, Factors influencing depreciation, common methods of Depreciation: Straight Line Method, Declining Balance Method, Sum of Year's Digits Method –Problems.
Economic Alternatives: Methods of Evaluating Alternatives under Present worth method, Future worth method, Annual Equivalent method - Problems.

TEXT BOOKS

1. M. Mahajan Industrial Engineering and Production Management Dhanpat Rai Publications 2nd Edition.
2. Martand Telsang" Industrial & Business Management" S.Chand publications

REFERENCE BOOKS

1. R.Paneer selvam "Production and Operations Management" PHI
2. Philip Kotler & Gary Armstrong "Principles of Marketing" ,pearson prentice Hall, New Delhi,2012 Edition.
3. IM Pandey, "Financial Management" Vikas Publications 11th Edition
4. B.B Mahapatro, "Human Resource Management",New Age International, 2011

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. https://www.toppr.com/guides/fundamentals-of-economics-and-management/ supply/supply-function/
2. https://keydifferences.com/difference-between-personnel-management- and-human-resource-management.html
3. http://productlifecyclestages.com/
4. https://speechfoodie.com/cash-flow-diagrams/

23HS3102
UNIVERSAL HUMAN VALUES 2:
UNDERSTANDING HARMONY

Course Category	Basic Sciences		Credits	3
Course Type	Theory		L-T-P	2-1-0
Prerequisites	-		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand and aware of themselves and their surroundings(family, society and nature).
2. Handle problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. Exhibit critical ability and become sensitive to their commitment towards their understanding of human values, human relationship and human society.
4. Apply what they have learnt to their own self in different day-to-day settings in real life.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1						1			2						2	
2			3												2	
3						2									3	
4								3				2			3	

COURSE CONTENT

UNIT I
Course introduction, need, basic guidelines, content and process for value education:
Part-1: Purpose and motivation for the course, recapitulation from UHV-I, Self-exploration: what is it?, its content and process, 'Natural acceptance' and experiential validation- as the process for self-exploration. Continuous Happiness and Prosperity – A look at basic Human Aspirations.

Part-2: Right understanding, Relationship and Physical Facility – the basic requirements for fulfillment of aspirations of every human being with their correct priority,

Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

(Practice sessions are to be included to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking).

UNIT II *Understanding Harmony in the Human Being – Harmony in Myself:*

Part-1: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' – happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).

Part-2: Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health.

(Practice sessions are to be included to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease).

UNIT III *Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:*

Part-1: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.

Part-2: Understanding the harmony in the society (society being an extension of family); Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society–Undivided Society, Universal Order–from family to world family.

(Practice sessions are to be included to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education, etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives).

UNIT IV *Understanding Harmony in Nature & Existence – Whole existence as Coexistence:*

Part-1: Understanding the harmony in the Nature, Inter-connectedness and mutual fulfillment among the four orders of Nature – recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in

all-pervasive space, Holistic perception of harmony at all levels of existence.

Part-2: Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for humanistic education, humanistic constitution and humanistic universal order, Competence in professional ethics: a) ability to utilize the professional competence for augmenting universal human order, b) ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) at the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) at the level of society: as mutually enriching institutions and organizations.
(Part-1:Practice sessions are to be included to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc.
Part-2: Practice exercises and case studies are to be taken up in practice (tutorial) sessions eg. to discuss the conduct as an engineer or scientist, etc.)

TEXT BOOKS

1. Human values and professional ethics, R. R. Gaur, R. Sangal and G. P. Bagaria, Excel Books Private Limited, New Delhi (2010).

REFERENCE BOOKS

1. JeevanVidya: EkParichaya, A. Nagaraj, JeevanVidya Prakashan, Amarkantak (1999).
2. Human Values, A. N. Tripathi, New Age International Publishers, New Delhi (2004).
3. TThe Story of Stuff: The impact of overconsumption on the planet, our communities, and our health and how we can make it better, Annie Leonard, Free Press, New York (2010).
4. The story of my experiments with truth: Mahatma Gandhi Autobiography, Mohandas Karamchand Gandhi, B. N. Publishing (2008).
5. Small is beautiful: A study of economics as if people mattered, E. F. Schumacher, Vintage Books, London (1993).
6. Slow is beautiful: New Visions of Community, Cecile Andrews, New Society Publishers, Canada (2006).
7. Economy of Permanence, J. C. Kumarappa, Sarva-Seva-Sangh Prakashan, Varanasi (2017).
8. Bharat Mein Angreji Raj, Pandit Sunderlal, Prabhath Prakashan, Delhi (2018).
9. Rediscovering India, Dharampal, Society for Integrated Development of Himilayas (2003).
10. Hind Swaraj or Indian Home Rule, M. K. Gandhi, Navajivan Publishing House,

Ahmedabad (1909).

11. India Wins Freedom: The Complete Version, Maulana Abul Kalam Azad, Orient Blackswan (1988).

12. The Life of Vivekananda and the Universal gospel, Romain Rolland, Advaitha Ashrama, India (2010).

13. Mahatma Gandhi: The Man who become one with the Universal Being, Romain Rolland, Srishti Publishers & Distributors, New Delhi (2002).

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. AICTE – SIP Youtube Channel: https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ

2. AICTE – UHV Teaching Learning Material: https://fdp-si.aicte-india.org/download.php#1

23BS3103B
DISCRETE MATHEMATICS

Course Category	Institutional Core	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	Set theory, Relations	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Analyze of propositional calculus and first order logic
2. Apply the basic and advanced counting techniques
3. Analyze of relations and digraphs and their applications.
4. Analyze of graphs and their applications

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	3		1								1		1	4	1.2.1,1.7.1, 2.5.1, 4.6.3, 12.4.2
2	3	3		1								1		1	3	1.2.1,2.5.1, 2.5.3, 12.4.2
3	3	3		1								1		1	4	1.2.1,2.8.1, 4.4.1, 12.4.2
4	3	3		1								1		1	4	1.2.1,2.5.3, 4.4.1 12.4.2

COURSE CONTENT

UNIT I Propositional Calculus:
Fundamentals of Logic: Propositions, Connectives, Propositional functions, Truth tables, Tautology, Contradiction, Logical equivalences, Normal forms, Logical inferences, Methods of proof of an implication.

First Order Predicate Logic: Predicate, Quantifiers, and Rules of inference for Quantified propositions.

UNIT II: Counting Techniques
Basics of Counting: Sum and product rules, Indirect counting, One to one correspondence, Combinations and permutations, Enumerating combinations and permutations with and without repetitions.

Advanced Counting Techniques: Generating function of sequences, Recurrence relations, Solving recurrence relations – substitution- Generating functions-The method of characteristic roots, Solution of inhomogeneous recurrences relations.

UNIT III: Relations and Digraphs

Relations and basic graphs, Special properties of binary relations, Equivalence relation, Partially ordered sets, Hasse diagrams, Lattices, Operations on relations, Paths and closures, Directed graphs and Adjacency matrices, Transitive closure, Warshall's algorithm.

UNIT IV: Graph Theory

Introduction(graphs, sub graphs, circuits, trees) Sum of degrees theorem, Isomorphism and sub graphs, planar graphs, Euler's formula, Multi graphs and Euler's circuits, Hamiltonian graphs, Grin-berg's theorem, Graph coloring, Chromatic numbers.

TEXT BOOKS

1. J. L. Mott, A. Kandel, and T. P. Baker: Discrete Mathematics for Computer Scientists Mathematicians, PHI, 2nd Edition.

REFERENCE BOOKS

1. J. P. Trembly and R. Manohar: Discrete Mathematical structures with applications to computer science, TMH.
2. K. H. Rosen: Discrete Mathematics and its Applications, Mc Graw Hill Companies, 7th Edition.
3. D. S. Malik and M. K. Sen: Discrete Mathematical Structures: Theory and applications

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. Prof. Arindama Singh Department of Maths IIT Madras, Last accessed on 15-02-2022, https://nptel.ac.in/courses/111/106/111106052/
2. Prof SoumenMaity, Department of Maths, IISER Pune, Last accessed on 15-02-2022, https://nptel.ac.in/courses/111/106/111106102/
3. Dr.L.SunilChandran, Department of Computer Science and Automation, IISC Bangalore, Last accessed on 15-02-2022,
https://nptel.ac.in/courses/106/108/106108051/

23ES3304
DATABASE MANAGEMENT SYSTEMS

Course Category	Engineering Science	Credits	3
Course Type	Theory	L-T-P	2-0-2
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the concepts of database systems.
2. Analyse the Entity-Relationship models, inturn develop the Relational models that leads to database design.
3. Apply various normalization techniques to relational models in order to improve database design quality.
4. Understand database transactions processing, protocols for Concurrency control, Recovery, indexing and storage techniques techniques for database.
5. Implement database management techniques using relational SQL database to real world applications

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	1	2											1	1	2	1.2.1, 1.7.1, 2.5.2, 2.5.3, 2.6.3
2		2	3										1	1	4	2.5.2, 2.5.3, 2.6.3, 2.7.2, 3.5.6,3.6.2
3		2	3										1	1	3	2.5.2, 2.5.3, 2.6.3, 2.7.2,3.5.6,3.6.2
4	1	2											1	1	2	1.7.1, 2.5.2, 2.6.3, 2.7.2
5		2	3		3								2	2	5	2.5.2, 2.5.3, 2.6.3, 2.6.4,2.8.4,5.4.2, 5.5.2

COURSE CONTENT

UNIT I
Introduction to Database Systems: Introduction, An example, Characteristics of Database Approach, Advantages of Using the DBMS Approach,A Brief History of

Database Applications.

Database System—Concepts and Architecture:Data Models, Schemas and Instances, Three-schemaArchitecture and Data Independence, Database Languages and Interfaces, The Database SystemEnvironment.

SQL Schema Definition, SQL Data Definition and Data Types , Specifying constraintsin SQL, Basic retrieval queries in SQL, Additional features of SQL, More complexSQL Queries, Insert, Delete and Update statements in SQL, Joined Tables in SQLand Outer Joins, Aggregate functions, The GROUP BY and HAVING Clauses, SpecifyingConstraints as Assertions and Triggers, Views (Virtual Tables) in SQL, SchemaChange Statement in SQL.

UNIT II

Data Modeling Using the Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; Entity Types,Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types.Refining the ER Design, ER Diagrams, Naming Conventions, Relational Database Design using ER to-Relational Mapping.

Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations.

Relational Algebra: Unary Relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra.

UNIT III

Relational Database Design: Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-CoddNormal Form; Properties of Relational Decomposition; Multi valued Dependencies,Fourth Normal Form and Fifth Normal Form.

Transaction Processing: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions. Serializability, Recoverability, Implementation of Isolation, Testing for Serializability.

UNIT IV

Concurrency Control and Recovery: lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification.

Recovery Concepts, NO-UNDO/REDO Recovery Techniques based on Deferred Update, Recovery Techniques Based on Immediate Update, The ARIES Recovery Algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing

TEXT BOOKS

1. Raghu Rama Krishnan,Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill Education, 2014 [UNIT II,III,IV]
2. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, "Database System Concepts", 7th edition, McGraw-Hill Education,2019 [UNIT I, V]

REFERENCE BOOKS

1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems",7th edition, Pearson Education Ltd, 2016.
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof P.Srinivasa Kumar IIT-Madras " Normalization process" https://nptel.ac.in/ courses/106/106/106106095/Lecture 7,Last accessed on 10/02/2022
2. D.Janakiram IIT-Madras "Concurrency Control techniques" https://nptel.ac.in/ courses/106/106/106106093/ Lecture 20,21,22,23 Last accessed on 10/02/2022
3. Andy Pavlo, Carnegie Mellon University, Relational model concepts, https://15445.courses.cs.cmu.edu/fall2017/slides/01-introduction.pdf Last accessed on 10/02/2022
4. Prof. Partha Pratim Das Prof. Samiran Chattopadhyay Prof. Kausik Datta, NOC:Data Base Management System, IIT Kharagpur https://nptel.ac.in/courses/ 106/105/106105175/Last accessed on 10/06/2024
5. https://infyspringboard.onwingspan.com/web/en/ login?ref=Flex_auth_01275806667282022456_shared

23AI&DS3304

ADVANCED DATA STRUCTURES
& ALGORITHMS ANALYSIS

Course Category	Program Core	Credits	3
Course Type	Theory	L-T-P	2-1-0
Prerequisites	23PC2104A Data Structures	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand algorithms, including recursive and randomized approaches, asymptotic notations, and the structures, operations, and applications of AVL and B-trees in computing.
2. Apply heap operations, graph algorithms for search, traversal, and component identification, and divide and conquer techniques for sorting, matrix multiplication, and convex hull problems.
3. Apply greedy method and dynamic programming techniques to solve different problems.
4. Apply backtracking and branch and bound techniques to solve different problems and compare P, NP, NP-Hard, and NP-Complete problems.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

| CO | PO | | | | | | | | | | | | PSO | | BTL | POI |
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2											2		2	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3
2	2	2											2		3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3, 2.8.4
3	2	2											2		3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3,2.6.3, 2.8.4
4	2	2											2		3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3, 2.8.4

COURSE CONTENT

UNIT I

Introduction: Algorithms, algorithms as a technology, recursive and randomized algorithms, growth of functions (Asymptotic notations)
AVL Trees Creation, Insertion, Deletion operations and Applications
B-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, Connected Components and Biconnected Components, applications
Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT III

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths.
Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths– General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem.

UNIT IV

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem.
Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem.
NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem.
NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP).
NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling.

TEXT BOOKS

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition Universities Press [Unit I, II]
2. Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2nd Edition University Press [Unit II, III, IV]

REFERENCE BOOKS

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson,

McGraw Hill
3. Algorithms + Data Structures & Programs:, N.Wirth, PHI

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. N.Garg, IIT Delhi, Dec 31, 2009, Data Structures and Algorithms, NPTEL, Available: http://nptel.ac.in/courses/106102064/25.
2. A. G. Ranade, S. Viswanathan, and A. A. Diwan, IIT Bombay, Dec 31, 2009, Design and Analysis of Algorithms, NPTEL, Available: https://nptel.ac.in courses/
106/101/106101060/(last accessed on 12-12-2022)
3. E. Demaine, S. Devadas, and N. Lynch, MIT, Design and Analysis of Algorithms, MIT OpenCourseWare, Available: (last accessed on 12-12-2022)
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/(last accessed on 12-12-2022)
4. Timroughgarden.org.Tim Roughgarden's Online Courses.
Available:http:timroughgarden.-org/videos.html.(last accessed on 12-12-2022)
5. https://www.tutorialspoint.com/advanced_data_structures/index.asp
6. http://peterindia.net/Algorithms.html
7. Abdul Bari, Introduction to Algorithms (youtube.com), Last Accessed on: 24-06-2024.

23AI&DS3305

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Category	Program Core	Credits	3
Course Type	Theory	L-T-P	2-1-0
Prerequisites	-	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:
1. Understand the basic concepts of object oriented programming.
2. Apply multiple inheritance through interfaces for a given application.
3. Apply exceptions, thread capabilities and handling files on a given application.
4. Apply functional programming and Collections framework for a given application.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	3													2	1.7.1,2.5.1, 2.5.2, 2.7.1
2	2	2	3										2	2	3	1.7.1,2.5.1,2.5.2, 2.6.3, 2.7.1, 3.5.1, 3.8.2
3	2	2	3										2	2	3	1.7.1,2.5.1, 2.5.2, 2.6.3, 2.6.4, 3.5.1, 3.8.2
4		2	3		2								2	2	3	1.7.1,2.5.1,2.5.2, 2.6.3,2.6.4, 3.5.1, 3.6.2, 3.8.2,4.6.2, 5.4.2

COURSE CONTENT

UNIT I

Object Oriented Programming: Basic concepts, Principles of OOP, Java introduction, history and evolution, Java features, Java's Magic: Byte Code, Program Structure in Java, A First simple Program.

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, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final.

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.

Introducing Classes and Objects: Class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, Garbage collection, overloading methods, using objects as parameters, returning objects, static and final keywords, nested and inner classes.

UNIT II

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

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, Interfaces and Inheritance.

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.

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.

UNIT III

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).

Multithread Programming: Introduction, Need for Multiple Threads Multi-

threaded 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.

UNIT IV

Pragmatic Functional Programming using Lambdas: Introduction to Functional programming, Functional Programming concepts and terminology, Functional Interfaces, Working with Lambda Expressions and Method References.

Collections Framework: Collections overview, Collection interfaces: Collection, List, and Set. Collection Classes: ArrayList, LinkedList, HashSet.Map Classes: HashMap,TreeMapJ.

The Stream API: Stream basics, Reduction operations, Using parallel streams, Mapping, Collecting, Iterators and Streams.

TEXT BOOKS

1. Herbert Schildt, "Java The Complete Reference", Eleventh Edition, Oracle Press, 2019.
2. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.

REFERENCE BOOKS

1. Herbert Schildt, Dale Skrien, "Java Fundamentals A Comprehension Introduction", Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2017.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.
4. Paul J. Dietel and Dr.Harvey M. Deitel, "Java How to Program", Eleventh Edition, Deitel & Associates, Inc.l , 2018.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof. Debasis Samanta. (14th,July, 2024), Department of Computer Science & Engineering, I.I.T.,Kharagpur, Swayam, NPTEL.
   https://onlinecourses.nptel.ac.in/noc21_cs03/preview.
2. Evan Jones, Adam Marcus, Eugene Wu "Introduction to Programming in Java", MIT OpenCourseWare, Massachusetts Institute of Technology, Sep 28, 2024
   https://ocw.mit.educourses
3. Prof. Owen Astrachan, "Object Oriented Programming in Java", Duke University, 21st Aug 2024. coursera.org
   https://www.coursera.org/specializations/object-oriented-programming
4. Dheeru Mundluru, "Java In-Depth: Become a Complete Java Engineer",Udemy, 14th Aug 2024.
   https://www.udemy.com/course/java-in-depth-become-a-complete- java-engineer/

5. Prof. Olufisayo Omojokun,"Introduction to Object-Oriented Programming with Java I: Foundations and Syntax Basics", Georgia Institute of Technology, edX, Jul 2024.
   https://www.edx.org/course/introduction-to-java-programming-i foundations-and-syntax- basics
6. https://nptel.ac.in/courses/106/105/106105191/
7. https://infyspringboard.onwingspan.com/web/en/app/toc/
   lex_auth_012880464547618816347_shared/overview

23TP3107
LOGIC & REASONING

Course Category	Soft Skills-1		Credits	1
Course Type	Learning by Doing		L-T-P	0-0-2
Prerequisites			Continuous Eval	100
			Semester End Eval	0
			Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Think reason logically in any critical situation.
2. Analyze given information to find correct solution.
3. To reduce the mistakes in day to day activities in practical life.
4. Develop time management skills by approaching different shortcut methods.
5. Use mathematical based reasoning to make decisions.
6. Apply logical thinking to solve problems and puzzles in qualifying exams for companies and in other competitive exams.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1						2									2	6.2.1
2		2													4	2.2.3
3								2							2	8.2.2
4									2						3	9.2.1
5	2														3	1.4.1
6	1														3	1.4.1

COURSE CONTENT

UNIT I:
1. Series Completion
2. Coding-Decoding
3. Blood Relation
4. Puzzles test

UNIT II:
1. Direction sense test
2. Logical Venn diagrams
3. Number test, ranking test
4. Mathematical operations

UNIT III:
1. Arithmetical Reasoning
2. Inserting missing character
3. Syllogism

UNIT IV: Non – Verbal:
1. Water images
2. Mirror images
3. Paper folding
4. Paper cutting
5. Embedded Figures
6. Dot situation
7. Cubes & Dice

TEXT BOOKS
1. R. S. Aggarwal, " Verbal and non-verbal reasoning", Revised Edition, S Chand publication, 2017 ISBN:81-219-0551-6,

23AI&DS3651
PYTHON PROGRAMMING LAB
(SKILL ENHANCEMENT COURSE)

Course Category	Program core		Credits	1
Course Type	Skill Enhancement		L-T-P	0-0-2
Prerequisites	23ES1152 Computer Programming Lab		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the python syntax and semantics of control flow statements
2. Apply functions, modules and string handling in Python to solve problems
3. Analyze the methods to create and manipulate programs with Python data structures
4. Analyse the concepts of object oriented approach to solve problems

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2	1		2						1		3		3	
2			1		2						1		1		3	
3		1	1		1						1		2		3	
4		3	2		2						2		3		4	

COURSE CONTENT

UNTI-I:
History: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupiter 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.
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.

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.
   (a) Arithmetic Operators
   (b) Relational Operators
   (c) Assignment Operators
   (d) Logical Operators
   (e) Bit wise Operators
   (f) Ternary Operator
   (g) Membership Operators
   (h) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.
7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.

UNTI-II:

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

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, Frozenset.

Sample Experiments

1. Write a program to perform the given operations on a list:
   (a) Addition
   (b) Insertion
   (c) slicing
2. Write a program to perform any 5 built-in functions by taking any list.

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

UNTI-III:
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.
7. 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.

UNTI-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 at least five keys and each key represent value as a list where this list contains at least 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

TEXT BOOKS

1. ReemaThareja,"Python ProgrammingUsing Problem Solving Approach", Oxford University Press, 2019.
2. Mastering Python for Data Science by Samir Madhavan Released August 2015 Publisher(s):Packt Publishing ISBN: 9781784390150

REFERENCE BOOKS

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

Online Learning Resources/Virtual Labs:

1. Charles Severance: University of Michigan,Python for Everybody [COURSERA]. (05-01-2021),
Available: https://www.coursera.org/
2. Prof. SudarshanIyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, The Joy Of Computing Using Python [NPTEL], (05-01-2021),
Available:https://nptel.ac.in/courses/106/106/106106182/
3. Prof KannanMoudgalya, Professor, IIT Bombay, Python 3.4.3, [SWAYAM], (05-01-2021),
Available: https://onlinecourses.swayam2.ac.in/aic20_sp33/preview
4. Corey Schafer,Python OOP Tutorials - Working with Classes, (05-01-2021),
Available: Python OOP Tutorials - Working with Classes - YouTube
5. https://www.coursera.org/learn/python-for-applied-data-science-ai
6. https://www.coursera.org/learn/python?specialization=python#syllabus

23AI&DS3352

ADVANCED DATA STRUCTURES & ALGORITHMS LAB

Course Category	Program Core	Credits	1
Course Type	Laboratory	L-T-P	0-0-2
Prerequisites	23PC2152A Data Structures Lab	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

1. Implement efficient binary trees, M-way search trees, graph traversal and shortest path algorithms.
2. Use divide and conquer, and greedy methods for implementing solutions for problems.
3. Implement solutions for problems using dynamic programming and backtracking.
4. Apply Branch and Bound techniques to write programs for different problems.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2									2	2	1	3	3	1.2.1, 1.7.1, 2.5.1, 2.5.2, 2.5.3, 2,6.3
2	2	3									2	2	1	3	3	1.2.1,1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3
3	2	3									2	2	1	3	3	1.2.1,1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3
4	2	3									2	2	1	3	3	1.2.1,1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.6.3

COURSE CONTENT

- **Task 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.
- **Task 2:** Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.

- **Task 3:** Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
- **Task 4:** Implement BFT and DFT for given graph, when graph is represented by
    1. Adjacency Matrix
    2. Adjacency Lists
- **Task 5:** Write a program for finding the bi-connected components in a given graph.
- **Task 6:** Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
- **Task 7:** Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
- **Task 8:** Implement Job sequencing with deadlines using Greedy strategy.
- **Task 9:** Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
- **Task 10:** Implement N-Queens Problem Using Backtracking.
- **Task 11:** Use Backtracking strategy to solve 0/1 Knapsack problem.
- **Task 12:** Implement Travelling Sales Person problem using Branch and Bound approach.

TEXT BOOKS

1. T.H.Cormen,C.E.Leiserson, R.L.Rivest and C.Stein, "Introduction to Algorithms", 2/e, PHI Pvt. Ltd., Pearson Education, 2009.
2. Ellis Horowitz, SatrajSahni and Rajasekharan, "Fundamentals of Computer Algorithms", Galgotia Publications Pvt. Ltd, 2008.

REFERENCE BOOKS

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

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. N.Garg, IIT Delhi, Dec 31, 2009, Data Structures and Algorithms, NPTEL, Available: http://nptel.ac.in/courses/106102064/25.
2. A. G. Ranade, S. Viswanathan, and A. A. Diwan, IIT Bombay, Dec 31, 2009, Design and Analysis of Algorithms, NPTEL, Available: https://nptel.ac.in courses/
106/101/106101060/(last accessed on 12-12-2022)
3. E. Demaine, S. Devadas, and N. Lynch, MIT, Design and Analysis of Algorithms, MIT OpenCourseWare,
Available: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/
6-046j-design-and-analysis-of-algorithms-spring-2015/
4. Timroughgarden.org.Tim Roughgarden's Online Courses.
Available:http:timroughgarden.-org/videos.html.(last accessed on 12-12-2022)
5. http://cse01-iiith.vlabs.ac.in/
6. http://peterindia.net/Algorithms.html

23AI&DS3353

OBJECT ORIENTED PROGRAMMING THORUGH JAVA LAB

Course Category	Program Core		Credits	1.5
Course Type	Laboratory		L-T-P	0-0-3
Prerequisites	23ES1152 Computer Programming Lab –		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Design solutions to applications using object oriented approach using Java.
2. Implement java technology to solve runtime errors and test the correctness of programs using exception handling and assertions.
3. Develop java applications to make use of I/O Streams and multithreading to solve real world problems.
4. Solve real world problems using Collections framework.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2				1						3		2	1	3	1.7.1, 2.5.1, 2.5.2, 2.7.1, 4.1, 5.4.2, 11.4.1
2		2	3		2						2		3	1	3	2.5.1, 2.5.2, 2.6.3, 2.7.1, 3.5.1, 3.8.2, 5.4.1, 5.4.2,11.4.1
3		2	2		3				3		2	2	2	2	5	2.5.1, 2.5.2, 3.5.1, 3.8.2, 5.4.1, 5.4.2, 9.6.1, 11.4.1
4		2	2		3				3		2	2	2	2	3	2.5.1, 2.5.2, 3.5.1, 3.8.2, 5.4.1, 5.4.2, 9.6.1, 11.4.1

COURSE CONTENT/TASK

Task 1: Apply fundamentals of Java Data types, Variables, Operators, and Control Statements.
Task 2: Apply the concepts of Classes and Objects.
Task 3: Apply the concepts of Arrays.

Task 4: Apply the concepts of String and String Tokenizer classes.

Task 5: Apply the concepts of Inheritance and types of Inheritance.

Task 6: Apply the concepts of Method Overloading and Method Overriding.

Task 7: Apply the concepts of Packages.

Task 8: Apply the concepts of Interfaces.

Task 9: Apply the concepts of Exception Handling.

Task 10: Develop a Java application to copy content from one file to another file using I/O Streams.

Task 11: Apply the concepts of Threads and Multithread.

Task 12: Design Employee Database for company or Organization (Employee Personal Details, Department, Salary (basic, DA, HRA.,) Details) and develop JDBC based java application for following tasks.

1. Insert Records into respective table
2. Select records of particular table of database
3. Delete Records from table.

Connect java FX GUI application to database and perform SQL commands via JDBC API.

Lab Projects:

1. A group project with unique topics.

TEXT BOOKS

1. Herbert Schildt, "Java The Complete Reference", Eleventh Edition, Oracle Press, . 2019.

REFERENCE BOOKS

1. Herbert Schildt, Dale Skrien, "Java Fundamentals A Comprehension Introduction", Special Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2017.
2. E Balaguruswamy, "Programming with Java", 4th Edition, Mc Graw Hill , 2020.
3. Paul J. Dietel and Dr.Harvey M. Deitel, "Java How to Program", Eleventh Edition, Deitel & Associates, Inc.l , 2018.
4. Timothy Budd, "Understanding Object Oriented Programming with Java ", Updated edition,Pearson Education, 2013.
5. Kathy Sierra & Bert Bates, "Head First Java", 2nd Edition, Oreilly.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof. Debasis Samanta. (14th,July, 2024), Department of Computer Science & Engineering, I.I.T.,Kharagpur, Swayam, NPTEL. https://onlinecourses.nptel.ac.in /noc21_cs03/preview.
2. Evan Jones, Adam Marcus,Eugene Wu "Introduction to Programming in Java", MIT OpenCourseWare, Massachusetts Institute of Technology, Sep 28, 2024. https://ocw.mit.edu courses

3. Prof. Owen Astrachan, "Object Oriented Programming in Java", Duke University, 21st Aug 2024. coursera.org https://www.coursera.org/specializations/object-oriented-programming

4. Dheeru Mundluru, "Java In-Depth: Become a Complete Java Engineer", Udemy, 14th Aug 2024. https://www.udemy.com/course/java-in-depth-become-a-complete-java-engineer/

5. Prof. Olufisayo Omojokun,"Introduction to Object-Oriented Programming with Java I: Foundations and Syntax Basics", Georgia Institute of Technology, edX, Jul 2024. https://www.edx.org/course/introduction-to-java-programming-i foundations-and-syntax- basics

SEMESTER IV

23BS4101A
STATISTICAL METHODS FOR
DATA SCIENCE

Course Category	Basic Science	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	-	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:
1. Analyze probability distributions with random variables
2. Apply knowledge of Continuous Random Variables and Probability Densities
3. Apply random phenomena of sample to test the Hypothesis concerning means
4. Analyze random phenomena of sample to test the hypothesis concerning variances and regression

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	3			2								1		4	1.2.1, 1.2.2, 2.6.3, 4.6.1
2	3	3			2								1		3	1.2.1, 1.2.2, 2.6.3, 4.6.1
3	3	3			2								1		3	1.2.2, 2.6.3, 4.6.1, 4.6.3
4	3	3			2								1		4	1.2.2, 2.6.3, 4.6.1, 4.6.3

COURSE CONTENT

UNIT I
Probability Theory: Sample Spaces and events -Counting – Probability-The Axioms of Probability- Conditional Probability -Bayes' Theorem.

Probability Distributions: Random Variables (discrete and continuous) -Expectation-Variance and Standard deviation of discrete random variable- Binomial distribution-Poisson distribution.

UNIT II
Probability Densities: Continuous random variables – The Normal Distribution

– The Normal approximation to the Binomial Distribution.

Other Probability Densities: The Uniform Distribution – The Log Normal Distribution – The Gamma Distribution-The Beta Distribution – The Weibull distribution.

UNIT III
Sampling Distributions: Introduction- Populations and Samples.

Inferences Concerning Mean: Point Estimation- Interval Estimation.

Test of Hypothesis: Null Hypothesis and Tests of Hypothesis – Hypothesis concerning one mean – Relation between tests and Confidence intervals –Operating characteristic curves - Inferences concerning two means.

UNIT IV
Inferences Concerning Variances: Estimation of variances- Hypothesis concerning one variance- Hypothesis concerning two variances.

Regression Analysis: The method of least squares - Multiple Regression- Correlation-Karl Pearson's coefficient of correlation.

TEXT BOOKS

1. Johnson, R. A. (2011). Probability and statistics for engineers (8th ed.). Prentice Hall India Learning Private Limited.

REFERENCE BOOKS

1. Walpole, R. E., Myers, R. H., Myers, S. L., Ye, K. (1993). Probability and statistics for engineers and scientists (Vol. 5). New York: Macmillan
2. Biswal, P. C.(2007). Probability and statistics. Prentice Hall India Learning Private Limited.
3. Iyengar, T. K. V., Gandhi, B. K., Ranganadham, S., Prasad, M. V. S. S. N.(2008). Probability and statistics. S. Chand Publishing.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. Prof. Somesh Kumar, Department of Maths, IIT Kharagpur, https://nptel.ac.in/courses/111105090
2. Prof.Niladri Chatterjee, Department of Maths, IIT Delhi, https://nptel.ac.in/courses/111102112
3. Prof. Soumen Maity, Department of Maths, IISER Pune, https://nptel.ac.in/courses/111105042

23AI&DS4302
ARTIFICIAL INTELLIGENCE

Course Category	Programme Core		Credits	3
Course Type	Theory		L-T-P	3-0-0
Prerequisites	23AI&DS3305 Advanced Data Structures and Algorithms Analysis		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the AI agents for problem solving
2. Understand AI solutions using Heuristic and Pruning approaches
3. Apply various knowledge representation techniques
4. Apply the logic concepts and learnings to Expert Systems

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2											1	1	2	1.2.1,1.6.1,1.7.1, 2.5.2, 2.6.4,3.5.1
2	1	2	2										1	1	2	1.6.1,1.7.1, 2.5.2, 2.6.4,2.8.1,3.5.1
3	1	2	2										1	1	3	1.6.1,1.7.1, 2.5.2, 2.6.4,3.5.1
4	1	2	2										1	1	3	1.6.1,1.7.1, 2.5.2, 2.6.4,2.7.1,3.5.1

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: Well defined problems and Solutions, problem formulation, Example problems- 8-puzzle problem, Water jug problem.

UNIT II
Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first Search.

Heuristic Search: Informed search strategies, Hill climbing, Best First search, A* Algorithm, Problem Reduction -AO* Algorithms.

Adversarial Search: Games, mini-max algorithm, optimal decisions in multiplayer games,Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT III
Representation of Knowledge: Weak Slot and filler structures, Semantic nets-frames and frame systems.

Representing knowledge using rules: Procedural versus declarative knowledge, Logic programming, Forward vs Backward reasoning.

Knowledge Representation Issues: Representation and mapping, Approaches in knowledge representation, Issues in knowledge representation. Reasoning under uncertainty.

UNIT IV
Logic concepts: Predicate Logic, Propositional vs. Predicate Logic, unification , Resolution.

Learning: Learning from observation, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

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

TEXT BOOKS

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", SecondEdition, Pearson Education.
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw 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 problemsolving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
4. Artificial Intelligence, SarojKaushik, CENGAGE Learning.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. Fundamentals of Artificial Intelligence, https://swayam.gov. in/nd1_noc19_me71/preview, Last Accessed on 12-11-2024
2. https://swayam.gov.in/nd1_noc19_me71/preview,Last Accessed on 12-11-2024

23AI&DS4303
INTRODUCTION TO DATA SCIENCE

Course Category	Programme Core	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	23PC2104A Data Structures	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the significance of Data Science
2. Analyze large data and apply NoSql for handling Bigdata
3. Apply Data Analytics tools for various data science applications
4. Apply Visualization and Development tools for data

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3												2		2	1.2.1,1.6.1,1.7.1, 2.5.2, 2.6.4,3.5.1
2	3	3	1										2		4	1.7.1, 2.6.3, 2.6.4, 2.8.3, 4.6.1
3	3	2	1										2		3	1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1
4	3	3	1										2		3	1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1

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, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them.

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.

UNIT II
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.

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 III
Tools and Applications of Data Science: PIntroducing Neo4jfor 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 IV
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, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. Python Data Science Handbook https://jakevdp.github.io/PythonDataScienceHandbook, Last accessed on 12-11-2024
2. Free interactive course on machine learning fundamentals.https://developers.google.com/ machine-learning/crash-course Lat accessed on 12-11-2024
3. Tutorials - Getting Started - Neo4j Graph Data Platform
4. Best Online Hadoop Courses and Programs - edX

23AI&DS4304
DIGITAL LOGIC AND COMPUTER DESIGN

Course Category	Programme Core	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:
1. Understand digital logic principles and basic structure of a computer
2. Apply concepts of combinational and sequential logic to design digital circuits
3. Apply algorithms to perform arithmetic operations on fixed point and floating point data
4. Understand Processor, Memory and I/O organization of basic computer

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2												1		2	1.2.1, 1.7.1
2	1	2	2										1		3	1.7.1,2.7.1, 2.7.2, 3.7.1 ,3.8.1
3	1	2	2										1		3	1.6.1,1.7.1, 2.7.1, 2.8.1
4	1	2											1		2	1.7.1, 2.7.1,2.8.1

COURSE CONTENT

UNIT I

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

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers.

UNIT II

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters.

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture.

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

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

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

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

TEXT BOOKS

1. Morris Mano, Digital Logic and Computer Design, Pearson Education, 16th Impression, 2016.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, Mc-Graw Hill, 5th Edition, 2014.
3. William Stallings, Computer Organization and Architecture, Pearson Education, 11th Edition, 2012.

REFERENCE BOOKS

1. M.Moris Mano, Computer Systems Architecture, Pearson Education, 3rd Edition, 2009.
2. Design, David A. Paterson, John L. Hennessy, Elsevier, Computer Organization and 2nd Edition, 2010.
3. Roth, Fundamentals of Logic Design, Thomson, 5th Edition, 2014.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. IIT Guwahati Prof. Jatindra Kumar Dekahttps, Computer Organization and Ar- chitecture, https://nptel.ac.in/courses/106103068, Last Accessed On: 31-05-2024

23TP4106
ENGLISH FOR PROFESSIONALS

Course Category	Soft Skills - 2	Credits	1
Course Type	Learning by Doing	L-T-P	0-0-2
Prerequisites	–	Continuous Eval	100
		Semester End Eval	0
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Present themselves effectively in the professional world
2. Introduce themselves as well as others appropriately
3. Use vocabulary to form sentences and narrate stories by using creative thinking skills
4. Involve in practical activity oriented sessions
5. Learn about various expressions to be used in different situations

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1										3	3				2	1.2.1, 1.7.1,2.8.1
2										3	3				2	1.2.1,1.7.1,2.8.1, 3.6.2, 4.6.1,5.4.1
3										3	3				3	1.2.1,1.7.1, 2.5.2, 5.5.2
4								2		3	3				3	1.2.1,1.7.1, 2.5.2, 5.5.2
5								2							2	

COURSE CONTENT

UNIT I

1. ***Beginners, Functional, Situational Conversations:*** Introduction, Importance of spoken English in the placements and Group Discussion Beginners Conversation, Self Introduction Introducing Self, Introducing each other in a team (Pair Activity) Functional Conversation, Seeking Permission from Seniors Teachers and other superiors (Team Activity), Asking Direction-Direction from stranger or from Helpline, Making Requests, Requests for borrowing books, applications, or any other help from office staff in college or outside.

2. ***Just a minute***: Give a topic and ask the student to talk impromptu, To present the topic in a structured manner

UNIT II

3. ***Structuring and forming sentences:*** Structure of mother tongue and pit falls in translation to English, Formation of sentences in English.

4. ***Errors in Usage***: Difficulty in right usage of words, Difficulty in Pronunciation-Phonetic differences in mother tongue and English –areas to improve, Idioms and Phrase –Frequently used Idiom and Phrases which help to enhance the quality of presentation and make the presentation meaningful, Meaning of frequently used Idioms and Phrases

UNIT III

5. ***Introduction to different ways of speaking:*** Elocution, Debate and Extempore, Principles of Elocution and its challenges practice in session, Principles of Debates and its challenges – practice session, Principles of Extempore - its pitfalls- practice sessions.

UNIT IV

6. ***Etiquette:*** Need of Etiquette in Social arena, Dining Etiquette, Social Etiquette in conversation -formal and informal gathering, Book a table etc.

7. ***Versant Test:*** Mode of versant Test, Aim of the test and various methods it follows, Practice session.

METHODOLOGY

- Audio—Visuals / Hand Outs (Compiled/Created by Training Division, T&P Cell, VR Siddhartha Engineering College), Board & Chalk and Interactive Sessions.

Text Books and Reference Books

1. KamaleshSadanand, "A Spoken English", VOL 1&2; Orient BlackSwan, Second Edition,2014.
2. "Communicative English"; Pearson; 2010.

23MC4107
ENVIRONMENTAL STUDIES

Course Category	Mandatory Course	Credits	–
Course Type	Theory	L-T-P	2-0-0
Prerequisites	Consciousness of Environment	Continuous Eval	100
		Semester End Eval	0
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Identify various factors causing degradation of natural resource and control measures
2. Identify various ecosystem and need for biodiversity
3. Realize and explore the problems related to environmental pollution and its management
4. Apply the information and technology to analyze social issues, use acts associated with environment

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	1							1					1		2	1.3.1
2		1	1							1			1		2	2.8.1,3.6.2
3				1	1							1	1		2	3.5.2,5.5.2
4						1	1	1					1		3	

COURSE CONTENT

UNIT I
The 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.

(a) **Forest resources:** Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forests and tribal people

(b) **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources.

(d) **Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

(e) **Energy resources:** Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

(f) **Land resources:** Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

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, definition: genetic, species and ecosystem diversity. Biogeographically 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-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ 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.

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.

Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. 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: Human Population and the Environment,Population growth, variation among nations, Population explosion—Family Welfare Programme.

Environment and human health: Human rights, Value education,HIV/AIDS,Women and Child Welfare,Role of Information Technology in environment and human health.

Field Work/ Case Studies: 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, birds. Study of simple ecosystems—pond, river, hill slopes, etc.

Self Study: Water resources, Threats to biodiversity, Solid waste management, Role of Information Technology in environment and human health.

TEXT BOOKS

1. Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses, Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, 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, 2/e, 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, 1/e, Prentice Hall of India Private limited, 1991.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://www.edx.org/learn/environmental-science/rice-university-ap-renvironmental-science-part-3-pollution-andresources?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%20Files/pdf/lec07.pdf
4. https://www.youtube.com/watch?v=5QxxaVfgQ3k

23AI&DS4651
FULL STACK DEVELOPMENT – I

Course Category	Skill Oriented Course-1	Credits	1
Course Type	Laboratory	L-T-P	0-0-2

Prerequisites	23PC2104A Data Structures	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:

1.
2.
3.
4.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1																1.2.1, 1.7.1, 2.5.1, 4.6.3
2																1.2.1, 2.5.1, 2.5.3, 4.4.1
3																1.2.1, 2.5.3, 4.4.1
4																1.2.1, 2.5.3, 4.4.1

COURSE CONTENT

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>, <div>, <span>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
     i. Simple selector (element, id, class, group, universal)
     ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
     iii. Pseudo-class selector
     iv. Pseudo-element selector
     v. 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 aprogram 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 'ARM-STRONG 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
       i. Factorial of that number
       ii. Fibonacci series up to that number
       iii. Prime numbers up to that number
       iv. 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
       i. Factorial of that number
       ii. Fibonacci series up to that number
       iii. Prime numbers up to that number
       iv. Is it palindrome or not

   (c) Write a program to validate the following fields in a registration page
       i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
       ii. Mobile (only numbers and length 10 digits)
       iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

TEXT BOOKS

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

E-RESOURCES AND OTHER DIGITAL MATERIALS:

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. dhanavanthini@vrsiddhartha.ac.inhttps://www.w3schools.com/typescript

23ES4152
DESIGN THINKING AND INNOVATION

Course Category	Engineering Science	Credits	2
Course Type	Theory	L-T-P	1-0-2
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Understand the fundamentals of Design Thinking and innovation
2. Apply the design thinking techniques for solving problems in various sectors
3. Analyse to work in a multidisciplinary environment
4. Analyse the value of creativity

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2											2	2	2	1.7.1,2.6.2,2.7.1
2	2	2											1	2	3	1.6.1, 1.7.1, 2.6.2, 2.7.1
3	2	2											1	2	4	1.6.1, 1.7.1, 2.5.1, 2.7.1
4	2	2											1	2	4	1.6.1, 1.7.1, 2.6.2, 2.7.1

COURSE CONTENT

UNIT I
Introduction to Design and Design Thinking, Definition of Design Thinking, Need of Design Thinking, Features of Design Thinking, Problem Solving and Design, Design thinking as Strategy of Innovation, Use of Design Thinking, Design Thinking-Attributes, The Principles of Design Thinking, The Five-step Process of Design Thinking(Empathize, Define, Ideate, Prototype, Test),Design Thinking-A Solution basedthinking: Design Thinking vs. Scientific Method, Problem Focused vs. Solution Focused, Analysis vs.Synthesis, Divergent Thinking vs. Convergent Thinking , Roots of Design Thinking in Human Centric Design Process.

UNIT II
Define: Define Point of view, "How might we ..." question, Storytelling, Context MappingIdeate Brainstorming, 2x2 Matrix.

Ideate: Purpose, Methods Tools, SCAMPER, SCAMPER for Ideation, SCAMPER template, AnalogousInspiration, IDEATION using Deconstruct & Reconstruct, User Experience Journey.

UNIT III
Get Visual, Design Principals, Determine What to Prototype, Storyboard Prototype-How to carry out Prototyping? Frequently used kinds of prototypes, Focused experiments– Critical Experience Prototype (CEP) Critical Function Prototype (CFP), Crazy experiments –Darkhorse Prototype, Combined experiments – Funky prototype. Prototyping -Paper Prototyping, Digital Prototyping- Wireframe vs Realistic Prototypes, HTML vs WYSIWYG Editors, Additional Tools for Prototyping, Working with a Developer, Prototype Examples.

UNIT IV
Test- Testing Sheet, Structured Usability Testing, A/B Testing, Design Testing with Users, Exploring Visual Design Mock-Ups Choosing a Design Testing, Usability Testing, Reflect- I like, I wish, I wonder, Create a pitch, Road map for implementation Evolve- Concept Synthesis, Viability Analysis(Impact Evaluation), Innovation Tool using user needs, CAP, 4s Design Thinking in Healthcare with IDEO, Design Thinking Transformed Airbnb, IBM Design Thinking: A Framework To Help Teams Continuously Understand and Deliver, UberEATS

TEXT BOOKS

1. Michael Lewrick, Patrick Link, Larry Leifer , "The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods", March 2020 edition, ISBN: 978-1-119- 62921-4, WILEY Publication.

REFERENCE BOOKS

1. Russ Unger, Carolyn Chandler, "A Project Guide to UX Design For user experience designers in the field or in the making (Voices That Matter)", 2nd Edition, ISBN 13: 978-0-321-81538-5
2. Karl T Ulrich, "Design – Creation of Artifacts in Society", 1st edition, ISBN 978-0-9836487-0-3, University of Pennsylvania
3. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", ISBN- 9780061937743, Harper Collins, 2009
4. Jeanne Liedtka, Andrew King, Kevin Bennett, "Solving Problems with Design Thinking: TenStories Of "What Works", Columbia Business School Publishing, E-ISBN 978-0-231-53605-9

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. Design Thinking - A Primer online course video lectures by IIT Madras (freevideolectures.com)
2. Design Thinking Transformed Airbnb: https://review.firstround.com/How-design-thinkingtransformed-Airbnb-from-failing-startup-to-billion-dollar-business
3. IBM Design Thinking: A Framework To Help Teams Continuously Understand and Deliver: https://www.ibm.com/blogs/think/2016/01/ibm-design-thinking-a-framework-for-teams tocontinuously-understand-and-deliver/

23AI&DS4353
ARTIFICIAL INTELLIGENCE LABORATORY

Course Category	Program Core		Credits	1.5
Course Type	Laboratory		L-T-P	0-0-3
Prerequisites	23AI&DS3352 Advanced Data Structures and Algorithms Analysis Lab		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:
1. Apply Pandas library to manipulate data structures and visualize data using built-in visualization tools
2. Analyze and implement various search algorithms to solve optimization and path finding problems
3. Evaluate AI problem-solving methods by implementing decision-making algorithms
4. Develop a knowledge base system for reasoning tasks using AI concepts

Contribution of Course Outcomes towards achievement of Program Outcomes (1 − Low, 2 - Medium, 3 − High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2			2								1	1	3	1.6.1,1.7.1, 2.5.1
2	2	2	2		2								1	1	4	1.6.1, 1.7.1, 2.5.1, 2.5.3
3	2	2	2		2								1	1	5	1.6.1, 1.7.1, 2.7.1, 5.6.1,5.6.2
4	2	2	2		2								1		5	1.6.1, 1.7.1, 3.5.1, 5.6.1,5.6.2

List of Experiments

1. **Pandas Library**

   (a) Write a python program to implement Pandas Series with labels

   (b) Create a Pandas Series from a dictionary

   (c) Creating a Pandas Data Frame

   (d) Write a program which makes use of the following Pandas methods

    (i) describe ()

   (ii) head ()

  (iii) tail ()

  (iv) info ()

2. **Pandas Library:** Visualization

   (a) Write a program which use pandas inbuilt visualization to plot following graphs:

     (i) Bar plots

    (ii) Histograms

   (iii) Line plots

   (iv) Scatter plots

3. Write a Program to Implement Breadth First Search using Python.

4. Write a program to implement Best First Searching Algorithm

5. Write a Program to Implement Depth First Search using Python.

6. Write a program to implement the Heuristic Search

7. Write a python program to implement A* and AO* algorithm. (Ex: find the shortest path)

8. Write a Program to Implement Water-Jug problem using Python.

9. Write a Program to Implement Alpha-Beta Pruning using Python.

10. Write a Program to implement 8-Queens Problem using Python.

11. Write a program to schedule a meeting among a 5 busy people using Default Reasoning the output should give the time, place and day of the meeting.

12. Write a program to implement the Unification algorithm

13. Develop a knowledge base system consisting of facts and rules about some specialized knowledge domain

14. Write a program to implement 8 puzzle programs using different heuristics. Using it play the game Tic-Tac-Toe at the end the game the program should display the no. of nodes generated, cutoff values at each stage in the form of a table.

TEXT BOOKS

1. Prateek Joshi, Artificial Intelligence with Python, Packt Publishing, 2017.
2. Xiao, Perry. Artificial intelligence programming with Python: from zero to hero. John Wiley & Sons, 202.

REFERENCE BOOKS

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Fourth Edition, Pearson, 2020.
2. Martin C. Brown (Author), "Python: The Complete Reference" McGraw Hill Education, Fourth edition, 2018.
3. R. NageswaraRao , "Core Python Programming" Dreamtech Press India Pvt Ltd 2018.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. https://www.coursera.org/learn/ai-for-everyone- Last Accessed 12-11-2024
2. https://course.fast.ai/- Last Accessed 12-11-2024
3. https://www.kaggle.com/learn/intro-to-machine-learning- Last Accessed 12-11-2024
4. https://www.upgrad.com/machine-learning-ai-pgd-iiitb-lpv1/-Last Accessed 12-11-2024

23AI&DS4354
DATA SCIENCE USING PYTHON LABORATORY

Course Category	Program Core	Credits	1.5
Course Type	Laboratory	L-T-P	0-0-3
Prerequisites	23PC2104A Data structures 23AI&DS3651 Python	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

1. Apply Numpy library to perform basic data operations
2. Apply Pandas for Data preparation and Exploration
3. Demonstrate data preprocessing and visualization using Python tools
4. Demonstrate Python tools like Sci Kit-Learn, NLTK/Spicy/Py NLPI for NLP

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	1	2	3										1	2	4	1.6.1,1.7.1,2.5.1, .5.2, 2.6.3, 2.7.1,3.5.1,3.8.2
2	1	2	3		2								1	2	4	1.6.1,1.7.1,2.5.1, 2.5.2,2.6.4,3.5.1,3.8.2, 5.4.1, 5.4.2
3	1	2	3		2								1	2	6	1.6.1,1.7.1,2.5.1, 2.5.2,2.6.3,3.5.1,3.6.2, 3.8.2, 5.4.1, 5.4.2
4	1	2	3		2								1	2	6	1.6.1,1.7.1,2.5.1, 2.5.2,2.6.3,3.5.1,3.6.2, 3.8.2, 5.4.1, 5.4.2

COURSE TASKS

Task 1

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

Task 2

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

Task 3

3. Expanding and Squeezing a NumPy Array

   (a) Expanding a NumPy array

   (b) Squeezing a NumPy array

   (c) Sorting in NumPy Arrays

Task 4

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

Task 5

5. Stacking and Concatenating Numpy Arrays

   (a) Stacking ndarrays

   (b) Concatenating ndarrayss

(c) Broadcasting in Numpy Arrays

Task 6

6. Perform following operations using pandas

    (a) Creating dataframe

    (b) concat()

    (c) Setting conditions

    (d) Adding a new column

Task 7

7. Perform following operations using pandas

    (a) Filling NaN with string

    (b) Sorting based on column values

    (c) groupby()

Task 8

8. Read the following file formats using pandas

    (a) Text files

    (b) CSV files

    (c) Excel files

    (d) JSON files

Task 9

9. Read the following file formats

    (a) Pickle files

    (b) Image files using PIL

    (c) Multiple files using Glob

    (d) Importing data from database

Task 10

10. Demonstrate web scraping using python

Task 11

11. Perform following preprocessing techniques on loan prediction dataset

   (a) Feature Scaling

   (b) Feature Standardization

   (c) Label Encoding

   (d) One Hot Encoding

Task 12

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

Task 13

13. Getting started with NLTK, install NLTK using PIP

Task 14

14. Python program to implement with Python Sci Kit-Learn & NLTK

Task 15

15. Python program to implement with Python NLTK/Spicy/Py NLPI

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. Python Data Science Handbook https://jakevdp.github.io PythonDataScience-Handbook, Last accessed on 12-11-2024.
2. Free interactive course on machine learning fundamentals.https://developers.google.com/ machine-learning/crash-course Last accessed on 12-11-2024.
3. Tutorials - Getting Started - Neo4j Graph Data Platform

4. Best Online Hadoop Courses and Programs - edX

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts/
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python/
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn/
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6.
6. https://www.nltk.org/book/ch01.html

SEMESTER V

23AI&DS5301
DATA WAREHOUSING AND DATA MINING

Course Category	PC		Credits	3
Course Type	Theory		L-T-P	3-0-0
Prerequisites	23AI&DS3304 Database Management Systems		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES

1. Understand fundamental concepts of and techniques of data warehousing and data mining.
2. Apply various pre-processing techniques in Data mining.
3. Analyze classification and apriori algorithms to solve real life problems.
4. Analyze different types of clustering algorithms to solve real life problems.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3												3	2	2	1.2.1, 1.7.1
2	1	3											1	1	3	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1
3	1	3											1	1	4	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1
4	1	2											2	2	4	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1

COURSE CONTENT

UNIT I
Introduction to Data Warehousing: 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 in Data Mining.
Getting to Know your data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.

UNIT II
Data Preprocessing: An Overview; Data Cleaning- Missing Values, Noisy data.Data

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Integration: Entity Identification problem, Redundancy and Correlation Analysis. **Data Reduction:** Overview of Data Reduction Strategies, Wavelet Transformation, Principal Components Analysis;Attribute Subset selection.

Data Transformation and Data Discretization: Data Transformation Strategies Overview, Data Transformation by Normalization, Discretization by Binning.

UNIT III

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.

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.

UNIT IV

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).

TEXTBOOKS

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

REFERENCE BOOKS

1. VikramPudi and P. Radha Krishna, Data Mining, 1st Edition, Oxford Publisher, 2009.
2. Arun K Pujari, Data Mining Techniques, 3rd edition, Universities Press, 2013.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof. PabitraMitra, Data Mining, https://onlinecourses.nptel.ac.in/noc2 2_cs11/preview, Last accessed on: 25/04/2025.
2. Dr. Saed Sayad, An Introduction to Data Science, http://www.saedsayad.com/ data_mining_map.html, Last accessed on: 25/04/2025.

23AI&DS5302
PRINCIPLES OF MACHINE LEARNING

Course Category	PC	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	223BS4101A Statistical methods for Data science	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

1. Understand the fundamentals of Machine Learning and build Nearest neighbour based models.
2. Apply models based on Decision trees and Bayes rule.
3. Analyze the use of Linear discriminants for machine Learning.
4. Analyze appropriate clustering technique.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	1											2	2	2	1.2.1, 1.7.1, 2.5.2
2	1	3											1	1	3	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1
3	1	3											1	1	4	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1
4	1	2											2	2	4	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1

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, Data Sets.
Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, KNN Classifier, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT II

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 III

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 IV

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.

TEXTBOOKS

1. M. N. Murthy and V. S. Ananthanarayana, Machine Learning: Theory and Practice, 1st ed. Hyderabad, India: Universities Press (India), 2024.

REFERENCE BOOKS

1. T. M. Mitchell, Machine Learning, 1st edition, New York, NY, USA: McGraw-Hill, 2017.
2. P. Harrington, Machine Learning in Action, 1st edition, New Delhi, India: DreamTech Press, 2012.
3. P.-N. Tan, M. Steinbach, and V. Kumar, Introduction to Data Mining, 7th edition, Pearson, 2019.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. A. Ng, Machine Learning, Stanford University, Available: `https://cs229.stanford.edu/`, Last Accessed on: 02/05/2025.
2. R. Barzilay, Introduction to Machine Learning, MIT OpenCourseWare, 2020, [Online]. Available: `https://ocw.mit.edu/courses/6-036-introduction-to-machine-learning-fall-2020/`, Last Accessed on: 02/05/2025.
3. User Guide, scikit-learn, Available: `https://scikit-learn.org/stable/user_guide.html`, Last Accessed on: 02/05/2025.

23AI&DS5303
OPERATING SYSTEMS

Course Category	PC		Credits	3
Course Type	Theory		L-T-P	3-0-0
Prerequisites	23ES1104 Introduction to Programming		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES

1. Understand the basic components of an Operating System.
2. Apply CPU Scheduling techniques and mechanisms used for process synchronization.
3. Analyse Memory management techniques and methods for handling deadlocks.
4. Analyse File system Implementation techniques and protection mechanisms.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3												1	1	2	1.7.1
2	2	2	3										1	1	3	1.7.1, 2.6.3, 2.6.4, 2.8.3, 2.8.4, 3.7.1
3	2	2	3										1	2	4	1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1
4	2	2	3										1	2	4	1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1

COURSE CONTENT

UNIT I

System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, operating system Design and Implementation, operating system structure, Building and Booting an Operating System, Operating system debugging.

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

Threads and Concurrency: Multithreading models, Thread libraries, threading issues.

UNIT II

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, multiple processor scheduling.

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

UNIT III

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

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 IV

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: File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing.

Protection:Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

TEXTBOOKS

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

REFERENCE BOOKS

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

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof Santanu Chattopadhyay - NPTEL Course on Operating Sytems, `https://nptel.ac.in/courses/106/105/106105214/`, Last Accessed On: 28/04/2025.
2. Stanford University - Lecture Notes on Operating Systems, `https://www.scs.stanford.edu/21wi-cs140/notes`, Last Accessed on: 28/04/2025.
3. IIT Bombay – Lecture Notes on Operating Systems , `https://www.cse.iitb.a`

`c.in/~mythili/os/`, Last Accessed on: 28/04/2025.

23AI&DS5404A
SOFTWARE ENGINEERING

Course Category	Program Core		Credits	2
Course Type	Theory		L-T-P	2-0-0
Prerequisites	-		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES

1. Understand the different software engineering process models.
2. Apply analysis model for different applications.
3. Apply design model for different application.
4. Apply different testing techniques.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	3											2	2	2	1.7.1, 2.5.1, 2.5.2, 2.6.4, 2.7.1
2	2	2	3										1	2	3	1.7.1, 2.5.1, 2.7.1, 3.5.1, 3.5.2, 3.5.6
3	2	2	3										1	2	3	1.7.1, 2.5.1, 2.6.4 3.5.1, 3.8.1
4	2	2	3										2	3	3	1.7.1, 2.5.1, 2.6.4 3.5.1, 3.6.2, 3.8.2

COURSE CONTENT

UNIT I

The Nature of Software: The Nature of Software, The changing nature of software. Software engineering: The Software Process, Software Engineering Practice, Software Development Myths.

The Software Process: Software Process Structure. A Generic Process Model, Defining a framework activity, identifying a task set, Process patterns, Process Assessment and Improvement. Process models: Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models.

Agile Development: Agility and the Cost of Change, Extreme Programming (XP) Other Agile Process Models, A Tool Set for the Agile Process.

UNIT II

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Analysis Model, Negotiating Requirements, Requirements monitoring, and Validating Requirements.
Requirements Modeling: Scenario Based Methods: Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case. Class based methods, Identifying Analysis classes, specifying attributes, Defining operators, Class-Responsibility-Collaborator Modeling, Associates and Dependencies, Analysis Packages.
Behavior, Patterns, And Web apps: Creating a Behavioral Model, identifying events with Use Cases, State Representations, Patterns for Requirements Modeling, Requirements Modeling for Web and Mobile Apps.

UNIT III

Design Concepts: Design within the Context of Software Engineering, the Design Process, Design Concepts, the Design Model.
Architectural Design: Software Architecture, Architectural Genres, Architectural Styles, Architectural Considerations, Architectural Decisions, Architectural Design. Component-Level Design: Designing Class-Based Components, Conducting Component Level Design, and Component level design for Web Apps, Component Level Design for Mobile Apps.
User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Web app and Mobile Interface Design

UNIT IV

Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for Web Apps, Test Strategies for Mobile Apps, Validation testing, System testing, the art of debugging. ***Testing Conventional Applications:*** Software Testing Fundamentals, Internal and External Views of Testing, White Box Testing, Basis Path Testing, Control Structure Testing, Black-Box Testing.

TEXTBOOKS

1. Roger S. Pressman, Bruce R.Maxim, Software Engineering a practitioners approach" 8th Edition, McGraw-Hill Publication 2019.

REFERENCE BOOKS

1. Ian Somerville, Software Engineering, 9th Edition, Pearson Education. 2011.
2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Software Engineering Course, `https://www.tutorialspoint.com/software_en gineering/index.htm`, Last Accessed on: 12/04/2025.
2. Prof. Rajib Mall, IIT Kharagpur, Software Engineering, `https://archive.npte l.ac.in/courses/106/105/106105182/` Last Accessed On: 12/04/2025.

23AI&DS5404B
RECOMMENDER SYSTEMS

Course Category	PE -I		Credits	3
Course Type	Theory		L-T-P	3-0-0
Prerequisites			Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES

1. Understand basic concepts behind recommender systems
2. Analyze a variety of approaches for building recommender systems
3. Apply system evaluation methods from both algorithmic and users perspectives
4. Apply applications of recommender systems in various domains

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	3											1		2	1.2.2, 1.6.1, 1.7.1, 2.5.1, 2.5.2
2	2	3											1		4	1.2.2, 1.6.1, 1.7.1, 2.5.1, 2.6.3
3	2	3											1		3	1.2.2, 1.6.1, 1.7.1, 2.6.3
4	2	3											1		3	1.2.2, 1.6.1, 1.7.1, 2.5.1

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.

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 II

Content-based recommendation: High level architecture of content-based sys-

tems, 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 III

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 IV

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.

TEXTBOOKS

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press, 1st edition, 2011.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer, 1st edition, 2011.

REFERENCE BOOKS

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer, 1st edition, 2013.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof. Mamata Jenamani, https://nptel.ac.in/courses/127105390, Last Accessed on: 02/04/25.

23AI&DS5404C
INFORMATION RETRIEVAL SYSTEMS

Course Category	PE-I		Credits	3
Course Type	Theory		L-T-P	3-0-0
Prerequisites	20AI&DS3304 Database Management Systems		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES

1. Understand the overview of information Retrieval
2. Apply different techniques for compression of an index including the dictionary and its posting list
3. Apply appropriate method for text classification or clustering
4. Understand the basics of web search

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2	1											1	2	1.2.1,1.2.2,1.6.1, 1.7.1
2	2		2	3	2									1	3	2.5.1,2.6.4,2.7.1, 4.6.1
3	2	1	2	3										1	3	1.2.1,1.2.2,1.6.1, 1.7.1,2.5.1,2.6.4, 2.7.1,4.6.1
4	2	2	1											1	2	1.2.1,1.6.1,1.7.1, 2.8.1

COURSE CONTENT

UNIT I

Fundaments of Information Retrieval(IR), ModelsandIndex construction and compression: Boolean retrieval, The term vocabulary and postings lists, Dictionaries and tolerant retrieval, Index construction and compression, Scoring, term weighting, and the vector space model, Computing scores in a complete search system, Introduction to Relevance feedback and query expansion.

Probabilistic information retrieval: Review of basic probability theory, The probability ranking principle, The binary independence model.

Language models for information retrieval: Language modeling versus other approaches in information retrieval

UNIT II: Text Classification

Text classification and Naive Bayes: The text classification problem, Naive Bayes text classification,Properties of Naive Bayes, The Bernoulli model, Feature selection, Evaluation of text classification.

Vector space classification: Document representations, Measures of relatedness in vector spaces, Rocchio classification, k nearest neighbour, Linear versus nonlinear classifiers, Classification with more than two classes. Support vector machines (SVM) and machine learning on documents, Evaluation in information retrieval.

UNIT III: Text Clustering, Matrix decompositions and latent semantic indexing

Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, K-means, Model-based clustering.

Hierarchical clustering: Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Optimality of hierarchical agglomerative clustering, Divisive clustering, Cluster labelling.

Matrix decompositions and latent semantic indexing: Term–document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.

UNIT IV: Web Information Retrieval

Web search basics: Web search basics, Web characteristics, Index size and estimation, Near duplicates and shingling ***Web Crawling and Indexes:*** Crawling, Distributing Indexes, Connectivity servers. ***Link Analysis:*** Web as a graph, PageRank, Hubs and authorities.

TEXTBOOKS

1. Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze, "An Introduction to Information Retrieval", Cambridge University Press,2008.

REFERENCE BOOKS

1. Stefan Büttcher, Charles L, A. Clarke, Gordon V. Cormack, "Information Retrieval: Implementing and evaluating search engines", MIT Press, 2010
2. David A. Grossman, OphirFrieder, "Information Retrieval: Algorithms and Heuristics", Springer, 2004
3. Frakes, "Information Retrieval: Data Structures and Algorithms", Pearson, 2009

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Information Retrieval and Web Search https://web.stanford.edu/class/cs276/ (Last accessed on 12-11-2-022)

23AI&DS5404D
EXPLORATORY DATA ANALYSIS WITH PYTHON

Course Category	PE-I	Credits	3
Course Type	Theory	L-T-P	2-0-2
Prerequisites	23AI&DS3651 - Python Programming Lab	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

1. Apply exploratory data analysis techniques using statistical and visualization tools to interpret and present different types of data effectively.
2. Apply data transformation techniques to prepare, analyze, and interpret datasets.
3. Apply descriptive statistical methods and grouping techniques to analyze and organize datasets effectively.
4. Analyze data using correlation and multivariate techniques and examine patterns in time series data.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	1	2			3								1	2	3	1.2.1, 2.5.3, 5.4.1
2		1	2	3									1	2	3	2.6.3, 3.6.2, 4.6.1
3		1	2		3								1	2	3	2.5.3, 2.6.3, 3.6.2, 5.4.2
4		3	1		2								1	2	4	2.8.2, 3.8.2, 5.5.1

COURSE CONTENT

UNIT I

Exploratory Data Analysis Fundamentals: Understanding data science, The significance of EDA, Making sense of data – Numerical data; Categorical data; Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA. Getting started with EDA – NumPy; Pandas; SciPy; Matplotlib.
Visual Aids for EDA: : Line chart, Bar charts, Scatter plot – Bubble chart; Scatter plot using seaborn, Area plot and stacked plot, Pie chart, Table chart, Polar chart, Histogram, Lollipop chart, Choosing the best chart.
Sample Experiments:
1. a) Download Dataset from Kaggle using the following link : `https://www.kaggle.com/datasets/sukhmanibedi/cars4u`

b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib, seaborn)

2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.

3. Loading Dataset into pandas dataframe.

4. Selecting rows and columns in the dataframe.

5. Apply different visualization techniques using sample dataset

a.) Line Chart b.) Bar Chart c.) Scatter Plots d.) Bubble Plot

6. Apply following visualization Techniques for a sample dataset

a.) Area Plot b.) Stacked Plot c.) Pie chart d.) Table Chart

UNIT II

EDA with Personal Email: Data transformation – Data cleansing; Loading the CSV file; Converting the date; Removing NaN values; Applying descriptive statistics; Data refactoring; Dropping columns; Refactoring timezones, Data analysis.

Data Transformation: Merging database-style data frames, Transformation techniques – Performing data deduplication; Replacing values; Handling missing data; Renaming axis indexes; Discretization and binning; Outlier detection and filtering; Permutation and random sampling, Benefits of data transformation.

Sample Experiments:

1. Perform the following operations

a) Merging Dataframes b) Reshaping with Hierarchical Indexing c) Data Deduplication d) Replacing Values

2. Apply different Missing Data handling techniques a)NaN values in mathematical Operations b) Filling in missing data c) Forward and Backward filling of missing values d) Filling with index values e) Interpolation of missing values

3. Apply different data transformation techniques

a) Renaming axis indexes b)Discretization and Binning c) Permutation and Random Sampling d) Dummy variables

UNIT III

Descriptive Statistics: Understanding statistics – Distribution function; Cumulative distribution function; Descriptive statistics, Measures of central tendency – Mean/average; Median; Mode, Measures of dispersion – Standard deviation; Variance; Skewness; Kurtosis; Calculating percentiles; Quartiles.

Grouping Datasets: Understanding groupby(), Groupby mechanics – Selecting a subset of columns; Max and min; Mean, Data aggregation – Group-wise operations; Group-wise transformations, Pivot tables and cross-tabulations – Pivot tables; Cross-tabulations.

Sample Experiments:

1. Study the following Distribution Techniques on a sample data a) Uniform Distribution b) Normal Distribution c) Gamma Distribution d) Exponential Distribution e) Poisson Distribution f) Binomial Distribution

2. Perform Data Cleaning on a sample dataset.

3. Compute measure of Central Tendency on a sample dataset

a) Mean b)Median c)Mode

4. Explore Measures of Dispersion on a sample dataset

a) Variance b) Standard Deviation c) Skewness d) Kurtosis

UNIT IV

Correlation:Introducing correlation, Types of analysis – univariate analysis; bivariate analysis; multivariate analysis, Discussing multivariate analysis using the Titanic dataset, Outlining Simpson's paradox.

Time Series Analysis: Understanding the time series dataset – Fundamentals of TSA; Characteristics of time series data, TSA with Open Power System Data – Data cleaning; Time-based indexing; Visualizing time series; Grouping time series data; Resampling time series data.

Sample Experiments:

1. a) Calculating percentiles on sample dataset b) Calculate Inter Quartile Range(IQR) and Visualize using Box Plots

2. Perform the following analysis on automobile dataset.

a) Bivariate analysis b)Multivariate analysis 3. Perform Time Series Analysis on Open Power systems dataset

TEXTBOOKS

1. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 1st Edition, 2020.

REFERENCE BOOKS

1. Ronald K. Pearson, Exploratory Data Analysis Using R, CRC Press, 1st Edition, 2020.

2. Radhika Datar, Harish Garg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, 1st Edition, Packt Publishing, 2019.

E-RESOURCES AND OTHER DIGITAL MATERIALS:

1. Prof. Ragunathan Rengasamy, Python for Data Science https://onlinecourses.nptel.ac.in/noc22_cs32/preview, Last Accessed on: 25/04/2025.

2. Exploratory Data Analysis in Python, https://www.udemy.com/course/exploratory-data-analysis-in-python/, Last Accessed on: 25/04/2025.

23AI&DS5205A
WEB PROGRAMMING

Course Category	OE- I	Credits	3
Course Type	Theory	L-T-P	3-0-0
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

1. Understand the concepts of Web designing.
2. Apply the concepts of HTML5 and CSS to design static web pages.
3. Apply client side technologies to design interactive Web interfaces
4. Apply interactive server side scripting for a web application.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3	2													2	1.3.1, 2.1.1
2		2	3										2		3	2.2.3, 3.2.1, 3.2.2
3		2	3										3		3	2.2.3, 2.2.4, 3.3.1, 3.2.1, 3.2.2
4		2	3										3		3	2.2.3, 3.2.1, 3.2.2

COURSE CONTENT

UNIT I

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol : Request and Response, Web browser and Web servers, Features of Web 2.0.
Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation.

UNIT II

HTML: Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5.
Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using

CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3

UNIT III

JavaScript: Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and Javascript, Events and buttons.
XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT.

UNIT IV

PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP.
PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

TEXT BOOKS

1. R. Moseley and M. T. Savaliya, Developing Web Applications, 2nd ed. New Delhi, India: Wiley India Pvt. Ltd., 2011.

REFERENCE BOOKS

1. J. Sklar, Web Design Principles, 5th edition, Boston, MA: Course Technology Cengage Learning, 2012.
2. H. M. Deitel, P. J. Deitel, and T. R. Nieto, Internet & World Wide Web: How to Program, 3rd edition, Upper Saddle River, NJ: Pearson/Prentice Hall, 2004.
3. B. M. Harwani, Developing Web Applications in PHP and AJAX. New Delhi, India: Tata McGraw-Hill Education, 2010.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Sengupta, Internet Technology, NPTEL, Jun. 28, 2014. `https://nptel.ac.in/courses/106105084`, Last Accessed: 05/05/2025.
2. PHP Group, PHP: MySQL - Manual, PHP: Hypertext Preprocessor, `https://www.php.net/manual/en/book.mysql.php`, Last Accessed: 05/05/2025.

23AI&DS5205B
INTERNET OF THINGS

Course Category	OE- I		Credits	3
Course Type	Theory		L-T-P	3-0-0
Prerequisites			Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES

1. Understand the design concepts and applications of Internet of Things
2. Understand Standards and Key Technologies in IoT.
3. Apply the steps of the design methodology in developing IoT applications using Raspberry Pi
4. Understand the Privacy, security and Vulnerabilities of internet of Things

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2												1	2	2	1.6.1,1.7.1
2	2												1	2	2	1.6.1, 1.7.1
3		2	2										2		3	2.7.1, 2.7.2, 3.6.2
4	1				2										2	1.6.1, 1.7.1, 5.4.1

COURSE CONTENT

UNIT I

Introduction to Internet of things: Introduction, Physical design of IoT, Logical Design of IoT, IoT Enabling technologies, IoT levels & Deployment templates.
Domain Specific IoTs – Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle

UNIT II

IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization.
IoT Platforms Design Methodology: Introduction, IoT Design Methodology, Case Study on IoT System for Home Automation , IoT system for Weather Monitoring.

UNIT III

IoT Physical Devices and Endpoints: Basic building blocks of an IoT Deice, Introduction to Raspberry Pi Board, Linux on Raspberry Pi, Raspberry Pi Interfaces (serial, SPI, I2C)

Programming Raspberry PI with Python – Controlling LED with Raspberry Pi, Interfacing an LED and Switch with Raspberry Pi, Interfacing a Light sensor (LDR) with Raspberry Pi.

UNIT IV

IoT Privacy, Security and Vulnerabilities Solutions: Introduction, Vulnerabilities, Security Requirements and Threat Analysis – Privacy, Vulnerabilities of IoT, Security Requirements, Threat Analysis, Use Cases and Misuse Cases, IoT Security Tomography and Layered Attacker model. Security models, profiles and protocols for IoT.

TEXTBOOKS

1. Arshdeep Bahga , Vijay Madisetti, Internet of Things (A Hands-on Approach), 1st Edition, Universities Press Private Limited, 2014.
2. Raj Kamal, Internet of Things, Architecture and Design Principles, 1st Edition, McGraw Hill Education Private Limited, 2017.

REFERENCE BOOKS

1. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014.
2. David Hanes, IOT Fundamentals, 1st Edition, CISCO Press, 2018.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof. Sudip Misra, IIT Kharagpur, Introduction to Internet of things, Available: https://nptel.ac.in/courses/106/105/106105166/, Last Accessed on: 24/04/2025.
2. Prof. T V Prabhakar, IISc Bangalore, Design for Internet of things, Available: https://nptel.ac.in/courses/108/108/108108098/, Last Accessed on: 24/04/2025.

23AI&DS5205C
MOBILE APPLICATION DEVELOPMENT

Course Category	OE- I	Credits	3
Course Type	Theory	L-T-P	3-0-0

Prerequisites		Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

1. Understand the fundamentals of Android Operating System.
2. Apply UI principles to develop interfaces for Android platform.
3. Apply mobile application concepts to deploy and publish a given app into android device.
4. Apply principles to develop a database connection for a given mobile application.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2													2	1.7.1, 2.5.1, 2.5.2, 2.7.1
2	2	2	3										2	2	3	1.7.1, 2.5.1, 2.5.2, 2.6.3, 2.7.1, 3.5.1
3	2	2	3										2	2	3	1.7.1, 2.5.1, 2.5.2, 2.6.3, 2.6.4 3.5.1, 3.8.2
4		2	3	2	2								2	2	3	2.5.1, 2.5.2, 2.6.3, 2.6.4, 3.5.1, 3.6.2, 3.8.2, 4.6.2, 5.4.2

COURSE CONTENT

UNIT I

Introduction to Android: An open platform for mobile development, Native android applications, Android SDK Features, Introducing the Development Framework, Downloading and Installing the Android SDK, Creating your First Android Application, Types of Android Applications, Developing for Mobile and Embedded devices, Android Development Tools.

Creating Applications and Activities: Introducing the Application Manifest File, Externalizing Resources, The Android Application Lifecycle, A Closer look at Android Activities.

UNIT II

Building User Interfaces: Fundamental Android UI Design, Android User Interface fundamentals, Introducing Layouts.
User Interface (UI) Components: Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers.
Event Handling: Handling clicks or changes of various UI components.

UNIT III

Introducing Fragments: Creating New Fragments, The Fragment Lifecycle, Introducing the Fragment Manager, Adding Fragments to Activities, Interfacing Between Fragments and Activities, Fragments Without User Interfaces.
Introducing Adapters:Introducing Some Native Adapters, Customizing the Array Adapter, Using Adapters to Bind Data to a View. ***Introducing Intents:*** Using intents to launch activities, Introducing Linkify, Using Intents to broadcast Events, Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT IV

Creating Intent Filters and Broadcast Receivers: Using Intent Filters to Service Implicit Intents, Using Intent Filters for Plug-Ins and Extensibility, Listening for Native.
Working with SQLite Databases: Introducing the SQLiteOpenHelper, Opening and Creating Databases without SQLite Open Helper, Android Database design considerations, Quering a Database, Extracting values from a cursor, Adding, Updating and Removing Rows.

TEXTBOOKS

1. R. Meier, Professional Android 4 Application Development, 3rd ed. Indianapolis, IN, USA: Wiley India (Wrox), 2012.

REFERENCE BOOKS

1. D. Griffiths and D. Griffiths, Head First Android Development: A Brain-Friendly Guide, 2nd ed. Sebastopol, CA, USA: O'Reilly Media, Inc., 2017.
2. J. C. Sheusi, Android Application Development for Java Programmers. Boston, MA, USA: Cengage Learning, 2013.
3. W.-M. Lee, Beginning Android 4 Application Development. Indianapolis, IN, USA: Wiley India (Wrox), 2012.
4. B. Phillips, C. Stewart, B. Hardy, and K. Marsicano, Android Programming: The Big Nerd Ranch Guide, 3rd ed. Atlanta, GA, USA: Big Nerd Ranch LLC, 2017.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Mehmet Ongel, Build Real Android Apps: Android 11 App Development: Java,`https://www.udemy.com/course/build-real-android-apps-android-app-development-with-java/`, Last Accessed on: 24/04/2025.

2. Courseera : Dr. Jerry Roth, Android App Development Specialization, Department of Computer Science and Electrical Engineering, Vanderbilt University `https://www.coursera.org/specializations/android-app-development,` Last Accessed on: 24/04/2025.

23AI&DS5351
DATA WAREHOUSING AND MACHINE LEARNING LAB

Course Category	PC	Credits	1
Course Type	Laboratory	L-T-P	0-0-2
Prerequisites	23AI&DS3304 Data Base Management Systems	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

1. Apply techniques of data warehousing and data mining.
2. Apply various pre-processing techniques on datasets using Data mining techniques.
3. Analyze classification and apriori algorithms to solve real life problems.
4. Analyze different types of clustering algorithms to solve real life problems.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	3				2								3	2	3	1.2.1, 1.7.1. 5.4.2
2	1	3			2								1	1	3	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1, 5.4.2
3	1	3											1	1	4	1.2.1, 1.7.1, 2.5.2
4	1	2											2	2	4	1.2.1, 1.7.1, 2.5.2, 2.6.4, 2.8.1

Software Requirements: WEKA Tool/Python/R-Tool/Rapid Tool/Oracle Data mining

COURSE CONTENT

Task 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

Task 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

Task 3: Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets

- 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.

Task 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.

Task 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.

Task 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

Task 7: Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations

Task 8: Write a java program to prepare a simulated data set with unique instances.

Task 9: Write a Python program to generate frequent item sets / association rules using Apriori algorithm

Task 10: Write a program to calculate chi-square value using Python/R. Report your observation.

Task 11: Write a program of Naive Bayesian classification using Python/R programming language

Task 12: Implement a Java/R program to perform Apriori algorithm

Task 13: Write a R program to cluster your choice of data using simple k-means algorithm using JDK

Task 14: Write a program of cluster analysis using simple k-means algorithm Python/R programming language.

Task 15: Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python

Task 16: Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc.,)

TEXTBOOKS

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

REFERENCE BOOKS

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

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof. PabitraMitra, Data Mining Techniques, `https://onlinecourses.nptel.ac.in/noc22_cs11/preview`, Last accessed on: 25/04/2025.
2. Dr. Saed Sayad, An Introduction to Data Science, `http://www.saedsayad.com/data_mining_map.html`, Last accessed on: 25/04/2025.

23AI&DS5352
OPERATING SYSTEMS LAB

Course Category	PC		Credits	1
Course Type	Laboratory		L-T-P	0-0-2
Prerequisites	23ES1104 Introduction to Programming		Continuous Eval	30
			Semester End Eval	70
			Total Marks	100

COURSE OUTCOMES

1. Implement UNIX concepts for creation of Shell Scripts
2. Apply CPU Scheduling algorithms, page replacement algorithms, thread implementation
3. Analyze Bankers Algorithm for Dead Lock avoidance and process Synchronization
4. Analyze the memory management techniques

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO 1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	2	BTL	POI
1	1	2											1	1	3	1.7.1, 2.6.4
2	1	3	3	2									1	1	3	1.7.1, 2.6.3, 2.6.4, 2.8.3, 2.8.4, 3.7.1, 4.6.1
3	1	3	3	2									1	1	4	1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1, 4.6.1
4	1	3	3	2									1	1	4	1.7.1, 2.5.2, 2.6.3, 2.6.4, 2.8.4, 3.7.1, 4.6.1

COURSE CONTENT

Task 1: Practicing of Basic UNIX Commands.
Task 2: Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir
Task 3: Simulate UNIX commands like cp, ls, grep, etc.,
Task 4: Simulate the following CPU scheduling algorithms a) FCFS b) SJF c) Priority d) Round Robin
Task 5: Control the number of ports opened by the operating system with a) Semaphore b) Monitors.

Task 6: Write a program to illustrate concurrent execution of threads using pthreads library.

Task 7: Write a program to solve producer-consumer problem using Semaphores.

Task 8: Implement the following memory allocation methods for fixed partition a) First fit b) Worst fit c) Best fit

Task 9: Simulate the following page replacement algorithms a) FIFO b) LRU c) LFU

Task 10: Simulate Paging Technique of memory management.

Task 11: Implement Bankers Algorithm for Dead Lock avoidance and prevention

Task 12: Simulate the following file allocation strategies a) Sequential b) Indexed c) Linked

Task 13: Download and install nachos operating system and experiment with it

REFERENCE BOOKS

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

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof Santanu Chattopadhyay - NPTEL Course on Operating Sytems, `https://nptel.ac.in/courses/106/105/106105214/`, Last Accessed On: 28/04/2025.
2. Stanford University - Lecture Notes on Operating Systems, `https://www.scs.stanford.edu/21wi-cs140/notes`, Last Accessed on: 28/04/2025.
3. IIT Bombay – Lecture Notes on Operating Systems , `https://www.cse.iitb.ac.in/~mythili/os/`, Last Accessed on: 28/04/2025.

23HS5153
ADVANCED COMMUNICATION SKILLS LAB

Course Category	Institutional Core	Credits	1
Course Type	Laboratory	L-T-P	0-0-2
Prerequisites	20TP4106 English for Professionals	Continuous Eval Semester End Eval Total Marks	30 70 100

COURSE OUTCOMES

1. Execute rational pronunciation of speech sounds including accentuation.
2. Apply elements of listening comprehension in professional environments.
3. Develop the abilities of rational argumentation and skills of public speaking.
4. Demonstrate proficiency in the elements of professional communication including the competitive examination.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1										3					3	5.5.1, 10.4.1, 10.4.2, 10.5.2
2					2					3					4	5.5.2, 10.4.1, 10.4.2, 10.5.1
3					2					3					4	5.5.2, 10.4.1, 10.4.2, 10.5.2
4					1					3					4	5.5.1, 5.5.2, 10.4.1, 10.4.2

COURSE CONTENT/TASK

UNIT:I Elements of Spoken Expression and processes of Listening Comprehension:

- Speech Mechanism

- Articulation of vowels and consonants

- Patterns of Accentuation

- Types and processes of Listening comprehension

UNIT II: Patterns of Substantiation and Refutation in Public Speaking:

- Group Discussion(Open and Monitored)

- Pyramid Discussion

- PNI

- Seminar Talk and Power Point Presentation

UNIT III: Professional Communication:

- Self Affirmation Advanced Composition including

- Memo and e-mail

- Résumé Preparation

- Corporate ethic of Non-Verbal Communication

UNIT IV: Life Skills and Vocabulary for Competitive Examinations:

- Select Life Skills(50)

- Select Logies, Isms, Phobias and Manias (25 each)

- Sentence Completion and Double Unit Verbal Analogies (50 items)

- Fundamentals of Syllogisms(Descriptive and Pictorial)

TEXTBOOKS

1. M. Cutts, Oxford Guide to Plain English, 7th impression, Oxford, UK: Oxford University Press, 2011.
2. Department of Phonetics and Spoken English, Exercises in Spoken English, 21st impression, Hyderabad, India: Central Institute of English and Foreign Languages (CIEFL), published by Oxford University Press, 2003.

REFERENCE BOOKS

1. S. R. Covey, The 7 Habits of Highly Effective People, 2nd edition, London, UK: Simon & Schuster UK Ltd (Pocket Books), 2004.
2. J. S. Brubacher, Eclectic Philosophy of Education: A Book of Readings, Englewood Cliffs, NJ, USA: Prentice-Hall, 1951.

23AI&DS5651
FULL STACK DEVELOPMENT-II

Course Category	SEC	Credits	1
Course Type	Laboratory	L-T-P	0-0-2
Prerequisites	23AI&DS 3305 Object Oriented Programming Through Java	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

1. Implement router, template engine and authentication using sessions to develop application in ExpressJS.
2. Build a single page application using RESTful APIs in ExpressJS
3. Apply router and hooksin designing ReactJS application
4. Implement MongoDB queries to perform CRUD operations on document database

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2													3	1.7.1, 2.5.1, 2.5.2
2	2	2	3										2	2	3	1.7.1, 2.5.1, 2.5.2, 2.6.3, 2.7.1, 3.5.1
3	2	2	3										2	2	3	1.7.1, 2.5.1, 2.5.2, 2.6.3, 2.6.4 3.5.1
4		2	3	2									2	2	3	2.5.1, 2.5.2, 2.6.3, 2.6.4, 3.5.1, 4.6.2

Experiments covering the Topics:

- ExpressJS – Routing, HTTP Methods, Middleware, Templating, Form Data

- ExpressJS – Cookies, Sessions, Authentication, Database, RESTful APIs

- ReactJS – Render HTML, 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

- MongoDB – Installation, Configuration, CRUD operations, Databases, Collections and Records

Sample Experiments:

1. **ExpressJS – Routing, HTTP Methods, Middleware**

   - Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
   - Write a program to accept data, retrieve data and delete a specified resource using http methods.
   - Write a program to show the working of middleware.

2. **ExpressJS – Templating, Form Data**

   - Write a program using templating engine.
   - Write a program to work with form data.

3. **ExpressJS – Cookies, Sessions, Authentication**

   - Write a program for session management using cookies and sessions.
   - Write a program for user authentication

4. **ExpressJS – Database, RESTful APIsl**

   - Write a program to connect MongoDB database using Mangoose and perform CRUD operations.
   - Write a program to develop a single page application using RESTful APIs.

5. **ReactJS – Render HTML, JSX, Components – function & Class**

   - Write a program to render HTML to a web page.
   - Write a program for writing markup with JSX.
   - Write a program for creating and nesting components (function and class).

6. **ReactJS – Props and States, Styles, Respond to Events**

   - Write a program to work with props and states.
   - Write a program to add styles (CSS & Sass Styling) and display data.
   - Write a program for responding to events.

7. **ReactJS – Conditional Rendering, Rendering Lists, React Forms**

   - Write a program for conditional rendering.
   - Write a program for rendering lists.

- Write a program for working with different form fields using react forms.

8. **ReactJS – React Router, Updating the Screen**

   - Write a program for routing to different pages using react router.
   - Write a program for updating the screen.

9. **ReactJS – Hooks, Sharing data between Components**

   - Write a program to understand the importance of using hooks.
   - Write a program for sharing data between components.

10. **MongoDB – Installation, Configuration, CRUD operations**

    - Install MongoDB and configure ATLAS
    - Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

11. **MongoDB – Databases, Collections and Records**

    - Write MongoDB queries to Create and drop databases and collections.
    - Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().

12. **Augmented Programs: (Any 2 must be completed)**

    - Design a to-do list application using NodeJS and ExpressJS.
    - Design a Quiz app using ReactJS.
    - Complete the MongoDB certification from MongoDB University website.

TEXTBOOKS

1. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, 2nd edition, APress, O'Reilly.
2. Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich, Node.Js in Action, Manning Publications. (Chapters 1-11)
3. AzatMardan, React Quickly, Manning Publications, 2nd Edition, 2017.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. ExpressJS - https://www.tutorialspoint.com/expressjs, Last Accessed on: 25/04/2025.
2. ReactJS - https://www.w3schools.com/REACT/DEFAULT.ASP, Last Accessed on: 25/04/2025.
3. MongoDB - https://learn.mongodb.com/learning-paths/introduction-to-mongodb , Last Accessed on: 25/04/2025.

23TP5106
PERSONALITY DEVELOPMENT

Course Category	SS-3		Credits	1
Course Type	Learning by Doing		L-T-P	0-0-2
Prerequisites	20TP4106 English for Professionals	Continuous Eval		100
		Semester End Eval		0
		Total Marks		100

COURSE OUTCOMES

1. Understand the corporate etiquette.
2. Make presentations effectively with appropriate body language.
3. Be composed with positive attitude.
4. Understand the core competencies to succeed in professional and personal life.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1									2	3					2	9.5.2, 10.5.1, 10.4.2
2									2	3					3	9.5.1, 10.4.1, 10.4.2
3									3	3					3	9.4.1, 10.5.1, 10.4.2
4									2	3					2	9.5.2, 10.4.1, 10.4.2

COURSE CONTENT

UNIT I

Analytical Thinking and Communication Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self–Analysis, Developing Positive Attitude, Perception; Verbal Communication, Non Verbal Communication (Body Language)

UNIT II

Self-Management Skills and Etiquette: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities; Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT III

Standard Operation Methods and Verbal Ability: Note Making, Note Taking, Minutes Preparation, Email Letter Writing; Synonyms, Antonyms, One Word Substitutes-Correction of Sentences-Analogies, Spotting Errors, Sentence Completion, Course of

Action -Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work.

UNIT IV

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

METHODOLOGY Audio—Visuals / Hand Outs (Compiled/Created by Training Division, T&P Cell, VR Siddhartha Engineering College), Board & Chalk and Interactive Sessions.

REFERENCE BOOKS

1. Mitra, B. K., Personality development and soft skills (Vol. 156). Oxford University Press, 2011.
2. Dhanavel, S. P, English and Soft Skills. Orient Blackswan Pvt Limited, 2011.
3. Aggarwal, R. S., A Modern Approach to Verbal & Non Verbal Reasoning. S. Chand, 2018.
4. Meenakshi, R. & Sharma, S, Technical Communication Principles and Practice, Oxford University Press, 2011.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Aptitude Questions and Answers, IndiaBIX. `https://www.indiabix.com`, Last accessed on 02/05/25.
2. Placement Papers of all IT Companies, Freshersworld, `https://placement.freshersworld.com/placement-papers`, Last accessed on 02/05/25.

USER INTERFACE DESIGN USING FLUTTER

Course Category	ES	Credits	1
Course Type	Laboratory	L-T-P	0-0-2
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

1. Learns to Implement Flutter Widgets and Layouts
2. Understand Responsive UI Design and with Navigation in Flutter
3. Knowledge on Widges and customize widgets for specific UI elements, Themes
4. Understand to include animation apart from fetching data

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1	2	2													2	1.7.1, 2.5.1, 2.5.2
2	2	2	3										2	2	2	1.7.1, 2.5.1, 2.5.2, 2.6.3, 2.7.1, 3.5.1
3	2	2	3										2	2	2	1.7.1, 2.5.1, 2.5.2, 2.6.3, 2.6.4 3.5.1
4		2	3	2									2	2	2	2.5.1, 2.5.2, 2.6.3, 2.6.4, 3.5.1, 4.6.2

List of Experiments: Students need to implement the following experiments:

1. (a) Install Flutter and Dart SDK
   (b) Write a program to accept data, retrieve data and delete a specified resource using http methods.

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.

TEXTBOOKS

1. M. L. Napoli, Beginning Flutter: A Hands-on Guide to App Development, Hoboken, NJ, USA: John Wiley & Sons, 2020.
2. R. Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, 1st edition, New York, NY, USA: Apress, 2021.
3. R. Rose, Flutter & Dart Cookbook: Developing Full-Stack Applications for the Cloud, Sebastopol, CA, USA: O'Reilly Media, 2022.

23AI&DS5354
ENGINEERING PROJECT FOR COMMUNITY SERVICES

Course Category	Project Work/Internship	Credits	2
Course Type	Laboratory	L-T-P	0-0-0
Prerequisites	–	Continuous Eval	30
		Semester End Eval	70
		Total Marks	100

COURSE OUTCOMES

1. Identify the Societal problems.
2. Solve the problems.
3. Design of the problem/work plan.
4. Design of the prototype/model.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1						2	3						2	2
CO2						3	1		2				2	2
CO3						3			2				2	2
CO4									1	3			2	2

EPICS: Engineering Project for community services will be carried out during summer vacation for a period of six weeks after IV Semester and the report shall be submitted in V Semester. Students will go to the society (Villages/ Hospitals/Towns, etc,.) to identify the problem and survey the literature for a feasible solution. The student(s) is encouraged to solve real life problems leading to innovative model building.. This can be done in a group of students or as an individual.

20MC5107
INTELLECTUAL PROPERTY RIGHTS (IPR)

Course Category	MC	Credits	–
Course Type	Theory	L-T-P	2-0-0
Prerequisites	–	Continuous Eval	100
		Semester End Eval	0
		Total Marks	100

COURSE OUTCOMES

1. Learn the innovation concepts related to business organizations.
2. Understand the importance of innovation in new start-ups.
3. Know fundamental aspects of Intellectual property Rights.
4. Learn the basic concepts of entrepreneurship and its benefits.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO												PSO		BTL	POI
	1	2	3	4	5	6	7	8	9	10	11	12	1	2		
1		1						2	2		2		1		2	2.5.1, 2.5.1, 2.6.2, 2.6.3, 2.6.4, 8.3.1, 8.4.2, 9.4.2, 9.5.1, 11.6.1, 11.6.2
2		2						1	2		2		1		2	2.5.1, 2.5.1, 2.6.2, 2.6.3, 2.6.4, 8.3.1, 8.4.2, 9.4.2, 9.5.1, 11.6.1, 11.6.2
3		2						2	3		3		1		2	2.5.1, 2.5.1, 2.6.2, 2.6.3, 2.6.4, 8.3.1, 8.4.2, 9.4.2, 9.5.1, 11.6.1, 11.6.2
4		1						3	2		2		1		2	2.5.1, 2.5.1, 2.6.2, 2.6.3, 2.6.4, 8.3.1, 8.4.2, 9.4.2, 9.5.1, 11.6.1, 11.6.2

COURSE CONTENT

UNIT I

Innovation Management: Introduction Innovation: Definition, Importance –

The need to view innovation in an organizational context – Different types of innovation - Innovation and Invention – Popular views of innovation – Innovation as a management process.

UNIT II

Innovation: New Product Development (NPD): Innovation Management and New Product Development – Considerations when developing as NPD strategy - NPD as a strategy for growth – What is new product? – Classification of new products – NPD as an industry innovation cycle.

UNIT III

Intellectual Property Rights (IPR): Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development.

UNIT IV

Entrepreneurship Concept and need of entrepreneurship: Characteristics and Types of Entrepreneurship - Entrepreneurship as a career - Entrepreneurship as a style of Management - The changing role of the entrepreneur - Entrepreneurial traits, factors affecting entrepreneurs.

TEXT BOOKS

1. P. Trott, Innovation Management and New Product Development, 6th edition, Harlow, UK: Pearson Education Limited, 2017.
2. K. V. Nithyananda, Intellectual Property Rights: Protection and Management, 1st edition, New Delhi, India: Cengage Learning India Pvt. Ltd., 2019.
3. S. S. Khanka, Entrepreneurial Development, Revised edition, New Delhi, India: S. Chand Publishing, 2020.

REFERENCE BOOKS

1. J. Tidd and J. R. Bessant, Managing Innovation: Integrating Technological, Market and Organizational Change, 6th edition, Hoboken, NJ, USA: Wiley, 2018.
2. N. Pandey and K. Dharni, Intellectual Property Rights, 1st edition, New Delhi, India: PHI Learning Pvt. Ltd., 2014.
3. V. Desai, The Dynamics of Entrepreneurial Development and Management, 6th edition, Mumbai, India: Himalaya Publishing House, 2022.

E-RESOURCES AND OTHER DIGITAL MATERIALS

1. Prof . K. D. Raju, Prof. Niharika Sahoo Bhattacharya, Intellectual Property Rights and Competition Law, NPTEL, IIT Kharagpur, https://archive.nptel.ac.in/courses/110/105/110105139/#, Last Accessed on: 02/05/2025.