ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE (AI)
(Effective for the batches admitted in 2023-24)

Semester I (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9903	Engineering Physics	4	2	0	3	30	70	100
2	BS	23ABS9904	Linear Algebra & Calculus	4	2	0	3	30	70	100
3	ES	23AES0201	Basic Electrical & Electronics Engineering	3	1	0	3	30	70	100
4	ES	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	23AES0501	Introduction to Programming	4	2	0	3	30	70	100
6	ES	23AES0503	IT Workshop	0	0	2	1	30	70	100
7	BS	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	23AES0202	Electrical & Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	ES	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9904	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5	50	-	50
			Total	**16**	**7**	**15**	**20.5**	**320**	**630**	**950**

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Semester II (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	HM	23AHM9901	Communicative English	2	2	0	2	30	70	100
2	BS	23ABS9901	Chemistry	4	2	0	3	30	70	100
3	BS	23ABS9905	Differential Equations &Vector Calculus	4	2	0	3	30	70	100
4	ES	23AES0101	Basic Civil& Mechanical Engineering	3	0	0	3	30	70	100
5	PC	23APC0501	Data Structures	4	2	0	3	30	70	100
6	HM	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	BS	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	ES	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	23APC0502	Data Structures Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9903	Health and wellness, Yoga and Sports	0	0	1	0.5	50	-	50
			Total	**17**	**8**	**11**	**19.5**	**320**	**630**	**950**

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Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9913	Discrete Mathematics & Graph Theory	4	2	0	3	30	70	100
2	HM	23AHM9905	Universal Human Values	4	2	0	3	30	70	100
3	PC	23APC0508	Database Management Systems	4	2	0	3	30	70	100
4	PC	23APC0504	Advanced-Data Structures and Algorithms Analysis	4	2	0	3	30	70	100
5	PC	23APC0506	Object-Oriented Programming Through JAVA	4	2	0	3	30	70	100
6	PC	23APC0505	Advanced-Data Structures and Algorithms Analysis Lab	0	0	3	1.5	30	70	100
7	PC	23APC0507	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0501	Python Programming	0	1	2	2	30	70	100
			Total	**20**	**11**	**8**	**20**	**240**	**560**	**800**

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Semester IV (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	HM	23AHMMB01	Managerial economics and financial analysis	2	0	0	2	30	70	100
2	BS	23ABS9915	Statistical Methods for Data Science	4	2	0	3	30	70	100
3	PC	23APC3001	Artificial Intelligence	4	2	0	3	30	70	100
4	PC	23APC3201	Introduction to Data Science	4	2	0	3	30	70	100
5	PC	23APC0503	Digital Logic & Computer Organization	4	2	0	3	30	70	100
6	PC	23APC3002	Artificial Intelligence Lab	0	0	3	3	30	70	100
7	PC	23APC0509	Data Science using Python Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0503	Full Stack Development-1	0	1	2	2	30	70	100
9	ES	23AES0304	Design Thinking & Innovation	0	1	2	2	30	70	100
10	MC	23AMC9901	Environmental Science	2	0	0	-	30	-	30
			Total	**20**	**10**	**10**	**22.5**	**300**	**630**	**930**
			Mandatory Community Service Project Internship of 08 weeks duration during summer vacation							

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Semester V (Third year)

S.No.	Category	Title	L	T / CLC	P	Credits
1	Professional Core	Data warehousing and data mining	4	2	0	3
2	Professional Core	Natural language processing	4	2	0	3
3	Professional Core	Data visualization	4	2	0	3
4	Professional Elective-I	1. OOAD 2. Soft computing 3. internet of things(IoT) 4. Exploratory data analysis with Python 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	4	2	0	3
5	Open Elective-I		3	0	0	3
6	Professional Core	Data warehousing and data mining Lab	0	0	3	1.5
7	Professional Core	Natural Language Processing Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack Development-II	0	1	2	2
9	Engineering Science	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
	Total		19	9	10	23

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Semester VI (Third year)

S.No.	Category	Title	L	T / CLC	P	Credits
1	Professional Core	Big Data Analytics	4	2	0	3
2	Professional Core	Deep learning	4	2	0	3
3	Professional Core	Machine Learning	4	2	0	3
4	Professional Elective-II	1. Software Testing Methodology 2. Cryptography & Network Security 3. Operating Systems 4. Recommended Systems 5. Predictive Analytics 6. Automata Theory & Compiler Design 7. 12-week MOOC Swayam/NPTEL course recommended by the BoS	4	2	0	3
5	Professional Elective-III	1. Software project management 2. Computer vision 3. Quantum Computing 4. Cloud computing 5. Social network analysis 6. 12-week MOOC Swayam/NPTEL course recommended by the BoS	4	2	0	3
6	Open Elective – II		3	0	0	3
7	Professional Core	Deep learning Lab	0	0	3	1.5
8	Professional Core	Big data analytics & Data Visualization Lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
Total			**25**	**11**	**08**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation						

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Semester VII (Fourth year)

S.No.	Category	Title	L	T / CLC	P	Credits
1	Professional Core	Generative AI	4	2	0	3
2	Management Course- II	Management Science Human Resource Management Enterpreneurship & Incubation	2	0	0	2
3	Professional Elective-IV	1. Software architecture and design patterns 2. Block chain technology 3. Devops 4. NoSQL Database 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	4	2	0	3
4	Professional Elective-V	1. Agile methodologies 2. Expert methodologies 3. Reinforcement learning 4. HPC 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	4	2	0	3
5	Open Elective-III		3	0	0	3
6	Open Elective-IV		3	0	0	3
7	Skill Enhancement Course	Prompt Engineering	0	1	2	2
8	Audit Course	Gender sensitization	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
Total			**22**	**7**	**02**	**21**

Semester VIII (Fourth year)

S.No.	Category	Title	L	T	P	Credits
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

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Semester I (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9903	Engineering Physics	4	2	0	3	30	70	100
2	BS	23ABS9904	Linear Algebra & Calculus	4	2	0	3	30	70	100
3	ES	23AES0201	Basic Electrical & Electronics Engineering	3	1	0	3	30	70	100
4	ES	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	23AES0501	Introduction to Programming	4	2	0	3	30	70	100
6	ES	23AES0503	IT Workshop	0	0	2	1	30	70	100
7	BS	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	23AES0202	Electrical & Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	ES	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9904	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5	50	-	50
			Total	**16**	**7**	**15**	**20.5**	**320**	**630**	**950**

Course Code	**ENGINEERING PHYSICS**		**L**	**T/CLC**	**P**	**C**
23ABS9903			**4**	**2**	**0**	**3**
Regulation: **AK23**	**Common to I B.Tech ECE, AI&DS, AI&ML, ME, CE (Sem-1) & CSE, CIC, EEE, &CSD (Sem-2)**					

Course Outcomes (CO): At the end of the course students will be able to

CO1:**Understand** the intensity variation of light due to interference, diffraction, and polarization.
CO2:**Analyze** the fundamentals of crystallography and X-ray diffraction.
CO3:**Apply** the basic concepts of dielectric and magnetic materials for engineering applications.
CO4:**Analyze** the fundamentals of Quantum mechanics and interpret the nanomaterials for engineering problems.
CO5:**Analyze** the charge carrier dynamics in semiconductors by implementing the equations of state.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	The intensity variation of light due to interference, diffraction, and polarization.			L2
2	**Analyze**	The fundamentals of crystallography and X-ray diffraction.			L4
3	**Apply**	The basic concepts of dielectric and magnetic materials		for engineering applications.	L3
4	**Analyze**	The fundamentals of Quantum mechanics and interpret the nanomaterials		for engineering problems.	L4
5	**Analyze**	The charge carrier dynamics in semiconductors.	By implementing the equations of state.		L4

UNIT I   Wave Optics   10 Hrs

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

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit (Qualitative) – Diffraction Grating.

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II Crystallography and X-ray diffraction   8 Hrs

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   8 Hrs

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-Applications of Dielectric materials.

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials - Applications of magnetic materials.

UNIT IV   Quantum Mechanics and Nanomaterials   12 Hrs

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

Nanomaterials: Introduction to Nanomaterials–Significance of nanoscale - Physical, Mechanical, Magnetic, and optical properties of nanomaterials –Synthesis of nanomaterials: Ball Milling, Applications of Nanomaterials.

UNIT V Semiconductors   10 Hrs

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

Textbooks:
1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. K.Thyagarajan —Engineering Physics‖,-Mc Graw Hill Publishing Company Ltd, 2016.
3. 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).

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

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3												
2	3												
3	3			3									
4	3												
5	3			3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	15	22.3	3	**Understand**	L2	PO1	PO1: Apply (L3)	2
2	11	16.4	2	**Analyze**	L4	PO1	PO1: Apply (L3)	3
3	12	17.9	2	**Apply**	L3	PO1, PO4	PO1, PO4: Apply (L3)	3
4	13	19.4	2	**Analyze**	L4	PO1	PO1: Apply (L3)	3
5	16	23.8	3	**Analyze**	L4	PO1, PO4	PO1, PO4: Apply (L3)	3
	67							

CO1: The intensity variation of light due to interference, diffraction, and polarization.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is lesser than PO1 verb by one level; Therefore, correlation is moderate (2).
CO2: The fundamentals of crystallography.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
CO3: Apply the basic concepts of dielectric and magnetic materials for engineering applications.
Action Verb: Apply (L3)
PO1 and PO4 Verbs: Apply (L3)
CO3 Action Verb level is equal to PO1 and PO4 verb; Therefore correlation is high (3).
CO4: The fundamentals of Quantum mechanics and interpret the nanomaterials for engineering problems.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO4 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
CO5: The charge carrier dynamics in semiconductors by implementing the equations of state.
Action Verb: Analyze (L4)
PO1 and PO4 Verb: Apply (L3)
CO5 Action verb is greater than PO1 verb; therefore, the correlation is high (3).

Year : I   **Semester** : I   **Branch of Study :** Common to All

Subject Code: 23ABS9904	Subject Name: Linear Algebra & Calculus	L 4	T/CLC 2	P 0	Credits 3	

Course Outcomes (CO):
Student will be able to
CO1. **Analyze** the matrix algebraic techniques for engineering applications.
CO2. **Understand** the concept of Eigen values, Eigen vectors and quadratic forms.
CO3. **Analyze** the mean value theorems for real time applications.
CO4. **Apply** the concepts of partial differentiation to functions of several variables.
CO5. **Apply** the multivariable integral calculus for computation of Area and Volume.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Analyze**	the matrix algebraic techniques	for engineering applications.		**L4**
2	**Understand**	the concept of eigen values, eigen vectors and quadratic forms.	-		**L2**
3	**Analyze**	the mean value theorems	for real time applications.		**L4**
4	**Apply**	the concept of Maxima and Minima	to functions of several variables.		**L3**
5	**Apply**	the multivariable integral calculus	for computation of Area and volume.		**L3**

Unit I: Matrices   **12hrs**
Rank of a matrix by Echelon form, Normal form, Cauchy-Binet formula (without proof).Inverse of Non-singular matrices by Gauss-Jordan method, system of linear equations: solving system of Homogeneous and Non-homogeneous equations by Gauss Elimination method, Jacobi and Gauss Seidel Iteration methods.

Unit II: Eigen values, Eigen vectors and Orthogonal Transformation   **9hrs**
Eigen values, Eigen vectors 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: Calculus   **9hrs**
Mean Value Theorems: Rolle's theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof), problems and applications on the above theorems.

Unit IV: Partial differentiation and Applications(Multi Variable Calculus)   **10hrs**
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 V: Multiple Integrals   **10hrs**
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).

Textbooks:
1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

References:
1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass,Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar,Alpha Science International Ltd., 25th Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearsonpublishers, 2018, 5 th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearsonpublishers, 9 th edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1		3									
2		2									
3		3									
4	3										
5	3										

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	10	14	2	Analyze	L4	PO2	Analyze	3
2	15	21.4	3	Understand	L2	PO2	Apply	2
3	15	21.4	3	Analyze	L4	PO2	Analyze	3
4	16	22.8	3	Apply	L3	PO1	Apply	3
5	14	20	3	Apply	L3	PO1	Apply	3

CO1: Analyze the matrix algebraic techniques that are needed for engineering applications.
Action Verb: Analyze(L4)
PO2 Verbs: Analyze (L4)
CO1 Action Verb is equal toPO2 verb ; Therefore correlation is high (3).

CO2: Understand the concept of eigen values, eigen vectors and quadratic forms.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO2 Action Verb is low level to PO1 verb by one level; Therefore correlation is moderate (2).

CO3: Analyze the mean value theorems for real life problems.
Action Verb: Analyze (L4)
PO1 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

CO4: Apply the concept of Maxima and Minima of functions of several variables.
Action Verb: Apply (L3)
PO2 Verb: Apply (L3)
CO4 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

CO5: Apply the multivariable integral calculus for computation of area and volume.
Action Verb: Apply(L3)
PO1 Verb: Apply (L3)
CO5 Action verb is high level to PO1 verb; therefore the correlation is high (

Course Code	Year & Sem	Basic Electrical & Electronics Engineering	L	T	P	C
23AES0201	I-I		3	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the fundamental laws of A. C circuits and D. C circuits.

CO2: **Understand** operating principles of motors, generators and measuring instruments.

CO3: **Understand** the fundamentals of power generation, costing and safety measures.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
1	Understand	The fundamentals laws of A. C circuits and D. C circuits.		A. C circuits and D. C circuits	L2
2	Understand	Operating principles of motors, generators and measuring instruments.			L2
3	Understand	The fundamentals of Power generation, costing and safety measures.			L2

PART-A
BASIC ELECTRICAL ENGINEERING

UNIT I: DC & AC Circuits

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

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

UNIT II: Machines and Measuring Instruments

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

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

UNIT III: Energy Resources, Electricity Bill & Safety Measures

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

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

WEB RESOURCES:

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

PART-B

<u>COURSE OUTCOMES:</u>

After completion of the course, students will be able to:

CO4: **Understand** the fundamental concepts of diodes, transistors and its applications.

CO5: **Analyze** the concepts of rectifiers, power supplies and amplifiers in electronics.

CO6: **Analyze** the concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
4	Understand	fundamental concepts of diodes, transistors and its applications			L2
5	Analyze	concepts of rectifiers, power supplies and amplifiers in electronics			L4
6	Analyze	concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits			L4

UNIT I: 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.

UNIT II   : BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

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

UNIT III: DIGITAL ELECTRONICS

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

Textbooks:

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

Reference Books:

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

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2	2				1						2	
CO2	2	1				1						1	
CO3	2	1				2						1	2
CO4	2	3											
CO5	3	3											
CO6	3	3											

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Justification Table:

CO	CO					Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	08	30	3	**Understand**	**L2**	PO1, PO2, PO6	PO1: Apply (L3) PO2: Identify (L3) PO6: Thumb Rule	2 2 1
2	08	30	3	**Understand**	**L2**	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	2 1 1
3	10	38	3	**Understand**	**L2**	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	2 1 2
4	08	30	3	Understand	**L2**	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	2 3
5	08	30	3	Analyze	**L4**	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3
6	10	38	3	Analyze	**L4**	PO1, PO2	PO1:Apply(L3) PO2:Review (L2)	3 3

CO1: Understand the fundamental laws of AC and DC circuits.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO1 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Identify (L3)
CO1 Action Verb is Less than PO2 verb by one level; Therefore, correlation is moderate (2).
PO6: Using thumb rule, CO1 correlates PO6 as low (1).
CO2: Understand operating principles of motors, generators, MC and MI instruments.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO2 Action Verb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6: Using thumb rule, CO2 correlates PO6 as low (1).
CO3: Understand the fundamentals of power generation, costing and safety measures.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO3 Action Verb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6: Using thumb rule, CO3 correlates PO6 as medium (2).
CO4: Understand the fundamental concepts of diodes, transistors and its applications
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verbs: Review (L2)
CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO5: Analyze the concepts of rectifiers, power supplies and amplifiers in electronics.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO5 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO6: Analyze the concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO6 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO6 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE (AI)

Course Code	Year & Sem	Engineering Graphics	L	T	P	C
23AES0301	I-I		1	0	4	3

Course Outcomes:

After studying the course, student will be able to

CO: 1   **Apply** the concepts of engineering curves and scales for technical drawing.

CO: 2   **Understand** the quadrant system to locate the position of points, lines and planes.

CO: 3   **Analyze** the projection of solids located in quadrant system.

CO: 4   **Analyze** the sectional views and development of surfaces of regular solids.

CO: 5   **Apply** orthographic and isometric projections concepts to construct the given object

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the concepts of engineering curves and scales	for technical drawing		L3
CO2	Understand	the quadrant system to locate the position of points, lines and planes			L2
CO3	Analyze	the projection of solids	located in quadrant system		L4
CO4	Analyze	the sectional views and development of surfaces	of regular solids		L4
CO5	Apply	orthographic and isometric projections concepts to construct the given object			L3

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

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

Scales: Plain scales, diagonal scales and vernier scales.

Unit II

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

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

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

Unit III

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

Unit IV

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

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

Unit V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. **Computer graphics**: Creating 2D&3D drawings of objects including PCB and Transformationsusing Auto CAD (*Not for end examination*).

Text Books:

1. K. L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers

2. N. D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers

Reference Books:
1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B. Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, TataMcGraw Hill, 2017.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Engineering Graphics	CO1	3		3							3		2	2
	CO2	2		2							3		2	2
	CO3	2		2							3		2	2
	CO4	3		3							3		2	2
	CO5	3		3							3		2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation Matrix

CO	CO						Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL				
1	18	24	3	Apply	L3		PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
2	15	20	2	Understand	L2		PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	2 2 3
3	15	20	2	Analyze	L4		PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
4	15	20	2	Analyze	L4		PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
5	12	16	2	Apply	L3		PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3

Justification Statements:

CO1: Apply the concepts of engineering curves and scales for technical drawing.
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Develop (L3)**
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO10 Verb: Thumb Rule (TR)
CO1: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

CO2: Understand the quadrant system to locate the position of points, lines and planes.
Action Verb: Understand (L2)
PO1 Verb: **Apply (L3)**
CO2: Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2) PO2 Verb: **Develop (L3)**
CO2: Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)
PO10 Verb: Thumb Rule (TR)
CO2: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

CO3: Analyze the projection of solids located in quadrant system.
Action Verb: Analyze (L4)
PO1 Verb: **Apply (L3)**
CO3: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Develop (L3)**
CO3: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO10 Verb: Thumb Rule (TR)

CO3: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)
CO4: Analyze the sectional views and development of surfaces of regular solids
Action Verb: Analyze (L4)
PO1 Verb: **Apply (L3)**
CO4: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Develop (L3)**
CO4: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO10 Verb: Thumb Rule (TR)
CO4: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)
CO5: Apply orthographic and isometric projections concepts to construct the given object.
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO5: Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Develop (L3)**
CO5: Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO10 Verb: Thumb Rule (TR)
CO5: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

Course Code	Year & Sem	INTRODUCTION TO PROGRAMMING	L	T / CLC	P	C
23AES0501	I-I	**(Common to All branches of Engineering)**	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO 1: **Understand** the computer Programming concepts and Algorithms.

CO 2: **Analyze** the control structures to implement basic programs.

CO 3: **Understand** the concept of Arrays and string to manipulate the stored data.

CO 4: **Create** the dynamic memory allocation using pointers and structures.

CO 5: **Create** the user defined functions and files for modifying stored data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the computer Programming concepts and Algorithms.			L2
CO2	Analyze	the control structures		to implement basic programs.	L4
CO3	Understand	the concept of Arrays and string		to manipulate the stored data	L2
CO4	Create	the dynamic memory allocation	using pointers and structures.		L6
CO5	Create	user defined functions and files		for modifying stored data.	L6

UNIT – I	Introduction to Programming and Problem Solving	10 Hrs

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	9 Hrs

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

UNIT – III	Arrays and Strings	9 Hrs

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

UNIT – IV	Pointers & User Defined Data types	9 Hrs

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

UNIT – V	Functions & File Handling	9 Hrs

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Textbooks:

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

Reference Books:

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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2									3	
CO2	3	3	3								2	2	
CO3	2	3									2	2	
CO4	3	3	3								2	2	
CO5	3	3	3									2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	19	25%	3	CO1: Understand	L2	PO1 PO2 PO3	PO1: Apply(L3) PO2: Review(L2) PO3:Develop(L3)	2 3 2
2	10	14%	2	CO2: Analyze	L4	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO11: Thumb rule	3 3 3 2
3	19	25%	3	CO3: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review (L2) PO1: Thumb rule	2 3 2
4	15	20%	2	CO4: Create	L6	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 2
5	12	16%	2	CO5: Create	L6	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 3
	75	100 %						

Justification Statements :

CO1: Understand the computer Programming concepts and Algorithms.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review (L2)
CO1 Action verb is same as than as PO2 verb by two level. Therefore, the correlation is High (3)
PO3 Verb: Develop (L3)
CO1 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate (2)
CO2: Analyze the control structures to implement basic programs.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Some of the flow of control statements knowledge are used to solve various problems. Therefore, the correlation is moderate (2)
CO3: Understand the concept of Arrays and string to manipulate the stored data.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Review (L2)
CO3 Action verb is Same as PO2 verb. Therefore, the correlation is High (3)
PO11: Thumb rule
For some matrix operations array and string concepts were used Therefore, the correlation is moderate (2)
CO4: Create the dynamic memory allocation using pointers and structures.
Action Verb: Create (L6)
PO1: Apply (L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)

CO4 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some mathematical operations Pointers and structures are used to manipulate the memory references. Therefore, the correlation is moderate (2)

CO5: Create the user defined functions and files for modifying stored data.
Action Verb: Create (L6)
PO1: Apply (L3)
CO5 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
In today's world file handling techniques were used in most of the areas. Therefore, the correlation is high (3)

Course Code	Year & Sem	IT workshop	L	T	P	C
23AES0503	I-I	**(Common to AIDS&AIML)**	0	0	2	1

Course Outcomes:

After studying the course, student will be able to

CO1: Understand The Process of Software Installation & Hardware troubleshooting.

CO2: Analyze the network configurations for customizing web pages and search engines.

CO3: Apply the basic editing function, formatting text & objects on a required content.

CO4: Apply the formulas, functions and visualizations to manage the data.

CO5: Understand the libraries and models of chatGPT to generate information.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	The Process of Software Installation & Hardware troubleshooting.			L2
CO2	**Analyze**	the network configurations		for customizing web pages and search engines	L4
CO3	**Apply**	The basic editing function, formatting text & objects		on a required content	L3
CO4	**Apply**	the formulas, functions and visualizations		to manage the data	L3
CO5	**Understand**	The libraries and models of chatGPT		to generate information	L2

List of Experiments

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.[CO1]

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.[CO1]

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.[CO1]

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.[CO1]

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.[CO1]

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is
 no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.[CO2]

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.[CO2]

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. [CO2]

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. [CO2]

LaTeX and WORD

Task 1 – 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. [CO3]

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. [CO3]

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. [CO3]

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. [CO3]

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. [CO4]

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text[CO4]

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, [CO4]

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting[CO4]

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. [CO4]

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts. [CO4]

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. [CO4]

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. [CO5]

• 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[CO5]

• 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. [CO5]

• 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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3										1	
CO2	3	3	3	3	3								
CO3	3	3	3	2	3						3	2	
CO4	3	3	3	2	3						3		2
CO5	2	2											1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	CO2: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 2 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 2 3 3
5	CO5: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify (L3)	2 2

Justification Statements :

CO1: Understand The Process of Software Installation & Hardware troubleshooting

Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2 Verb: Review(L2)

CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)

CO2: Analyze the network configurations for customizing web pages and search engines

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

PO2: idetify(L3)

CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

PO5: Apply (L3)

CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO 3: Apply The basic editing function, formatting text & objects on a required content.

Action Verb: Apply (L3)

PO1: Apply (L3)

CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

PO2: Review(L2)

CO3 Action verb is less than as PO2 verb. Therefore, the correlation is high(3)

PO3: Develop(L3)

CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is less than as PO4 verb. Therefore, the correlation is moderate (2)

PO5: Apply (L3)

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

Documentation and presentation is learning process to find the solution better manner the correlation is high (3)

CO 4: Apply the formulas, functions and visualizations to manage the data.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is less than as PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply (L3)
CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Spread sheets in Excel is the trending approach in the current days Therefore, the correlation is high (3)
CO 5: Understand the libraries and models of chatGPT to generate information.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Identify(L3)
CO1 Action verb is same as PO2 verb. Therefore, the correlation is moderate (2)

Subject Code: 23ABS9908	Subject Name: **Engineering Physics Lab**	L T P 0 0 2	Credits: 1

Course Outcomes

CO1: **Analyze** the properties of light for engineering problems.
CO2: **Evaluate** the crystallite size using X-ray diffraction.
CO3: **Analyze** the basic properties of dielectric and magnetic behavior of the given material.
CO4: **Determine** the mechanical behavior of a given material.
CO5: **Evaluate** the basic parameters of a given semiconductor material.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Analyze	The properties of light		for engineering problems.	L4
2	Evaluate	The crystallite size using X-ray diffraction.			L5
3	Analyze	The basic properties of dielectric and magnetic behavior of the given material.			L4
4	Determine	The mechanical behavior of a given material.			L5
5	Evaluate	The basic parameters of a given semiconductor material.			L5

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings – CO1.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration – CO1.
3. Study the variation of B versus H by magnetizing the magnetic material (B-H curve) – CO3.
4. Determination of wavelength of Laser light using diffraction grating – CO1.
5. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method – CO3.
6. Determination of energy gap of a semiconductor using p-n junction diode – CO5.
7. Determination of the resistivity of semiconductors by four probe methods – CO5.
8. Determination of the crystallite size using X-Ray Diffraction spectra – CO2.
9. Determination of the numerical aperture of a given optical fiber and angle of acceptance – CO1.
10. Verification of Brewster's law – CO1.
11. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum – CO4.
12. Determination of rigidity modulus of the material of the given wire using Torsional   pendulum   – CO4.
13. Determination of temperature coefficients of a thermistor – CO5.
14. Determination of dielectric constant using charging and discharging method – CO3.
15. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect – CO5.
16. Sonometer: Verification of laws of stretched string – CO4.
17. Determination of magnetic susceptibility by Kundt's tube method – CO3.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment – CO4.

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

Experiments may be conducted in virtual mode.
References: A Textbook of Practical Physics - S. Balasubramanian, M. N. Srinivasan, S. Chand Publishers, 2017.
URL: www.vlab.co.in

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3			3									
2	3			3									
3	3			3									
4	3			3									
5	3			3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	9	25	3	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
2	6	16	2	Evaluate	L5	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
3	9	25	3	Analyze	L4	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
4	6	16	2	Determine	L5	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
5	6	16	2	Evaluate	L5	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
	36							

CO1: Analyze the properties of light for solving engineering problems.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
   CO1 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
   CO1 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

CO2: Evaluate the crystallite size using X-ray diffraction.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)

   CO2 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).
   CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

CO3: Analyze the basic properties of dielectric and magnetic behavior of the given material.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
   CO3 Action Verb level is greater than PO1 action verb by one level; Therefore correlation is high (3).
   CO3 Action Verb level is equal to PO4 action verb; Therefore correlation is high (3).

CO4: Determine the mechanical behavior of a given material using dynamic methods.
Action Verb: Determine (L5)
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
   CO4 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).
   CO4 Action Verb is greater than PO4 verb by one level; Therefore correlation is high (3).

CO5: Evaluate the basic parameters of a given semiconductor material.
Action Verb: Evaluate (L5)
PO1 and PO4 Verb: Apply (L3)
   CO5 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).
   CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

Course Code	Year & Sem	**Electrical & Electronics Engineering Workshop**	L	T	P	C
23AES0202	I-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

    CO1: **Understand** the Electrical circuit design, measurement of resistance, power, and power factor.

    CO2: **Apply** suitable methods to measure Resistance, power, energy and power factor.

    CO3: **Design** suitable methods for magnetization characteristics of D. C shunt generator.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Electrical circuit design; measurement of resistance, power, power factor			L2
CO2	Apply	Suitable methods to measure Resistance, power, energy and power factor.			L3
CO3	Design	Suitable methods for magnetization characteristics of D. C shunt generator.			L6

SYLLABUS:

PART A
ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of Kirchhoff's current law and Voltage law-(CO1).
2. Verification of Superposition theorem-(CO1).
3. Measurement of Resistance using Wheat stone bridge-(CO1).
4. Measurement of Power and Power factor using Single-phase watt-meter-(CO2).
5. Measurement of Earth Resistance using Megger-(CO2).
6. Calculation of Electrical Energy for Domestic Premises-(CO2).
7. Magnetization Characteristics of DC shunt Generator-(CO3).

Reference Books:

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

Note: Minimum Six Experiments to be performed.

PART B
ELECTRONICS ENGINEERING LAB

COURSE OUTCOMES:

After completion of the course, students will be able to:

CO4: **Understand** the V-I Characteristics of diodes and its applications.

CO5: **Analyze** the input and output characteristics of BJT and its applications.

CO6: **Analyze** the truth tables of all logic gates and f/f's using IC's.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO4	Understand	V-I Characteristics of diodes and its applications.			L2
CO5	Analyze	input and output characteristics of BJT and its applications			L4
CO6	Analyze	Truth tables of all logic gates and f/f's using IC's.			L4

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias. (CO4)

2. Plot VI characteristics of Zener Diode and its application as voltage Regulator. (CO4)

3. Implementation of half wave and full wave rectifiers (CO4)

4. Plot Input & Output characteristics of BJT in CE and CB configurations (CO5)

5. Frequency response of CE amplifier. (CO5)

6. Simulation of RC coupled amplifier with the design supplied. (CO5)

7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs. (CO6)

8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. (CO6)

Tools Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROS, and all the required active devices.

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

3. R. T. Paynter, Introductory Electronic Devices & Circuits - Conventional Flow Version, Pearson Education, 2009.

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

Mapping of course outcomes with program outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping of Course outcomes with Program outcomes													
CO1	2	1		1					1			2	
CO2	3	2		2					1			2	
CO3		3		3					1			2	1
CO4	2	3											
CO5	3	3											
CO6	3	3											
Levels of correlation,viz.,1.Low,2.Moderate,3.High													

Justification Table:

CO	COs		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	**BTL**			
1	**Understand**	**L2**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4: Analyze (L4) PO9: Thumb Rule	2 1 1 1
2	**Apply**	**L3**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4: Analyze(L4) PO9: Thumb Rule	3 2 2 1
3	**Design**	**L6**	PO2, PO4, PO9	PO2: Analyze(L4) PO4: Design (L6) PO9: Thumb Rule	3 3 1
4	Understand	**L2**	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	2 3
5	Analyze	**L4**	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3
6	Analyze	**L4**	PO1, PO2	PO1:Apply(L3) PO2:Review (L2)	3 3

CO1: Understand the Electrical circuit design, measurement of resistance, power, and power factor.

Action Verb: Understand (L2)

PO1: Apply (L3)

CO1 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action Verb is Less than PO2 verb by two level; Therefore, correlation is low (1).

PO4: Analyze (L4)

CO1 Action Verb is Less than PO4 verb by two level; Therefore, correlation is low (1).

PO9: Using Thumb Rule, CO1 correlates to PO9 as low (1).

CO2: Apply suitable methods to measure Resistance, power, energy and power factor.

Action Verb: Apply (L3)

PO1: Apply (L3)

CO2 Action Verb is same as PO1 verb; Therefore, correlation is high (3).

PO2: Analyze (L4)

CO2 Action Verb is Less than PO2 verb by one level; Therefore, correlation is moderate (2).
PO4: Analyze (L4)
CO2 Action Verb is Less than PO4 verb by one level; Therefore, correlation is moderate (2).
PO9: Using Thumb Rule, CO2 correlates to PO9 as low (1).

CO3: Design suitable methods for magnetization characteristics of D. C shunt generator.
Action Verb: Design (L6)
PO2: Analyze (L4)
CO3 Action Verb is greater than PO2 verb by two level; Therefore, correlation is high (3).
PO4: Design (L6)
CO3 Action Verb is same as PO4 verb; Therefore, correlation is high (3).
PO9: Using Thumb Rule, CO3 correlates to PO9 as low (1).

CO4: Understand the V-I Characteristics of diodes and its applications.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2)
PO2 Verbs: Review (L2)
CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO5: Analyze the input and output characteristics of BJT and its applications.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO5 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO6: Analyze the truth tables of all logic gates and f/f's using IC's.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO6 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO6 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

Course Code	Year & Sem	COMPUTER PROGRAMMING LAB	L	T	P	C
23AES0502	I-I	(Common to All Branches of Engineering)	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the basic syntax of C program to build applications.

CO2: Create the control structure for solving complex problems.

CO3: Apply the concepts of arrays, functions, basic concepts of pointers to organize the data.

CO4: Apply the concepts of structures, unions and linked list to manage heterogeneous data .

CO5: Create the file applications for storing and accessing data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic syntax of C program		to build applications	L2
CO2	Create	the control structure		for solving complex problems	L6
CO3	Apply	the concepts of arrays, functions, basic concepts of pointers		to organize the data	L3
CO4	Apply	the concepts of structures, unions and linked list		to manage heterogeneous data	L3
CO5	Create	the file applications		for storing and accessing data	L6

List of Experiments:

Exercise 1: Problem-solving using Computers[CO1]

   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()

Exercise 2: Problem-solving using Algorithms and Flow charts.[CO1]

   i)   Sum and average of 3 numbers

   ii)   Conversion of Fahrenheit to Celsius and vice versa

   iii)   Simple interest calculation

Exercise 3: Variable types and type conversions[CO2]

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

Exercise 4: Operators and the precedence and as associativity[CO2]

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

list and perform insertion, deletion, and traversal.

Exercise 5: Branching and logical expressions[CO2]

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.

Exercise 6: Loops, while and for loops[CO2]

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

    iv) Construct a pyramid of numbers.

Exercise 7: 1 D Arrays: searching[CO3]
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.

Exercise 8: 2 D arrays, sorting and Strings[CO3]
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

Exercise 9: Pointers, structures and dynamic memory allocation[CO3]
   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()

Exercise 10: Bitfields, Self-Referential Structures, Linked lists[CO4]
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.

Exercise 11: Functions, call by value, scope and extent[CO2]
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

Exercise 12: Recursion, the structure of recursive calls[CO4]
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.

Exercise 13: Call by reference, dangling pointers[CO4]
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.
v)   Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

Exercise 14: File handling[CO5]
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.

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

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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2	2								2	
CO2	3	3		3							2	2	
CO3	3	3		2	3						3	2	
CO4	3	3	3	2							2	2	
CO5	3	3	3	3							3	2	

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: understand	L2	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4)	2 3 2 2
2	CO2: Create	L6	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 2
3	CO3: Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 2 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 2 2
5	CO5: Create	L6	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 3 3

Justification Statements :
CO1: Understand the basic syntax of C program to build applications.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review(L2)
CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop(L3)
CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO4: Analyze(L4)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate is (2)

CO2: Create the control structure for solving complex problems.
Action Verb: Create (L6)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L3)
CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply(L3)

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (2)

CO3: Apply the concepts of arrays, functions, basic concepts of pointers to organize the data..

Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L3)
CO3 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply(L3)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (3)

CO4: Apply the concepts of structures, unions and linked list to manage heterogeneous data.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L3)
CO4 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply(L3)
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (2)

CO5: Create the file applications for storing and accessing data.
Action Verb: Create (L6)
PO1: Apply (L3)
CO5 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L3)
CO5 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (3)

Course Code	Year & Sem	NSS/NCC/Scouts & Guides/Community Service	L	T	P	C
23AHM9904	I-I		0	0	1	0.5

Course Outcomes: After studying the course, students will be able to

CO1: **Understand** the importance of discipline, character and service motto of community.
CO2: **Analyze** the activities need to be done for nature protection
CO3: **Analyze** the social issues in a community and address it through the base camps.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the importance of discipline, character and service motto		of community	L1
CO2	Analyze	the activities need to be done for nature protection			L4
CO3	Analyze	the social issues in a community and address it through the base camps			L4

UNIT-I

Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.
Activities:
   i) Conducting –ice breaking sessions-expectations from the course-knowing personaltalents and skills
   ii) Conducting orientations programs for the students –future plans-activities-releasingroad map etc.
   iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
   iv) Conducting talent show in singing patriotic songs-paintings- any other contribution

UNIT-II

Nature & Care
Activities:
   i) Best out of waste competition.
   ii) Poster and signs making competition to spread environmental awareness.
   iii) Recycling and environmental pollution article writing competition.
   iv) Organizing Zero-waste day.
   v) Digital Environmental awareness activity via various social media platforms.
   vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
   vii) Write a summary on any book related to environmental issues.

UNIT-III

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

CORRELATION OF COS WITH THE POS & PSOS:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2								2			2
CO2	3	3								3			2
CO3	3	3								3			2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-POMAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s):Action Verb and BTL(forPO1 to PO12)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Understand	L2	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 2 2
2	Analyze	L4	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 3 3
3	Analyze	L4	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 3 3

Justification Statements:

CO1: Understand the importance of discipline, character and service motto of community.
Action Verb: Understand (L2)

   CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
   CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
   CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO10 as moderate (2).

CO2: Analyze the activities need to be done for nature protection
Action Verb: Analyze (L4)

CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is moderate (2).
CO2 Action Verb is same as PO2 verb, Therefore correlation is High (3)
CO2 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO10 as moderate (4).

CO3: Analyze the social issues in a community and address it through the base camps
Action Verb: Analyze (L4)

   CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is moderate (2).
   CO3 Action Verb is same as PO2 verb, Therefore correlation is High (3)

CO3 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO10 as moderate (4). **Textbooks:**

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
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.

Reference Books:

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

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547
618816347_shared/overview

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1		3			2							3	
CO2		3	3	2	3							2	
CO3			3	2	3							2	2
CO4		3	3	3	3			3		3	3	2	2
CO5			3		3			3		3	3	2	

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO2 PO5	PO2: Review(L2) PO5: Apply(L3)	3 2
2	CO2 :Apply	L3	PO2 PO3 PO4 PO5	PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 2 3
3	CO3: Apply	L3	PO3 PO4 PO5	PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 2 3
4	CO4: Analyze	L4	PO2 PO3 PO4 PO5 PO8 PO10 PO11	PO2: Analyze (L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3
5	CO5 :Create	L6	PO3 PO5 PO8 PO10 PO11	PO3: Design (L6) PO5: Create(L6) PO8: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3

Justification Statements :
CO1: Understand Java syntax thoroughly, encompassing data types and control structures.
Action Verb : Understand(L2)
PO2: Review(L2)
CO1 Action verb is same PO2 verb. Therefore the correlation is High(3)
PO5: Apply(L3)
CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)
CO2: Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.
Action Verb : Apply (L3)
PO2: Review(L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation is High(3)
PO3: Develop (L3)
CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is less than PO4 verb by one levels. Therefore the correlation is moderate (2)
PO5: Apply (L3)
CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
CO3: Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.
Action Verb : Apply(L3)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate(2)
PO5: Apply (L3)
CO3 Action verb is same as PO5 verb. Therefore the correlation is high(3)
CO4: Analyze the concepts of multithreading and collection frameworks for solving complex programs.
Action Verb :Analyze (L4)
PO2: Analyze (L4)
CO4 Action verb is same PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)

PO5: Apply (L3)

CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

PO8: Thumb Rule

It is a programming language we need to collaborate with team. Therefore the correlation is high (3)

PO10: Thumb Rule

By using java to manage enterprise projects in multi-disciplinary environments . Therefore the correlation is high (3)

PO11: Thumb Rule

It is a programming language we need to learn lifelong because new concepts arise. Therefore the correlation is high (3)

CO5: Create GUI based applications using Java FX.

Action Verb : Create (L6)

PO3: Design (L6)

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO5: Create(L6)

CO5 Action verb is same as PO5 verb. Therefore the correlation is high (3)

PO8: Thumb Rule

It is a programming language we need to collaborate with team. Therefore the correlation is high (3)

PO10: Thumb Rule

By using java to manage enterprise and web based projects in multi-disciplinary environments. Therefore the correlation is high (3)

PO11: Thumb Rule

It is a programming language we need to learn lifelong because new concepts arise. Therefore the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE (AI)
(Effective for the batches admitted in 2023-24)

Semester II (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	HM	23AHM9901	Communicative English	2	2	0	2	30	70	100
2	BS	23ABS9901	Chemistry	4	2	0	3	30	70	100
3	BS	23ABS9905	Differential Equations &Vector Calculus	4	2	0	3	30	70	100
4	ES	23AES0101	Basic Civil& Mechanical Engineering	3	0	0	3	30	70	100
5	PC	23APC0501	Data Structures	4	2	0	3	30	70	100
6	HM	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	BS	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	ES	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	23APC0502	Data Structures Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9903	Health and wellness, Yoga and Sports	0	0	1	0.5	50	-	50
			Total	**17**	**8**	**11**	**19.5**	**320**	**630**	**950**

Year: I B.Tech		(Common to all branches)				Semester: II	

Subject Code 23AHM9901	Subject Name **COMMUNICATIVE ENGLISH**	L 2	T 2	P 0	Credit: 2	CLC: 2

Pre-Requisites	Communicative English	Semester	**II**

Course Outcomes (CO): Student will be able to

 CO1: Understand reading / listening texts and to write summaries based on global comprehension of these texts.**(Listening & Reading)**

 CO2: Apply grammatical structures to formulate sentences and correct word forms.**(Grammar)**

 CO3: Analyze discourse markers to speak clearly on a specific topic in formal and informal conversations.(**Speaking**)

 CO4: Analyze a coherent paragraph interpreting graphic elements,figure/graph/chart/table**(Read & Write)**

 CO5: Create a coherent essay, letter writing, report writing and design a resume.**(Writing)**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	reading / listening texts and to write summaries based on global comprehension of these texts.			L2
2	Apply	grammatical structures to formulate sentences and correct word forms			L3
3	Analyze	Analyze discourse markers to speak clearly on a specific topic in formal and informal conversations...			L4
4	Analyze	coherent paragraph interpreting a graphic elements.			L4
5	Create	coherent essay, letter writing, report writing and design a resume			L6

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

Grammar: Verbs - tenses; subject-verb agreement**.**
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, Cover letters
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

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

Textbooks:
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)

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.

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

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

Correlation of COs with the POs & PSOs for B.Tech

Course Outcomes COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1									2		
CO2								2	2		
CO3									3		
CO4									3		
CO5									3		

(*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	12	22	3	**Understand**	**L2**	PO9	Thumb Rule	2
2	12	22	3	**Apply**	**L3**	PO8,PO9	Thumb Rule	2,2
3	10	18	**2**	**Analyze**	**L4**	PO9	Thumb Rule	3
4	10	18	**2**	**Analyze**	**L4**	PO9	Thumb Rule	3
5	10	18	**2**	**Create**	**L6**	PO9	Thumb Rule	3

CO1: Understand reading / listening text and to write summaries based on global comprehension of these texts.
Action Verb: Understand (L2)
CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO2: Apply grammatical structures to formulate sentences and correct word forms.
Action Verb: Apply (L3)
CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2) & (2)
CO3: Analyze discourse markers to speak clearly on a specific topic in Formal and informal Conversations.
Action Verb: Analyze (L4)
CO3 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).
CO4: Analyze a coherent paragraph interpreting graphic elements, figure/graph/chart/table
(Read & Write)
Action Verb: Analyze (L4)
CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L6 correlates PO6 to PO11 as high (3).
CO5: Create a coherent essay, letter writing, report writing and design a resume.(Writing)
Action Verb: Create(L6)
CO5 Action Verb Create is of BTL 6. Using Thumb rule, L5 correlates PO6 to PO1 as high (3).

<table>
<tr><td rowspan="3"></td><td colspan="4">ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI
(Autonomous)
(Effective for the batches admitted from 2023-24)</td></tr>
</table>

	ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI
	(Autonomous)

(Effective for the batches admitted from 2023-24)

Year: I B.Tech	(Semester: I **CSE, CIC, CSD& EEE**)	(Semester: II **ECE, AI&DS & AI&ML**)

Subject Code: 23ABS9901	**Subject Name:** Chemistry	L	T/CLC	P	Credits:3
		4	2	0	

Course Outcomes (CO): At the end of the course students will be able to
1. **Understand** the interaction of energy levels between atoms and molecules
2. **Apply** the principle of Band diagrams in the conductors and semiconductors
3. **Apply** the electrochemical principles to the construction of batteries, fuel cells and sensors
4. **Analyze** the preparation and mechanism of plastics, Elastomers and conducting polymers
5. **Analyze** the separation of liquid mixtures using instrumental methods.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the interaction of energy levels		between atoms and molecules	L2
2	**Apply**	principle of Band diagrams	conductors and semiconductors		L3
3	**Apply**	electrochemical principles to the construction of batteries, fuel cells and sensors			L3
4	**Analyze**	preparation and mechanism of plastics, Elastomers and conducting polymers			L4
5	**Analyze**	the separation of liquid mixtures	using instrumental methods		L4

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 O_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II: Modern Engineering materials
Semiconductors: Introduction, basic concept, application
Super conductors: Introduction basic concept, applications.
Super capacitors: Introduction, Basic Concept-Classification – Applications.
Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon Nano tubes and Graphines nanoparticles.

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

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

UNIT IV   Polymer Chemistry
Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.
Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.
Elastomers–Buna-S, Buna-N–preparation, properties and applications.
Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT V   Instrumental Methods and Applications

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

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

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

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2												
2	3												
3	3												
4		3											
5		3											

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10	10	15.6	2	Understand	L2	PO1	PO1: Apply (L3)	2
2	10	17	26.5	3	Apply	L3	PO1	PO1: Apply (L3)	3
3	10	12	18.7	3	Apply	L3	PO2	PO1: Apply (L3)	3
4	10	13	20.3	3	Analyze	L4	PO2	PO2: Analyze (L4)	3
5	10	12	18.7	3	Analyze	L4	PO1	PO2: Analyze (L4)	3

CO1: Understand the fundamentals of Atoms and Molecules
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
CO2: Apply electrochemical principles to construct batteries
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
CO3: Apply electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors
Action Verb: Apply (L3)
PO2 Verb: Apply (L3)
CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).
CO4: Analyze the preparation and mechanism of polymers
Action Verb: Analyze (L4)
PO2 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).
CO5: Analyze the identification of individual components
Action Verb: Analyze (L4)
PO1 Verb: Analyze (L4)
CO5 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

	ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI				
	(Autonomous)				
	(Effective for the batches admitted from 2023-24)				

Year : I	**Semester** : II	**Branch of Study : Common to all**			

Subject Code: 23ABS9905	**Subject Name: Differential Equations & Vector Calculus**	**L** **4**	**T/CLC** **2**	**P** **0**	**Credits** **3**

Course Outcomes (CO): Student will be able to

CO1. **Apply** the concepts of ordinary differential equations of first order and first degree.
CO2. **Apply** the methods of linear differential equations related to various engineering problems.
CO3. **Analyze** the solutions of partial differential equations using Lagrange's method.
CO4. **Understand** the different operators and identities in the vector calculus.
CO5. **Evaluate** the surface integral and volume integral in the vector calculus using various theorems.

CO	**Action Verb**	**Knowledge Statement**	**Condition**	**Criteria**	**Blooms level**
1	Apply	The concepts of ordinary differential equations.		of first order and first degree	L3
2	Apply	The methods of linear differential equations related to various engineering problems.			L3
3	Analyze	The solutions of partial differential equations.	Using Lagrange's method		L4
4	Understand	different operators and identities in the vector calculus.			L2
5	Evaluate	the surface integral and volume integral in the vector calculus.	Using various theorems		L5

UNIT I: Linear Differential Equations of first Order and first Degree   9hrs
Linear differential equations-Bernoulli's equations-Exat equations and equations reducible to exact form. Applications: Newton's Law of cooling-Law of natural growth and decay-Electrical circuits.

UNIT II: Equations Reducible to Linear Differential Equations and Applications   9 hrs
Definitions, homogeneous and non-homogeneous , complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and simple Harmonic motion.

UNIT III: Partial Differential Equations   9 hrs
Introduction and formation of partial differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV: Vector differentiation   9 hrs
Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V: Vector integration   9 hrs
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 applications of these theorems.

Text Books :
1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.

References:
1. Dr.T.K.V.Iyengar, Engineering Mathematics-I,S.Chand publishers
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics,Laxmipublication,2008
4. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	3										
2	3										
3		3									
4	2										
5		3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	14	20.8	3	Apply	L4	PO1	Apply	3
2	15	22.3	3	Apply	L3	PO1	Apply	3
3	14	20.8	3	Analyze	L4	PO2	Analyze	3
4	9	13.4	2	Understand	L2	PO1	Apply	2
5	15	22.3	3	Evaluate	L5	PO2	Analyze	3

CO1: Apply the concepts of ordinary differential equations of first order and first degree.
Action Verb: Apply(L3)
PO1 Verbs: Apply(L3)
CO1 Action Verb is equal to PO1 verb Therefore correlation is high (3).

CO2: Apply the methods of linear differential equations related to various engineering problems.
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

CO3: Analyze the solutions of partial differential equations.
Action Verb: Analyze(L4)
PO2 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

CO4: Understand the different operators and identities in the vector calculus.
Action Verb: Understand(L2)
PO1 Verb: Apply(L3)
CO4 Action Verb is low level to PO1 to one level; Therefore correlation is moderate (2).

CO5: Evaluate the surface integral and volume integral in the vector calculus.
Action Verb: Evaluate(L5)
PO2 Verb: Analyze (L4)
CO5 Action verb is high level to PO2 verb; therefore the correlation is high (3).

Course Code	Year & Sem	Basic Civil & Mechanical Engineering	L	T	P	C
23AES0101	I-II		3	0	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society

CO2: Apply the methods of surveying in finding the measurements on Earth surface

CO3: Understand the importance of transportation, water resources and environmental engineering

CO4: Understand the applications and role of various materials in Mechanical Engineering.

CO5: Understand the different manufacturing processes and the basics of thermal engineering with its applications.

CO6: Understand the working of different mechanical power transmission systems, power plants and applications of robotics.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Various sub-divisions of Civil Engineering		Role in ensuring better society	L2
CO2	Apply	Methods of surveying	Finding the measurements	On Earth surface	L3
CO3	Understand	Importance of transportation, water resources and environmental engineering			L2
CO4	Understand	applications and role of various materials in Mechanical Engineering			L2
CO5	Understand	different manufacturing processes and the basics of thermal engineering with its applications			L2
CO6	Understand	working of different mechanical power transmission systems, power plants and applications of robotics			L2

BASICS OF CIVIL ENGINEERING (PART-A)

UNIT I

Basics of Civil Engineering:

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

UNIT II

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

UNIT III

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

Water Resources and Environmental Engineering:

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

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

Reference Books:
1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. FifthEdition
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, KhannaPublishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition

5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012

PART-B
BASICS OF MECHANICAL ENGINEERING

UNIT I

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

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

UNIT II

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

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants.

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

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

Textbooks:

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

Reference Books:

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

Mapping of COs to POs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L3) Thumb Rule	2 2 2
2	12/33	34	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L3) Thumb Rule	2 2 2
4	9/30	30	3	Understand	L2	PO1 PO6	Identify-L3 Thumb Rule	2 2
5	12/30	40	3	Understand	L2	PO1 PO7	Identify-L3 Thumb Rule	2 2
6	9/30	30	3	Understand	L2	PO1 PO5 PO7	Apply(Identify)-L3 Apply-L3 Thumb Rule	2 2 2

Justification Statements:

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO1 Action verb is not same level as PO1 verb. Therefore, the correlation is medium (2)

PO2 Verb: **Analyze(L4)**

CO1 Action verb is not same level as PO2 verb. Therefore, the correlation is medium (2)

PO7 Verb: **Thumb Rule**

CO1 correlates medium with PO7. Therefore, the correlation is medium (2)

CO2: Apply the methods of surveying in finding the measurements on Earth surface.

Action Verb: **Apply (L3)**

PO1 Verb: **Apply (L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Analyze(L4)**

CO2 Action verb is not same level as PO2 verb. Therefore, the correlation is medium (2)

PO6 Verb: **Thumb Rule**

CO2 correlates medium with PO6. Therefore, the correlation is medium (2)

CO3: Understand the importance of transportation, water resources and environmental engineering.

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO3 Action verb is not same level as PO1 verb. Therefore, the correlation is medium (2)

PO2 Verb: **Analyze(L4)**

CO3 Action verb is not same level as PO2 verb. Therefore, the correlation is medium (2)

PO7 Verb: **Thumb Rule**

CO3 correlates medium with PO7. Therefore, the correlation is medium (2)

CO4: Understand the applications and role of various materials in Mechanical Engineering.

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**

CO4 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO3 Verb: **Review-L2**

CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO7 Verb: **Thumb Rule**

CO4 correlates moderately with PO6. Therefore, the correlation is medium (2).

CO5: Understand the different manufacturing processes and the basics of thermal engineering with its applications.

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**
CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO3 Verb: **Review-L2**
CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO7 Verb: **Thumb Rule**
CO5 correlates moderately with PO6. Therefore, the correlation is medium (2).
CO6: Understand the working of different mechanical power transmission systems, power plants and applications of robotics.
Action Verb: **Understand (L2)**
PO1 Verb: **Apply (L3)**
CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO3 Verb: **Review-L2**
CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO7 Verb: **Thumb Rule**
CO5 correlates moderately with PO6. Therefore, the correlation is medium (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE (AI)

Course Code	Year & Sem	Data Structures	L	T/CLC	P	C
23APC0501	I-II	(Common to CSE, CIC, CSE(DS), AIML & AIDS)	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the concepts of Linear Data Structures to sort the data

CO 2: Apply the Linked list concepts to perform operations on data.

CO 3: Apply the stacks features to manage the memory

CO 4: Analyse various operations of queues, dequeues and their applications.

CO 5: Understand binary search trees and hash tables to facilitate indexed search

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concepts of Linear Data Structures		to sort the data	L2
CO2	Apply	The Linked list concepts		to perform operations on data.	L3
CO3	Apply	The stacks features		to manage the memory	L3
CO4	Analyse	various operations of queues, dequeues and their applications.			L4
CO5	Understand	The Binary Search Trees and hash tables		to facilitate indexed search	L2

UNIT – I		9 Hrs

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort

UNIT – II		9 Hrs

Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists

UNIT – III		9 Hrs

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

UNIT – IV		9 Hrs

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc. Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

UNIT – V		9 Hrs

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

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

Textbooks:

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

Online Learning Resources:

www.nptel.ac.in

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3										2	
CO2	3	3		2							1	2	1
CO3	3	3		3							2	2	1
CO4	3	3	3	3							2	2	2
CO5	2	3	2	3							2	2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Lesson plan(Hrs)	%	CO Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
1	18	24%	3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	14	19%	2	CO2: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Analysis (L4) PO11: Thumb rule	3 3 2 1
3	15	20%	2	CO3: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Analysis (L4) PO11: Thumb rule	3 3 2 2
4	13	18%	2	CO4: Analyse	L4	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3 2
5	14	19%	2	CO5: Understand	L2	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: review(L2) PO3: develop(L3) PO4: Interpret(L2) PO11: Thumb rule	2 3 2 3 2
	74	100 %						

Justification Statements :

CO1: Understand the concepts of Linear Data Structures to sort the data
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review (L2)
CO1 Action verb is same level as PO2. Therefore, the correlation is high (3)
CO2: Apply the Linked list concepts to perform operations on data.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L3)
CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
For some of Linear Data Structure applications, array and structure concepts are used to write programs store the data. Therefore, the correlation is low (1)

CO3: Apply the stacks features to manage the memory
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L3)
CO3 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
For some of Data Structure applications, stacks concepts are used to write programs to manage programs. Therefore, the correlation is low (1)
CO4: Analyse various operations of queues, dequeues and their applications.
Action Verb: Analyse (L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Real Time problems Data Structure applications, queues concepts are used to write programs and evaluation the memory operations. Therefore, the correlation is moderate (2)
CO5: Understand binary search trees and hash tables to facilitate indexed search
Action Verb: Create (L6)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb by three levels. Therefore, the correlation is high (3)
PO2: Review (L6)
CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO4: Interpret (L2)
CO5 Action verb is greater than PO4 verb by two levels. Therefore, the correlation is high (3)
PO11S: Thumb rule
For some of data manipulations Sorting and File Organization methods are used to solve storage problems. Therefore, the correlation is low (3)

	ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI **(Autonomous)** (Effective for the batches admitted from 2023-24)				

Year: I B.Tech **(Commonto all branches)** Semester: I & II

Subject Code **23AHM9901**	Subject Name **COMMUNICATIVE ENGLISH LAB**	L 2	T 2	P 2	Credit: 2

Course Outcomes (CO): Student will be able to

CO1: **Understand**-the different aspects of the English language proficiency with emphasis
On LSRW skills.
CO2: **Apply** communication skills through various language learning activities.
CO3: **Analyze** the English speech sounds, for better listening and speaking.
CO4: **Evaluate** and exhibit professional is min participating in debates and group discussions.
CO5: **Analyze** the mselves to face interviews in future.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the different aspects of the English language proficiency with emphasis on LSRW skills			L2
2	**Apply**	communication skills through various language learning activities			L3
3	**Analyze**	the English speech sounds, for better listening and speaking.			L4
4	**Evaluate**	and exhibit professionalism in participating in debates and group discussions			L5
5	**Analyze**	themselves to face interviews in future			L4

List of Topics:
1. Vowels & Consonants (CO3)
2. Non Verbal Communication (CO2)
3. Communication Skills(CO2)
4. Role Playor Conversational Practice (CO1,CO2)
5. E-mail Writing (CO1)
6. Just A Minute (CO1,CO2)
7. Group Discussions-methods&practice (CO4)
8. Debates-Methods &Practice (CO4)
9. PPT Presentations/Poster Presentation (CO2)
10. Interviews Skills (CO5)

Suggested Software:
- Walden Infotech
- Young India Films

Reference Books:
1. RamanMeenakshi,Sangeeta-Sharma.*TechnicalCommunication.*OxfordPress.2018.
2. TaylorGrant:*EnglishConversationPractice,*TataMcGraw-HillEducationIndia,2016
3. Hewing's, Martin. Cambridge *AcademicEnglish*(B2).CUP,2012.
4. J.Sethi & P.V.Dhamija. *ACourse in Phonetics and Spoken English,*(2ndEd),Kindle,2013.

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:
1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1										2	
2									2	2	
3										3	
4									3	3	
5										3	

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1				Understand	L2	10	Thumb Rule	2
2				Apply	L3	9,10	Thumb Rule	2,2
3				Analyze	L4	10	Thumb Rule	3
4				Evaluate	L5	9,10	Thumb Rule	3,3
5				Analyze	L4	10	Thumb Rule	3

CO1: Understand the different aspects of the English language proficiency with emphasis   on LSRW skills
Action Verb: Understand (L2)
CO1 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).
CO2: Apply communication skills through various language learning activities.
Action Verb: Apply (L3)
CO2 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate(2).
CO3: Analyze the English speech sounds, for better listening and speaking.
Action Verb: Analyze (L4)
CO3 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3).
CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.
Action Verb: Evaluate (L5)
CO4 Action Verb is Evaluate of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).
CO5: Analyze themselves to face interviews in future.
Action Verb: Develop (L4)
CO5 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3).

	ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI
	(Autonomous)
	(Effective for the batches admitted from 2023-24)

Year: I B.Tech   (Common to EEE, ECE, CSE & allied branches) Semester: I &II

Subject Code: 23ABS9906	**Subject Name:** Chemistry Lab	L 0	T 0	P 2	Credits:1

Course Objectives: Students are expected to
    Verify the fundamental concepts with experiments.

Course Outcomes: At the end of the course, the students will be able to
    CO1: Determine the cell constant and conductance of solutions.
    CO2: Prepare advanced polymer Bakelite materials.
    CO3: Measure the strength of an acid present in secondary batteries.
    CO4: Analyze the UV-Visible spectra of some organic compounds.
    CO5: Estimate the unknown solution by volumetric analysis

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Determine**	Cell constant and conductance of solutions.			**L4**
2	**Prepare**	advanced polymer Bakelite materials			**L4**
3	**Measure**	Strength of an acid present in secondary batteries.			**L4**
4	**Analyze**	UV-Visible spectra of some organic compounds.			**L4**
5	**Estimate**	Unknown solution by volumetric analysis.			**L5**

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method(CO1)
2. Conductometric titration of strong acid vs. strong base (CO1)
3. Conductometric titration of weak acid vs. strong base (CO1)
4. Determination of cell constant and conductance of solutions (CO1)
5. Potentiometry - determination of redox potentials and emfs (CO5)
6. Determination of Strength of an acid in Pb-Acid battery (CO3)
7. Preparation of a Bakelite (CO2)
8. Verify Lambert-Beer's law (CO4)
9. Estimation of copper by Iodometry (CO5)
10. Wavelength measurement of sample through UV-Visible Spectroscopy (CO1)
11. Preparation of nanomaterials by precipitation method (CO1)
12. Estimation of Ferrous Iron by Dichrometry (CO5)

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

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publicationsby J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1				3									
2				3									
3				3									
4				3									
5				3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				**Determine**	**L4**	PO4	PO4: Analyze (L4)	3
2				**Prepare**	**L4**	PO4	PO4: Analyze (L4)	3
3				**Measure**	**L4**	PO4	PO4: Analyze (L4)	3
4				**Analyze**	**L4**	PO4	PO4: Analyze (L4)	3
5				**Estimate**	**L5**	PO4	PO4: Analyze (L5)	3

Justification Statements

CO1: Determine the cell constant and conductance of solutions.
Action Verb: Determine **(L4)**
PO4 Verb: Analyze (L4)
CO1 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).
CO2: Prepare advanced polymer Bakelite materials.
Action Verb: Prepare **(L4)**
PO4 Verb: Analyze (L4)
CO2 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).
CO3: Measure the strength of an acid present in secondary batteries.
Action Verb: Measure **(L4)**
PO4 Verb: Analyze (L4)
CO3 Action Verb is equal to PO4 verb; Therefore, correlation is high (3)
CO4: Analyze the UV-Visible spectra of some organic compounds.
Action Verb: Analyze **(L4)**
PO4 Verb: Analyze (L4)
 CO4 Action Verb is equal to PO4 verb; Therefore, correlation is high (3)
CO5: Estimate the unknown solution by volumetric analysis.
Action Verb: Estimate **(L5)**
 PO4 Verb: Analyze (L4)
CO5 Action Verb is greater than PO4; Therefore correlation is high (3).

Course Code	Year & Sem	Engineering Workshop	L	T	P	C
23AES0302	I-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

    CO1: Apply the wood working skills to prepare different joints.
    CO2: Analyze the sheet metal and fitting operations to prepare various components
    CO3: Apply the basic electrical engineering knowledge for house wiring practice.
    CO4: Apply the Welding process for Lap and Butt Joints.
    CO5: Understand the various plumbing pipe joints

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Apply	the wood working skills to prepare different joints			L3
CO2	Analyze	the sheet metal and fitting operations to prepare various components			L4
CO3	Apply	the basic electrical engineering knowledge for house wiring practice			L3
CO4	Apply	the Welding process for Lap and Butt joints			L3
CO5	Understand	the various plumbing pipe joints			L2

SYLLABUS

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

Textbooks:

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, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, MediaPromoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.

Mapping of COs to POs and PSOs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3						3			3	3
CO2	3	3	3						3			3	3
CO3	3	3	3						3			3	3
CO4	3	3	3						3			3	3
CO5	2	2	2						2			3	3

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Lesson Plan (Hrs)	%	Correlation	Verb	BTL	Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
			CO					
1	-	-	3	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
2	-	-	3	Analyze	L4	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
3	-	-	1	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
4	-	-	2	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
5	-	-	2	Understand	L2	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	2 2 2 2

Justification Statements:

CO1: Apply the wood working skills to prepare different joints

Action Verb: **Apply** (L3)

PO1 Verb: **Apply** (L3)

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Review (L2)**

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: **Develop (L3)**

CO1 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO9 Verb: **Thumb Rule**

CO1 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

CO2: Analyze the sheet metal and fitting operations to prepare various components

Action Verb: **Analyse** (L4)

PO1 Verb: **Apply** (L3)

CO2 Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Review (L2)**

CO2 Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: **Develop (L3)**

CO2 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is high (3)

PO9 Verb: **Thumb Rule**

CO2 Action verb is same level (greater) as PO9 verb. Therefore, the correlation is high (3)

CO3: Apply the basic electrical engineering knowledge for house wiring practice

Action Verb: **Apply** (L3)
PO1 Verb: **Apply** (L3)
CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Review (L2)**
CO3 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO3 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO9 Verb: **Thumb Rule**
CO3 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

CO4: Apply the Welding process for Lap and Butt Joints

Action Verb: **Apply** (L3)
PO1 Verb: **Apply** (L3)
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Review (L2)**
CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO9 Verb: **Thumb Rule**
CO4 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

CO5: Understand the various plumbing pipe joints.

Action Verb: **Understand (L2)**
PO1 Verb: **Apply** (L2)
CO5 Action verb is less than as PO1 verb. Therefore, the correlation is high (2)
PO2 Verb: **Review (L2)**
CO5 Action verb is less than as PO2 verb. Therefore, the correlation is high (2)
PO3 Verb: **Develop (L3)**
CO5 Action verb is less than as PO3 verb. Therefore, the correlation is high (2)
PO9 Verb: **Thumb Rule**
CO5 Action verb is less than as PO9 verb. Therefore, the correlation is high (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE (AI)

Course Code	Year & Sem	Data Structures Lab	L	T	P	C
23APC0502	I-II	**(Common to CSE, CIC, CSE(DS), AIML & AIDS)**	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Apply the sorting and searching techniques using Arrays

CO 2: Develop linked list operations for efficient access to data.

CO 3: Develop stacks and queues to solve real time applications.

CO 4: Develop binary search tree operations using linked list

CO 5: Apply the hashing techniques to organise the data in hash table.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Apply**	sorting and searching algorithm	using arrays		L3
CO2	**Develop**	linked list operations		for efficient access to data.	L6
CO3	**Develop**	stacks and queues		to solve real time applications.	L6
CO4	**Develop**	binary search tree operations	using linked list		L6
CO5	**Apply**	the hashing techniques		to organise the data in hash table.	L3

List of Experiments:
Exercise 1: Array Manipulation[CO1]
i)   Write a program to reverse an array.
ii)   C Programs to implement the Searching Techniques – Linear & Binary Search
iii)   C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort
Exercise 2: Linked List Implementation[CO2]
i)   Implement a singly linked list and perform insertion and deletion operations.
ii)   Develop a program to reverse a linked list iteratively and recursively.
iii)   Solve problems involving linked list traversal and manipulation.
Exercise 3: Linked List Applications[CO2]
i)   Create a program to detect and remove duplicates from a linked list.
ii)   Implement a linked list to represent polynomials and perform addition.
iii)   Implement a double-ended queue (deque) with essential operations.
Exercise 4: Double Linked List Implementation[CO2]
i)   Implement a doubly linked list and perform various operations to understand its properties and applications.
ii)   Implement a circular linked list and perform insertion, deletion, and traversal.
Exercise 5: Stack Operations[CO3]
i)   Implement a stack using arrays and linked lists.
ii)   Write a program to evaluate a postfix expression using a stack.
iii)   Implement a program to check for balanced parentheses using a stack.
Exercise 6: Queue Operations[CO3]
i)   Implement a queue using arrays and linked lists.
ii)   Develop a program to simulate a simple printer queue system.
iii)   Solve problems involving circular queues.
Exercise 7: Stack and Queue Applications[CO3]
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.
Exercise 8: Binary Search Tree CO4]
i)   Implementing a BST using Linked List.
ii)   Traversing of BST.
Exercise 9: Hashing [CO5]
i)   Implement a hash table with collision resolution techniques.
ii)   Write a program to implement a simple cache using hashing.

Textbooks:
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.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3										2	
CO2	3	3		3							3	2	1
CO3	3	3		3							3	2	1
CO4	3	3	3	3							3	2	2
CO5	3	3		2							3	2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Apply	L3	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	3 3
2	CO2: Develop	L6	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Design (L6) PO11: Thumb rule	3 3 3 3
3	CO3: Develop	L6	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Design (L6) PO11: Thumb rule	3 3 3 3
4	CO4: Develop	L6	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Design (L6) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO4: Analysis(L4) PO11: Thumb rule	3 3 2 3

Justification Statements :
CO1: Apply the sorting and searching techniques using Arrays
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review(L2)

CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
CO2: Develop linked list operations for efficient access to data.
Action Verb: Develop (L6)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L6)
CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (3)
CO3: Develop stacks and queues to solve real time applications
Action Verb: Develop (L6)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L3)
CO3 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO3 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Data Structure applications, stacks concepts are used to manage data in the memory. Therefore, the correlation is high (3)

CO4: Develop binary search tree operations using linked list
Action Verb: Develop (L6)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Real Time problems Data Structure applications, queues concepts are used to write programs and evaluation the memory operations. Therefore, the correlation is high (3)

CO5:Apply the hashing techniques to organise the data in hash table.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO5 Action verb less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
For some of data manipulations tree and graphs concepts are used to solve data storage problems. Therefore, the correlation is high (3)

Common to I SEM CSE/CIC/SCD/EEE & II SEM ECE/AI&DS/AI&ML/CE/ME

Course Code: 23AHM9903	HEALTH AND WELLNESS, YOGA AND SPORTS	L 0	T 0	P 1	C 0.5

Course Objectives:

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

Course Outcomes: After completion of the course the student will be able to

CO1. **Understand** the health & fitness by diet

CO2. **Understand** the importance of yoga.

CO3. **Apply** The yoga practices including Surya Namaskar

CO4. **Understand** the importance of sports.

CO5. **Analyze** various activities that help enhance their health & Positive Personality

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	Health & fitness by diet			**L2**
2	**Understand**	Importance of yoga.			**L2**
3	**Apply**	yoga practices including Surya Namaskar			**L3**
4	**Understand**	Importance of sports			**L2**
5	**Analyze**	Various activities that help enhance their health & Positive Personality			**L4**

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:

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.

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. HumanKinetics, Inc.2014

General Guidelines:

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

Evaluation Guidelines:
- Evaluated for a total of 100 marks.
- 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, totalingto 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva in the subject

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1						2	2						
2						2	2						
3						2	2						
4						2	2						
5						3	3						

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL		
1					Understand	L2	P06,P07	2
2					Understand	L2	P06,P07	2
3					Apply	L3	P06,P07	2
4					Understand	L2	P06,P07	2
5					Analyze	L4	P06,P07	3

CO-PO mapping justification:

CO1: Understand the health & fitness by diet

Action Verb: Understand (L2)

CO1 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO2: Understand the Importance of yoga

Action Verb: Understand (L2)

CO2 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO3: APPLY

 yoga practices including Surya Namaskar

Action Verb: APPLY (L3)

CO3 Action Verb is APPLY of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO4: .Understand Importance of sports

Action Verb: Understand (L2)

CO4 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

Action Verb: APPLY (L3)

CO5: Analyze the Various activities that help enhance their health & Positive Personality

Action Verb: Analyze (L4)

CO5 Action Verb is Analyze of BTL 2.Using Thumb rule; L4 correlates PO6 and PO7 as a moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ARTIFICIAL INTELLIGENCE (AI)
(Effective for the batches admitted in 2023-24)

Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9913	Discrete Mathematics & Graph Theory	4	2	0	3	30	70	100
2	HM	23AHM9905	Universal Human Values	4	2	0	3	30	70	100
3	PC	23APC0508	Database Management Systems	4	2	0	3	30	70	100
4	PC	23APC0504	Advanced Data Structures and Algorithms Analysis	4	2	0	3	30	70	100
5	PC	23APC0506	Object-Oriented Programming Through JAVA	4	2	0	3	30	70	100
6	PC	23APC0505	Advanced Data Structures and Algorithms Analysis Lab	0	0	3	1.5	30	70	100
7	PC	23APC0507	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0501	Python Programming	0	1	2	2	30	70	100
			Total	**20**	**11**	**8**	**20**	**240**	**560**	**800**

Course Code	Year & Sem	Discrete Mathematics & Graph Theory	L	T/ CLC	P	C
23ABS9913	II-I	(Common to CSE,CIC,CSD,AI&DS, AI&ML)	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Apply** the concepts of mathematical logic in various engineering fields.

CO2: **Understand** the concepts related to set theory and algebraic structures.

CO3: **Analyze** the theory of elementary combinatorics by using binomial and multinomial theorems.

CO4: **Evaluate** the solutions of homogeneous and inhomogeneous recurrence relations.

CO5: **Apply** the graph theory in solving computer science problems and finite difference approximation**.**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the concepts of mathematical logic	in various engineering fields		L3
CO2	Understand	the concepts related to set theory and algebraic structures.			L2
CO3	Analyze	the theory of elementary combinatorics	by using binomial and multinomial theorems		L4
CO4	Evaluate	The solutions of homogeneous and inhomogeneous recurrence relations.			L5
CO5	Apply	The graph theory solving computer science problems.		and finite difference approximation.	L3

UNIT – I: Mathematical Logic	9Hrs
Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus	

UNIT – II: Set theory	9Hrs
The Principle of Inclusion-Exclusion, Pigeon hole principle and its application, Functions : composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups , Monoids, groups, sub groups, homomorphism, Isomorphism.	

UNIT – III: Elementary Combinatorics	9Hrs
Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.	

UNIT – IV: Recurrence Relations	9Hrs
Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.	

UNIT – V: Graphs	9Hrs
Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler"s Formula, Multi graphs and Euler Circuits, Hamiltonian Graphs.	

Textbooks
1.J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.
2.Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited

Reference Books

1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.
3. Dr.J.Rajendra Prasad,T.Rama Rao and A.Madana Mohan Rao, Mathematical Foundation of Computer Science

Online Learning Resources:

http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										
CO2	2										
CO3		3									
CO4		3									
CO5	3										

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				Apply	L3	PO1	Apply (L3)	3
2				Understand	L2	PO1	Apply (L3)	2
3				Analyze	L4	PO2	Analyze (L4)	3
4				Evaluate	L5	PO2	Analyze (L4)	3
5				Apply	L3	PO1	Apply (L3)	3

CO1: .Apply the concepts of mathematical logic in various engineering fields
Action Verb: Apply (L3)
PO1 Verbs: **Apply** (L3)
CO1 Action Verb is equal to PO1 verb . Therefore correlation is high (3).
CO2: Understand the concepts related to set theory and algebraic structures
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO2 Action Verb is one level below to PO1 verb; Therefore correlation is moderate (2).
CO3: . Analyze the theory of elementary combinatorics by using binomial and multinomial theorems.
Action Verb: Analyse (L4)
PO2 Verb: **Analyse** (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).
CO4: Evaluate the solutions of homogeneous and inhomogeneous recurrence relations.
Action Verb: Evaluate (L5)
PO2 Verb: Analyze (L4)
CO4 Action Verb is one level high to PO2 verb; Therefore correlation is high (3).
CO5: Apply the graph theory in solving computer science problems and finite difference approximation.
Action Verb: Apply(L3)
PO1 Verb: Apply (L3)
CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).

Course Code	Year & Sem	**Universal Human Values**	**L**	**T/ CLC**	**P**	**C**
23AHM9905	II-I		**4**	**2**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1:**Understand** the essentials of human values, self-exploration, happiness and prosperity for value added education.

CO2:**Analyze** the harmony in the human being as sentient „I" and the material „Body" in various aspects.

CO3:**Apply** the nine universal human values in relationships for harmony in the family and orderliness in the society.

CO4:**Evaluate** the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.

CO5:**Apply** the holistic understanding of harmony on professional ethics through augmenting universal human order.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the essentials of human values, self-exploration, happiness and prosperity for value added education.			**L2**
2	Analyze	the harmony in the human being as sentient „I" and the material „Body" in various aspects.			**L4**
3	Apply	the nine universal human values in relationships for harmony in the family and orderliness in the society.			**L3**
4	Evaluate	the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.			**L5**
5	Apply	the holistic understanding of harmony on professional ethics through augmenting universal human order.			**L3**

UNIT – I:	6 lectures and 3 tutorials for practice session

Introduction to Value Education (6 lectures and 3 tutorials for practice session)
Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and   the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT – II:	6 lectures and 3 tutorials for practice session

Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT – III:	6 lectures and 3 tutorials for practice session

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT – IV:	4 lectures and 2 tutorials for practice session

Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT – V:	6 lectures and 3 tutorials for practice session

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Textbooks

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

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Online Learning Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-

SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								2			2		
CO2							3	3					
CO3						2	2	2					
CO4						3	3	3			3		
CO5						2	2	2			2		

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

CO	CO Lesson Plan (Hrs)	%	Correlation	Verb	BTL	Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
1	7	19.4	2	Understand	2	PO8,PO11	Thumb Rule	2,2
2	8	22.2	3	Analyze	4	PO7,PO8	Thumb Rule	3,3
3	7	19.4	2	Apply	3	PO6,PO7,PO8	Thumb Rule	2,2,2
4	8	22.2	3	Evaluate	5	PO6,PO7,PO8,PO11	Thumb Rule	3,3,3,3
5	7	19.4	2	Apply	3	PO6,PO7,PO8,PO11	Thumb Rule	2,2,2,2

Justification Statements:

CO1: Understand the essentials of human values, self-exploration, happiness and prosperity for value added education.
Action Verb: Understand (L2)
CO1 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO2: Analyze the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.
Action Verb: Analyze (L4)
CO2 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

CO3: Apply the nine universal human values in relationships for harmony in the family and orderliness in the society.
Action Verb: Apply (L3)
CO3 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

CO4: Evaluate the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.
Action Verb:Evaluate (L5)
CO4 Action Verb is Evaluate of BTL5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

CO5: Apply the holistic understanding of harmony on professional ethics through augmenting universal human order.
Action Verb: Apply (L3)
CO5 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

Course Code	Year & Sem	Database Management Systems	L	T/CLC	P	C
23APC0508	II-I	Common to CSE,AIML,CSE(DS) & CIC	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the fundamentals of databases to design relational models.

CO2: Apply the E-R model for database design of real world applications.

CO3: Apply the SQL and PL/SQL concepts to formulate queries.

CO4: Analyze normalization methods to enhance database structures

CO5: Analyze the concurrent transactions and recover systems to prevent data loss in system crash.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The fundamentals of databases		To design relational models.	L2
CO2	Apply	the E-R model		for database design of real world applications	L3
CO3	Apply	the SQL and PL/SQL concepts		To formulate queries.	L3
CO4	Analyze	normalization methods		to enhance database structures	L4
CO5	Analyze	the concurrent transactions and recover systems		to prevent data loss in system crash.	L4

UNIT - I		9 Hrs

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

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

UNIT - II		9Hrs

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

UNIT - III		9 Hrs

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

NoSQL: Introduction and Properties of NoSQL, Different NoSQL Systems, Columnar families, Schema-Less Databases, Materialized Views, Distribution Models, Sharding

UNIT - IV		9 Hrs

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT - V		**9 Hrs**

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.
Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

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

Reference Books:
1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Online Learning Resources:
1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728202 2456_shared/overview

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3										1	
CO2	3	3									2		2
CO3	3	3	3	2	3		2	2			2		2
CO4	3	3	3	3	3		3						
CO5		3	3	3	3		2	2			2		2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co''s Action verb		BTL			
1	9	20	2	CO1 :Understand		L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	9	20	2	CO2 :Apply		L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	9	20	2	CO3 :Apply		L3	PO1 PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 3 2 3 2 2 2
4	9	20	2	CO4 :Analyze		L4	PO1 PO2 PO3 PO4 PO5 PO7	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: Thumb rule	3 3 3 3 3 3

5	9	20	2	CO5 :Analyze	L4	PO2	PO2: Analyze(L4)	3
						PO3	PO3: Develop (L3)	3
						PO4	PO4: Analyze (L4)	3
						PO5	PO5: Apply(L3)	3
						PO7	PO7: Thumb rule	2
						PO8	PO8: Thumb rule	2
						PO11	PO11: Thumb rule	2
	45	100%						

Justification Statements:

CO1: Understand the fundamentals of databases to design relational models.
Action Verb: Understand(L2) PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)
PO2 Verb: Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the E-R model for database design of real world applications.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO11: Thumb rule
For some of DB applications, PL/SQL concepts are used to formulate queries. Therefore the correlation is moderate (2)

CO3: Apply the SQL and PL/SQL concepts to formulate queries.
Action Verb: Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze(L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO5: Apply(L3)
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO7: Thumb rule
Since ethical principles should be followed to create a database. Therefore the correlation is moderate(2)
PO8 : Thumb rule
Team work is required between DBA and Database designer to create a database. Hence the correlation is moderate (2)
PO11: Thumb rule
For some of DB applications, ER model concepts are used to create designs. Therefore the correlation is moderate(2)

CO4: Analyze normalization methods to enhance database structures
Action Verb: Analyze(L4) PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb . Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO7: Thumb rule
Since ethical principles shall be followed in data manipulation. Therefore the correlation is high(3)

CO5: Analyze the concurrent transactions and recover systems to prevent data loss in system crash.
Action Verb: Analyze (L4) PO2: Analyze (L4)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO5: Apply(L3)

CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

PO7 : Thumb rule

Since ethical principles should be followed for transaction management. Therefore the correlation is moderate(2)

PO8: Thumb rule

Team work is required for transaction management and recovery of failure transactions. Hence the correlation is moderate (2)

PO11: Thumb rule

In real time transaction management is continuously updating. Therefore the correlation is moderate (2)

ARTIFICIAL INTELLIGENCE (AI)

Course Code	Year & Sem	Advanced Data Structures and Algorithms Analysis	L	T/ CLC	P	C
23APC0504	II-I	(Common to CSE,CIC,CSE(DS),AIDS & AIML)	4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the asymptotic notations and operations on AVL, B-Trees.

CO2: **Apply** the Trees, Graphs, Divide and conquer method to solve various problems.

CO3: **Apply** the greedy and dynamic programming methods to solve real time problems.

CO4: **Evaluate** the backtracking , branch and bound methods to solve minimization problems.

CO5: **Analyze** the P, NP, NP hard and NP complete problems for solving reduction problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The asymptotic notations	operations on AVL,B-Trees		L2
CO2	Apply	The Trees, Graphs, Divide and conquer method		to solve various problems	L3
CO3	Apply	The greedy and dynamic programming methods		to solve real time problems.	L3
CO4	Evaluate	The backtracking , branch and bound methods		to solve minimization problems	L5
CO5	Analyze	The P, NP, NP hard , NP complete problems		for solving reduction problems	L4

UNIT – I		9Hrs

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.
Review of Binary Search Trees: Binary Search Tree – Insertion, Deletion & Traversal
AVL Trees – Creation, Insertion, Deletion operations and Applications
B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II		9 Hrs

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, Finding Minimum and Maximum, Strassen"s matrix multiplication.

UNIT – III		9 Hrs

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

UNIT – IV		8 Hrs

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.

UNIT – V		10Hrs

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

Textbooks:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press.
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran2nd Edition University Press

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. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein&Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures &Programs:,N.Wirth, PHI

6. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia.

Online Learning Resources:

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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1									2	3	
CO2	3	2		2		2					2	2	
CO3	3	2	3	2		2					2	2	
CO4	3	3	3	3		2					2	2	
CO5	2	3	3	3	3						2	2	

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co"s Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	9	20	2	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO11: Thumb rule	2 1 2
2	9	20	2	CO2: Apply	L3	PO1 PO2 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO4: Analyze(L4) PO6: Thumb rule PO11: Thumb rule	3 2 2 2 2
3	9	20	2	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO6: Thumb rule PO11: Thumb rule	3 2 3 2 2 2
4	9	20	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 2 2
5	9	20	2	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	2 3 3 3 3 2
	45	100						

Justification Statements:

CO1: Understand the asymptotic notations and operations on AVL, B-Trees.
Action Verb: Understand (L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Analyze (L4)
CO1 Action verb is less than PO2 verb by two level. Therefore, the correlation is low (1)
PO11: Thumb rule
The asymptotic performance of algorithms, To Analyze the behavior of algorithms as their input increases. Therefore the correlation is moderate (2)
CO2: Apply the Trees, Graphs, Divide and conquer method to solve various problems.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)
CO2 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)
PO4: Analyze (L4)
CO2 Action verb is lesser than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO6: Thumb rule
Greedy and dynamic programming concepts were applied to solve traffic problems and finding best route to

the destination. Therefore, the correlation is moderate (2)
PO11: Thumb rule
Finding optimal solution to a real-world problem is a continuous activity. Therefore, the correlation is moderate (2)
CO3: Apply the greedy and dynamic programming methods to solve real time problems.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO3 Action verb is same level of PO1 verb. Therefore, the correlation is High (3)
PO2: Analyze (L4)
CO3 Action verb is less than of PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3: Develop (L3)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2))
PO6 : Thumb rule
backtracking and searching techniques were applied for GPS. Therefore, the correlation is moderate (2)
PO11: Thumb rule
backtracking and searching techniques will give optimal solutions to various problems. Therefore, the correlation is moderate (2)
CO4: Evaluate the backtracking, branch and bound methods to solve minimization problems.
Action Verb: Evaluate (L5)
PO1: Apply(L3)
CO3 Action verb is greater than of PO1 verb . Therefore, the correlation is High (3)
PO2: Analyze (L4)
CO3 Action verb is greater than of PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is greater than of PO3 verb. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO3 Action verb is greater than of PO4 verb. Therefore the correlation is high(3)
PO6 : Thumb rule
Backtracking and searching techniques were applied for GPS. Therefore, the correlation is moderate (2)
PO11: Thumb rule
Backtracking and searching techniques will give optimal solutions to various problems. Therefore, the correlation is moderate (2)
CO5: Analyze the P, NP, NP hard and NP complete problems for solving reduction problems.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO5 Action verb is less than of PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Analyze (L4)
CO5 Action verb is same level of PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
In research-oriented purpose P, NP concepts can be applied. Therefore, the correlation is moderate (2)

Course Code	Year & Sem	Object-Oriented Programming Through JAVA (common to CSE, CIC, CSE(DS), AIDS & AIML)	L	T/ CLC	P	C
23APC0506	II-I		4	2	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the Java language components and how to apply in applications

CO2: Apply the concepts of OOP‟s fundamentals like classes, Methods and class libraries to develop applications

CO3: Analyze the concepts of arrays, inheritance and interfaces to develop efficient java applications.

CO4: Evaluate the concepts of packages, file I/O, by using access control, and exception handling mechanisms to solve real world scenarios

CO5: Create the GUI applications by using concepts like multi-threading, Java FX, JDBC

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the Java language components		How to apply in applications	L2
CO2	Apply	the concepts of OOP‟s fundamentals	like classes, methods and class libraries	to develop applications	L3
CO3	Analyze	the concepts of arrays, inheritance and interfaces		to develop efficient java applications	L4
CO4	Evaluate	the concepts of packages , file I/O	by using access control, and exception handling mechanisms	to solve real world scenarios	L5
CO5	Create	The GUI applications, JDBC applications	by using concepts like multi-threading, Java FX, JDBC		L6

UNIT – I		7 Hrs

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

Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, 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.

UNIT – II		12 Hrs

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT – III		19 Hrs

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

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.

UNIT – IV		19 Hrs

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

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

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

UNIT – V		19 Hrs

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

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

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

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

Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.

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.

Reference Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH

2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105191/

2.https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1										1	1
CO2		3	3	2	3					2	2	1	1
CO3	3	3	1	2	2							1	1
CO4	3	3		3	3							1	1
CO5		3	3		3					3	3	1	1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co"s Action verb	BTL			
1	12	13.63%	2	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	13	14.77%	2	CO2: Apply	L3	PO2 PO3 PO4 PO5 PO10 PO11	PO2: Review (L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3) PO10: Thumb Rule PO11: Thumb Rule	3 3 2 3 2 2
3	23	26.13%	3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design(L6) PO4: Interpret(L5) PO5: SSelect(L5)	3 3 1 2 2
4	20	22.72%	3	CO4: Evaluate	L5	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze(L4) PO5: Select(L3)	3 3 3 3
5	20	22.72%	3	CO5: Create	L6	PO2 PO3 PO5 PO10 PO11	PO2: Formulate (L6) PO3: Design (L6) PO5: Create(L6) PO10: Thumb Rule PO11: Thumb rule	3 3 3 3 3
	88	100 %						

Justification Statements:
CO1: Understand the Java language components and how to apply in applications.
Action Verb: Understand(L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)
CO2: Apply the concepts of OOP's fundamentals like classes, Methods and class libraries to develop applications
Action Verb: Apply (L3)
PO2: Review (L2)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is High (3)
PO3: Develop (L3)
CO2 Action verb is same level as PO3 verb. Therefore, the correlation is High (3)
PO4: Analyze(L4)
CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply(L3)
CO2 Action verb is less than PO5 verb by three level. Therefore, the correlation is High (3)
PO10: Thumb Rule
Create some Java programs to solve real world problems. Therefore, the correlation is moderate (2)
PO11: Thumb Rule
Learn java programs to solve. Therefore, the correlation is moderate (2)
CO3: Analyze the concepts of arrays, inheritance and interfaces to develop efficient java applications.
Action Verb: Analyze(L4)
PO1: Apply (L3)
CO3 Action verb is Greater than PO1. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is same level as PO2. Therefore, the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by two level. Therefore, the correlation is low (1)
PO4: Interpret (L5)
CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
PO5: Select (L5)

CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)

CO4: Evaluate the concepts of packages, access control, file I/O, and exception handling mechanisms to solve real world scenarios

Action Verb: Evaluate(L5)

PO1: Apply(L3)

CO4 Action verb is Greater than PO1. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is Greater than PO2. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO4 Action verb is Greater than PO4. Therefore, the correlation is high (3)

PO5: Select (L3)

CO4 Action verb is Greater than PO5. Therefore, the correlation is high (3)

CO5: Create GUI applications by using concepts like multi-threading, Java FX, JDBC

Action Verb: Create (L6)

PO2: Formulate (L6)

CO5 Action verb is same level as PO2. Therefore, the correlation is high (3)

PO3: Design (L6)

CO5 Action verb is same level as PO3. Therefore, the correlation is high (3)

PO5: Create (L6)

CO5 Action verb is same level as PO5. Therefore, the correlation is high (3)

PO10: Thumb Rule

Java is used to design simple and enterprise applications so need for project management. Therefore, the correlation is high (3)

PO11: Thumb Rule

It is a programming language so new version available so we need to learn. Therefore, the correlation is high (3)

Course Code	Year & Sem	Advanced Data Structures and Algorithms Analysis Lab (Common to CSE,CIC,AIDS & AIML)	L	T	P	C
23APC0505	II-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the operations on AVL Trees, B-Trees and graph traversals.

CO2: Create the Min, Max Heap using arrays and find BFT, DFT for the graphs.

CO3: Create the sorting techniques for finding the time complexities and use greedy method to find single source shortest path.

CO4: Apply backtracking strategy for finding the N-Queens ,0/1 knapsack problem.

CO5: Apply greedy strategy for job sequencing and using dynamic programming to find 0/1 knapsack problem.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the operations	on AVL Trees, B-Trees and graph traversals		L2
CO2	**Create**	the Min, Max Heap using arrays and find BFT, DFT		for the graphs	L6
CO3	**Create**	the sorting techniques		for finding the time complexities	L6
CO4	**Apply**	backtracking strategy		for finding the N-Queens ,0/1 knapsack problem	L3
CO5	**Apply**	greedy strategy		for job sequencing	L3

List of Experiments:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.**(CO1)**
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array.Implement searching, insertion and deletion operations.**(CO1)**
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.**(CO2)**
4. Implement BFT and DFT for given graph, when graph is represented by
   a) Adjacency Matrix b) Adjacency Lists. **(CO2)**
5. Write a program for finding the bi-connected components in a given graph.**(CO2)**
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).**(CO2)**
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.**(CO3)**
8. Implement Job sequencing with deadlines using Greedy strategy.**(CO5)**
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.**(CO4)**
10. Implement N-Queens Problem Using Backtracking.**(CO4)**
11. Use Backtracking strategy to solve 0/1 Knapsack problem.**(CO4)**
12. Implement Travelling Sales Person problem using Branch and Bound approach.**(CO5)**

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2ndEdition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2ndEdition, 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

Online Learning Resources:

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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1						1			2	1	
CO2	3	3			3						2		
CO3	3	3	2	2				1			1		
CO4	3	2						2			2		2
CO5	3	2	3	3				1			2		2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1 : Understand	L2	PO1 PO2 PO8 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO8: Thumb rule PO11: Thumb rule	2 1 1 2
2	CO2 : Create	L6	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO5: Develop (L6) PO11: Thumb rule	3 3 3 2
3	CO3 : Create	L6	PO1 PO2 PO3 PO4 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Design (L6) PO4: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 1 1
4	CO4 : Apply	L3	PO1 PO2 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO8: Thumb rule PO11: Thumb rule	3 2 2 2
5	CO5 : Apply	L3	PO1 PO2 PO3 PO4 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Develop (L3) PO8: Thumb rule PO11: Thumb rule	3 2 3 3 1 2

Justification Statements :

CO1: Understand the operations on AVL Trees, B-Trees and graph traversals.

Action Verb : Understand (L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

PO2 Verb : Analyze(L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

PO8: Thumb rule

Perform operations on AVL trees and B-trees are individual. There fore the correlation is low(1)

PO11 : Thumb rule

Apply different values of operations on AVL Trees, B-Trees and graph traversals is life long. Therefore the correlation is moderate (2)

CO2: Create the Min, Max Heap using arrays and find BFT, DFT for the graphs

Action Verb : Create (L6)

PO1 Verb : Apply(L3)

CO2 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2 Verb : Analyze(L4)

CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO5: Develop(L6)

CO2 Action verb is less than PO5 verb by one level. Therefore the correlation is high (3)

PO11: Thumb rule

To Apply the min and max heap on arrays and finding traversals on graphs is lifelong learning. Therefore the correlation is moderate (2)

CO3: Create the sorting techniques for finding the time complexities and use greedy method to find single source shortest path.

Action Verb : Create (L6)

PO1: Apply(L3)

CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2:Analyze (L4)

CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)

PO4: Develop (L6)

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)

PO8: Thumb rule

Team work or individual work is required to analyze sorting techniques time complexities. Hence the correlation is low (1)

PO11: Thumb rule

To Develop sorting techniques and single source shortest path as life long learning. Therefore the correlation is low (1)

CO4: Apply backtracking strategy for finding the N-Queens ,0/1 knapsack problem

Action Verb : Apply (L3)

PO1: Apply(L3)

CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

PO8: Thumb rule

Team work/ individual work is required find the N-Queens and 0/1 Knapsack trough backtracking. Hence the correlation is medium (2)

PO11: Thumb rule

To Develop back tracking in N-Queens problem is life long learning. Therefore the correlation is medium (2)

CO5 : Apply greedy strategy for job sequencing and using dynamic programming to find 0/1 knapsack problem.

Action Verb : Apply (L3)

PO1: Apply (L3)

CO5 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO5 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

PO3: Design (L3)

CO5 Action verb is less than PO3 verb. Therefore the correlation is high (3)

PO4: Design (L3)

CO5 Action verb is less than PO4 verb. Therefore the correlation is high (3)

PO8: Thumb rule

Team work / individual work is required applying greedy strategy on job sequencing. Hence the correlation is low (1)

PO11: Thumb rule

To apply dynamic programming for 0/1 knapsack is life long learning. Therefore the correlation is medium (2)

Course Code	Year & Sem	Object-Oriented Programming Through Java Lab	L	T	P	C
23APC0507	II-I	**(common to CSE,CIC, CSE(DS), AIDS & AIML)**	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the Java syntax, data types, control structures and OOPs principles.

CO2: Apply the problem-solving skills and algorithmic thinking by using OOP concepts

CO3: Apply the fundamental OOP principles to solve programming problems effectively.

CO4: Analyze the Java libraries to implement thread Applications.

CO5: Create graphical user interface (GUI) applications using JavaFX

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The Java syntax, data types, control structures and OOPs principles			L2
CO2	Apply	The problem-solving skills and algorithmic thinking	by using OOP concepts		L3
CO3	Apply	The fundamental OOP principles		to solve programming problems effectively	L3
CO4	Analyze	The Java libraries		to implement thread Applications.	L4
CO5	Create	graphical user interface (GUI) applications	using JavaFX		L6

List of Experiments:

Exercise – 1

a) Write a JAVA program to display default value of all primitive data type of JAVA **(CO1)**

b) Write a java program that display the roots of a quadratic equation $ax2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root. **(CO2)**

Exercise - 2

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism. b) Write a JAVA program to sort for an element in a given list of elements using bubble sort. **(CO2)**

c) Write a JAVA program using StringBuffer to delete, remove character. **(CO2)**

Exercise - 3

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method. **(CO2)**

b) Write a JAVA program implement method overloading. **(CO3)**

c) Write a JAVA program to implement constructor**. (CO3)**

d) Write a JAVA program to implement constructor overloading. **(CO3)**

Exercise - 4

a) Write a JAVA program to implement Single Inheritance **(CO3)**

b) Write a JAVA program to implement multi level Inheritance **(CO3)**

c) Write a JAVA program for abstract class to find areas of different shapes **(CO3)**

Exercise - 5

a) Write a JAVA program give example for "super" keyword. **(CO3)**

b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? **(CO3)**

c) Write a JAVA program that implements Runtime polymorphism **(CO3)**

Exercise - 6

a) Write a JAVA program that describes exception handling mechanism **(CO4)**

b) Write a JAVA program Illustrating Multiple catch clauses **(CO4)**

c) Write a JAVA program for creation of Java Built-in Exceptions **(CO4)**

d) Write a JAVA program for creation of User Defined Exception **(CO4)**

Exercise - 7

a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds, (Repeat the same by implementing Runnable) **(CO4)**

b) Write a program illustrating is Alive and join () **(CO4)**

c) Write a Program illustrating Daemon Threads. **(CO4)**

d) Write a JAVA program Producer Consumer Problem **(CO4)**

Exercise – 8
a) Write a JAVA program that import and use the user defined packages **(CO4)**
b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX) **(CO5)**
c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI **(CO5)**
Exercise – 9
a) Write a java program that connects to a database using JDBC **(CO5)**
b) Write a java program to connect to a database using JDBC and insert values into it. **(CO5)**
c) Write a java program to connect to a database using JDBC and delete values from it. **(CO5)**

Textbooks:
1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
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.
Reference Books:
1. The complete Reference Java, 11th edition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson
Online Resources:
1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547 618816347_shared/overview

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1		3			2							3	
CO2		3	3	2	3							2	
CO3			3	2	3							2	2
CO4		3	3	3	3			3		3	3	2	2
CO5			3		3			3		3	3	2	

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO2 PO5	PO2: Review(L2) PO5: Apply(L3)	3 2
2	CO2 :Apply	L3	PO2 PO3 PO4 PO5	PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 2 3
3	CO3: Apply	L3	PO3 PO4 PO5	PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 2 3
4	CO4: Analyze	L4	PO2 PO3 PO4 PO5 PO8 PO10 PO11	PO2: Analyze (L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3
5	CO5 :Create	L6	PO3 PO5 PO8 PO10 PO11	PO3: Design (L6) PO5: Create(L6) PO8: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3

Justification Statements :

CO1: Understand Java syntax thoroughly, encompassing data types and control structures.

Action Verb : Understand(L2)

PO2: Review(L2)

CO1 Action verb is same PO2 verb. Therefore the correlation is High(3)

PO5: Apply(L3)

CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)

CO2: Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.

Action Verb : Apply (L3)

PO2: Review(L2)

CO2 Action verb is greater than PO2 verb. Therefore the correlation is High(3)

PO3: Develop (L3)

CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO2 Action verb is less than PO4 verb by one levels. Therefore the correlation is moderate (2)

PO5: Apply (L3)

CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

CO3: Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.

Action Verb : Apply(L3)

PO3: Develop (L3)

CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate(2)

PO5: Apply (L3)

CO3 Action verb is same as PO5 verb. Therefore the correlation is high(3)

CO4: Analyze the concepts of multithreading and collection frameworks for solving complex programs.

Action Verb :Analyze (L4)

PO2: Analyze (L4)

CO4 Action verb is same PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)

PO5: Apply (L3)

CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

PO8: Thumb Rule

It is a programming language we need to collaborate with team. Therefore the correlation is high (3)

PO10: Thumb Rule

By using java to manage enterprise projects in multi-disciplinary environments . Therefore the correlation is high (3)

PO11: Thumb Rule

It is a programming language we need to learn lifelong because new concepts arise. Therefore the correlation is high (3)

CO5: Create GUI based applications using Java FX.

Action Verb : Create (L6)

PO3: Design (L6)

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO5: Create(L6)

CO5 Action verb is same as PO5 verb. Therefore the correlation is high (3)

PO8: Thumb Rule

It is a programming language we need to collaborate with team. Therefore the correlation is high (3)

PO10: Thumb Rule

By using java to manage enterprise and web based projects in multi-disciplinary environments. Therefore the correlation is high (3)

PO11: Thumb Rule

It is a programming language we need to learn lifelong because new concepts arise. Therefore the correlation is high (3)

Course Code	Year & Sem	PYTHON PROGRAMMING	L	T	P	C
23ASC0501	II-I	**(SKILL ENHANCEMENT COURSE)** **(Common to CSE,CIC,CSE(DS),AIDS & AIML)**	0	1	2	2

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the Basic concepts of python programming to build scripts in IDLE.

CO2: Apply the modularity techniques to invoke user defined functions**.**

CO3: Apply the concept of Dictionaries, Tuples and sets to perform operations on data.

CO4: Analyze the file concepts and oops paradigms to manage data.

CO5: Apply the concepts of JSON and XML for data processing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	Basic concepts of python programming		to build scripts in IDLE	L2
CO2	**Apply**	the modularity techniques		to invoke user defined functions	L3
CO3	**Apply**	the concept of Dictionaries, Tuples and sets		to perform operations on data.	L3
CO4	**Analyze**	the file concepts and oops paradigms.		to manage data	L4
CO5	**Apply**	the concepts of JSON and XML		for data processing	L3

UNIT – I	9Hrs

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

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

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

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

UNIT – II	9 Hrs

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

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

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

  Sample Experiments:
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.
11. Write a program to perform the given operations on a list:
    i.Addition   ii. Insertion   iii. slicing

12. Write a program to perform any 5 built-in functions by taking any list.	

UNIT – III	9 Hrs

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:

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

UNIT – IV	9 Hrs

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:

18. 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.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT – V	9Hrs

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

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. 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
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2		2						1	
CO2	3	3	3	2	3							2
CO3	3	3	3	2	3							2
CO4	3	3	3	3	3						2	
CO5	3	3	3	2	3							2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	9	20	2	CO1 : Understand	L2	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO5: Apply (L3)	2 3 2 2
2	9	20	2	CO2 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
3	9	20	2	CO3 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
4	9	20	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3) PO11:Thumb Rule	3 3 3 3 3 2
5	9	20	2	CO5 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
	53	100 %						

Justification Statements:

CO1: Understand the Basic concepts of python programming to build scripts in IDLE.

Action Verb : Understand(L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

PO2 Verb : Review(L2)

CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)

PO3 Verb : Develop(L3)

CO1 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)

PO5 Verb : Apply(L3)

CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)

CO2: Apply the modularity techniques to invoke user defined functions**.**

Action Verb : Apply (L3)

PO1: Apply(L3)

CO2 Action verb is same as PO1 verb. Therefore the correlation is high (3)

PO2 Verb : Review(L2)

CO2 Action verb is greater than PO2 verb. Therefore the correlation high (3)

PO3 Verb : Develop (L3)

CO2 Action verb same as PO3 verb. Therefore the correlation high (3)

PO4 Verb : Analyze(L4)

CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)

PO5 Verb : Apply(L3)

CO2 Action verb is same as PO5 verb. Therefore the correlation is high (3)
CO3: Apply the concept of Dictionaries, Tuples and sets to perform operations on data.
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Review(L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation high (3)
PO3 Verb : Develop (L3)
CO3 Action verb same as PO3 verb. Therefore the correlation high (3)
PO4 Verb : Analyze(L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO5 Verb : Apply(L3)
CO3 Action verb is same as PO5 verb. Therefore the correlation is high (3)
CO4: Analyze the file concepts and oops paradigms to manage data.
Action Verb: Analyze(L4)
PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Review(L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3 Verb : Develop (L3)
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4 Verb : Analyze(L4)
CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO5 Verb : Apply(L3)
CO3 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO11: Thumb rule
To solve the real time problems oops and file concepts are necessary for data security. Therefore the correlation is medium(2)
CO5: Apply the concepts of JSON and XML for data processing.
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Review(L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation high (3)
PO3 Verb : Develop (L3)
CO3 Action verb same as PO3 verb. Therefore the correlation high (3)
PO4 Verb : Analyze(L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO5 Verb : Apply(L3)
CO3 Action verb is same as PO5 verb. Therefore the correlation is high (3)

B. Tech – II Year II Semester

S.No.	Category	Course code	Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	HM	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	BS	23ABS9915	Statistical Methods for Data Science	4	2	0	3	30	70	100
3	PC	23APC3001	Artificial Intelligence	4	2	0	3	30	70	100
4	PC	23APC3201	Introduction to Data Science	4	2	0	3	30	70	100
5	PC	23APC0503	Digital Logic & Computer Organization	4	2	0	3	30	70	100
6	PC	23APC3002	Artificial Intelligence Lab	0	0	3	3	30	70	100
7	PC	23APC3202	Data Science Using Python Lab	0	0	3	3	30	70	100
8	SC	23ASC0503	Full Stack Development - 1	0	1	2	2	30	70	100
9	ES	23AES0304	Design Thinking & Innovation	0	1	2	2	30	70	100
10	MC	23AMC9901	Environmental Science	2	0	0	-	30	-	30
Total				**20**	**10**	**10**	**22.5**	**300**	**630**	**930**
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation										

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T	P	C
23AHMMB01	(Common to ALL branches of Engineering)	2	0	0	2

Course Outcomes (CO):
CO1: Understand the fundamentals of managerial economics and Apply the forecasting techniques for estimation of demand.
CO2: Understand the production and cost concepts to optimize the output
CO3: Analyze the price output relationship in different markets.
CO4: Evaluate the capital budgeting techniques to invest in various projects.
CO5: Analyze the accounting statements to evaluate the financial performance of business entity.

CO	Action Verb	Knowledge Statement	Condition	Criteria	BL
CO1	Understand Apply	The fundamentals of Managerial economics and the demand of a product	by using statistical and survey methods.		L3
CO2	Understand	Production and cost concepts		To optimize the output	L2
CO3	Analyze	Price output relationship		In perfect and imperfect competition markets	L4
CO4	Evaluate	Capital budgeting techniques		To invest in various projects	L5
CO5	Analyze	Accounting statements		to evaluate the financial performance of business entity	L4

UNIT – I :   **Managerial economics**
Introduction – meaning, nature, significance, functions, and advantages, ME and its role in other fields. Demand - Concept, Function, Law of Demand- Demand Elasticity-Types– Measurement. Demand Forecasting- Factors governing forecasting, Methods.

UNIT-II   **Production and Cost Analysis**
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Iso quants and Iso costs, MRTS, Cobb-Douglas Production Function- Laws of Returns- Internal and External Economies of scale. Cost & Break-Even Analysis- Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

UNIT-III   **Business Organizations and Markets**
Introduction-Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises.Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition, Monopoly- Monopolistic Competition– Oligopoly- Price-Output Determination- Pricing Methods and strategies.

UNIT-IV   **Capital Budgeting**
Introduction- Nature, meaning, significance, types of working capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting – Features, Proposals, Time value of money. Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), and Internal Rate Return (IRR) Method, Profitability Index(PI) Method (simple problems).

UNIT-V   **Financial Accounting and Analysis**
Introduction - Concepts and Conventions- Double- Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). **Financial Analysis -** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.
Text books:
1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:
1. Ahuja Hl Managerial economics Schand, 3/e, 2013
2. S.A.Siddiqui and A.S.Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G.Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. DomnickSalvatore: Managerial Economics in a Global Economy, Cengage, 2013.

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

Course Title	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Managerial Economics and Financial Analysis	CO1	3												
	CO2		1											
	CO3	3												
	CO4		3											
	CO5		3											

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	**10**	16.1%	2	CO1: Apply	L3	PO1	Apply	**3**
2	14	22.5%	3	CO2: Understand	L2	PO2	Analyse	**1**
3	14	22.5%	3	CO3: Analyze	L4	PO1	Apply	**3**
4	10	16.1%	2	CO4: Evaluate	L5	PO2	Analyse	**3**
5	14	22.5%	3	CO5: Analyze	L4	PO2	Analyse	**3**
total	**62**	**100**						

Justification Statements:
CO1: Understand the fundamentals of managerial economics and Apply the forecasting techniques for estimation of demand.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO1 Action verb is same as PO1verb. Therefore the correlation is high (3)

CO2: Understand the production and cost concepts to optimize the output.
Action Verb: Understand (L2)
PO2: Analyze (L4)
CO2 Action verb is less than PO1 verb by two levels. Therefore the correlation is low (1)

CO3: Analyze the price output relationship in different markets.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)

CO4: Evaluate the capital budgeting techniques to invest in various projects.
Action Verb: Evaluate (L5)
PO2: Analyze
CO3 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)

CO5: Analyze the accounting statements to evaluate the financial performance of   business entity.
Action Verb: Analyze (L4)
PO2: Analyze (L4)
CO5 Action verb is same as PO2 verb. Therefore the correlation is high (3)

Course Code	Year & Sem	STATISTICAL METHODS FOR DATA SCIENCE	L	T	P	C
23ABS9915	II-II		4	2	0	3

Course Outcomes (CO): Students will be able to
1) **Apply** the discrete and continuous probability distributions to the given random data
2) **Evaluate** the estimators using Methods of point estimation for given data.
3) **Apply** the methods of Interval estimation to the given data.
4) **Analyze** the techniques for testing of hypothesis and types of errors for large samples.
5) **Analyze** the techniques for testing of hypothesis for small samples.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
1	**Apply**	the discrete and continuous probability distributions	to the given random data		**L3**
2	**Evaluate**	the estimators using Methods of point estimation	for given data		**L5**
3	**Apply**	the methods of Interval estimation	to the given data		**L3**
4	**Analyze**	the techniques for testing of hypothesis and types of errors	for large samples		**L4**
5	**Analyze**	the techniques for testing of hypothesis	for small samples		**L4**

Unit I: Random Variables and Sampling Theory   9 Hrs
Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Probability distributions: Binomial, Poisson and Normal-their properties.
Sampling Theory: Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency.

UNIT II: Point Estimation   **10** Hrs
Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator (without proof)- applications, Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.

UNIT III: Interval Estimation   **10** Hrs
Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.

Unit IV: Testing of hypotheses   9 Hrs
Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.

Unit V: Small sample tests   9 Hrs
Student's t-test, test for a population mean, equality of two population means, paired t-test, F-test for equality of two population variances, Chi-square test for goodness of fit and test for independence of attributes, χ^2 test for testing variance of a normal distribution.

Textbooks:
1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, Prentice Hall of India, 2014
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Books:
1. S. Ross, a First Course in Probability, Pearson Education India, 2002.
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
3. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and Statistical Inference, 9th edition, Pearson publishers,2013
4. S.Chand ,Probability and Statistics, Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad

Online Learning Resources:
1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1	3										
2	3										
3	3										
4		3									
5		3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	**13**	18	2	**Apply**	**L3**	PO1	**Apply (L3)**	3
2	**15**	21	3	**Evaluate**	**L5**	PO1	**Apply (L3)**	3
3	**14**	20	**3**	**Apply**	**L3**	PO1	**Apply (L3)**	3
4	**15**	21	**3**	**Analyze**	**L4**	PO2	**Analyze (L4)**	3
5	**15**	21	**3**	**Analyze**	**L4**	PO2	**Analyze (L4)**	3

CO1: Apply the discrete and continuous probability distributions to the given random data.
CO Action Verb: Apply **(L3)**
PO2 Verb: Apply(L3)
CO1 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

CO2: Evaluate the estimators using Methods of point estimation for given data..
CO Action Verb: Evaluate (L5)
PO2 Verb: Apply(L3)
CO2 Action Verb high level to PO1 verb; Therefore correlation is high (3).

CO3: Analyze the methods of Interval estimation to the given data.
CO Action Verb: Apply **(L3)**
PO2 Verb: Apply(L3)
CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

CO4: Analyze the techniques for testing of hypothesis and types of errors for large samples.
CO Action Verb: Analyze (L4)
PO1 Verb: Analyze (L4)
CO4 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

CO5: Apply the techniques for testing of hypothesis for small samples.
CO Action Verb: Analyze (L4)
PO1 Verb: Analyze (L4)
CO5 Action verb is equal to PO2 verb ; therefore the correlation is high (3).

Course Code	Year & Sem	Artificial Intelligence	L	T	P	C
20APC3001	II-II	(common to AIDS, AIML)	4	2	0	3

Course Outcomes:

Student will able to After studying the course, students will be able to

CO1: Understand the basic concepts of artificial intelligence and intelligent agents

CO2: Apply the searching techniques for solving searching problems.

CO3: Apply the techniques for uncertainties and representing the knowledge

CO4: Understand learning methods for implementing logic concepts

CO5: Analyze the architecture and roles of expert systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of artificial intelligence and intelligent agents			L2
CO2	Apply	the searching techniques		for solving searching problems	L3
CO3	Apply	the techniques for uncertainties and representing the knowledge			L3
CO4	Understand	learning methods		for implementing logic concepts	L2
CO5	Analyze	the architecture and roles of expert systems			L4

UNIT – I		

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

UNIT – II		

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

UNIT – III		

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes" probabilistic interferences and dempstershafer theory.

UNIT – IV		

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

UNIT – V		

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

Textbooks:

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.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3											
CO2	3	2	3	2	3							1	1
CO3	3	3	3	2	3							1	
CO4		3	2		2						2	1	1
CO5	3	3	3	3	2						2	1	

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1				CO1 :Understand	L2		PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2				CO2 : Apply	L3		PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3)	3 2 3 2 3
3				CO3 : Apply	L3		PO1 PO2 PO3 PO4 PO5	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 2 3
4				CO4 : Understand	L2		PO2 PO3 PO5 PO11	PO2: Review(L2) PO3: Develop(L3) PO5: Apply(L3) PO11:Thumb Rule	3 2 2 2
5				CO5 :Analyze	L4		PO1 PO2 PO3 PO4 PO5 PO11	PO1:Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb Rule	3 3 3 3 2 2

Justification Statements :

CO1: Understand the basic concepts of artificial intelligence and intelligent agents
Action Verb : Understand(L2)
PO1 : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 : Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the searching techniques for solving searching problems.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is medium(2)
PO3: Develop (L3)
CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
PO5:Apply(L3)
CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

CO3: Apply the techniques for uncertainties and representing the knowledge.
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb . Therefore the correlation is high (3)

PO2: Identify(L3)
CO3 Action verb is same level as PO2 verb . Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
PO5:Apply(L3)
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high(3)

CO4: Understand learning methods for implementing logic concepts
Action Verb : Understand(L1)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is less than one level as PO3 verb. Therefore the correlation is medium (2)
PO4: Apply(L3)
CO4 Action verb is less than one level as PO4 verb. Therefore the correlation is medium (2)
PO11: Thumb rule
Artificial intelligence learning methods are used for developing intelligent agents. Therefore the correlation is medium(2)

CO5: Analyze the architecture and roles of expert systems.
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO5 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5:Apply(L3)
CO3 Action verb is less than one level as PO5 verb. Therefore the correlation is medium(2)
PO11: Thumb rule
For developing expert systems some of python program concepts are used to create programs. Therefore the correlation is medium (2)

Course Code	Year & Sem	Introduction to Data Science	L	T	P	C
23APC3201	II-II		4	2	0	3

Course Outcomes:

After studying the course, students will be able to

CO 1: Understand the basic significance of Data Science

CO 2: Analyze the large data sets using python libraries.

CO 3: Apply the ACID Principles of relational data and NOSQL Data

CO 4: Apply the Machine learning techniques for data analytics on standard data sets.

CO 5: Understand the python programs to present and interpret data sets using visualization packages in python.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloomslevel
CO1	**Understand**	The basic significanceof Data science			L2
CO2	**Analyze**	The large data sets	using pythonlibraries		L4
CO3	**Apply**	The ACID Principles of relational data and NOSQL Data			L3
CO4	**Apply**	The Machine learning techniques		for data analytics on standarddata sets	L3
CO5	**Understand**	the python programs to present and interpret data sets	using visualizationpackages in python.		L2

UNIT – I		9 Hrs

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

UNIT – II		9 Hrs

Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT – III		9 Hrs

NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT – IV		9 Hrs

Tools and Applications of Data Science: Introducing **Neo4j**for dealing with graph databases, graph query language **Cypher**, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts		
UNIT – V		9 Hrs
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.		
Textbooks:		
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		
Online Learning Resources:		
www.nptel.ac.in		

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3		1									
CO2	3	3	3	3									
CO3	3	2	3	3	3								
CO4	3	2	3	2	3								
CO5	2	3	2	2	2								

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 toPO12)	Level of Correlation(0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Actionverb	BTL				
1	9	20	2	CO1: Understand	L2	PO1 PO2 PO4	PO1: Apply(L3) PO2: Review(L2) PO4: Analyze (L4)	2 3 1
2	9	20	2	CO2: Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
3	9	20	2	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO10: Thumb rule	3 2 3 3 3 2
4	9	20	2	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 2 3 2 3

5	9	20	2	CO5: Understand	L2	PO1	PO1: Apply(L3)	2
						PO2	PO2: Review(L2)	3
						PO3	PO3: Develop (L3)	2
						PO4	PO4: Analyze (L4)	2
						PO5	PO5: Apply(L3)	2
						PO11	PO11: Thumb rule	2
	45	100						

Justification Statements:

CO 1: Understand the basic significance of Data Science
Action Verb: Understand (L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than of PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: Review(L2)
CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO1 Action verb is less than PO4 verb. Therefore the correlation is Low (1)

CO 2: Analyze the large data sets using python libraries
Action Verb: Analyze (L4)
PO1: Apply(L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)

CO 3 : Apply the ACID Principles of relational data and NOSQL Data
Action Verb: Apply (L3)
PO1: Apply(L3)
CO3 Action verb is same as of PO1 verb. Therefore, the correlation is High (3)
PO2: Review (L2)
CO3 Action verb is greater than level as PO2 verb by one. Therefore, the correlation is medium (2)
PO3: Develop (L3)
CO3 Action verb is same as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO3 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)
PO10: Thumb rule
The fundamental tools of data analysis and statistics to solve difficult problems in different data sets Therefore, the correlation is medium (2)

CO 4: Apply the Machine learning techniques for data analytics on standard data sets **Action Verb: Apply (L3)**
PO1: Apply(L3)
CO4 Action verb is same level of PO1 verb. Therefore the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is medium (2)
PO3: Develop (L3)

CO3 Action verb is same as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb. Therefore the correlation is medium(2)
PO5: Apply(L3)
CO3 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

CO 5: Understand the python programs to present and interpret data sets using visualization packages in python
Action Verb: Understand (L2)
PO1: Apply(L3)
CO5 Action verb is Less than of PO1 verb. Therefore, the correlation is Medium (2)
PO2: Review (L2)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is High (3)
PO3: Develop (L3)
CO5 Action verb is Less than of PO3 verb. Therefore, the correlation is Medium (2)
PO4: Analyze (L4)
CO5 Action verb is Less than of PO4 verb. Therefore, the correlation is Medium (2)
PO5: Apply(L3)
Action verb is Less than of PO5 verb. Therefore, the correlation is Medium (2)
PO11: Thumb rule
To deployment of application need suitable visualization reports to be generated by project team members.Therefore, the correlation is medium (2)

Course Code	Year & Sem	DIGITAL LOGIC & COMPUTER ORGANIZATION	L	T	P	C
23APC0503	II-II	(Common to CSE & CIC,AIDS)	4	2	0	3

CO Statements:

CO1: Understand the number system concepts, number conversions, logic gates using binary numbers

CO2: Understand the sequential circuits, flip-flops, registers and computer fundamentals.

CO3: Evaluate the Arithmetic operations for understanding execution process

CO4: Analyze the memory concepts, cache memory, virtual memory and managing requirements.

CO5: Apply Input/Output devices and Interfaces.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the Binay number system concepts number, conversions,logic		using binary numbers	L2
CO2	Understand	the sequential circuits, flip-flops, registers and computer fundamentals			L2
CO3	Evaluate	the Arithmetic operations		for understanding execution process	L5
CO4	Analyze	the memory concepts, cache memory, virtual memory and managing requirements			L4
CO5	Apply	Input/Output devices and Interfaces			L3

UNIT – I	9Hrs

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

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

UNIT – II	9Hrs

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, Addressing modes,subroutines.

UNIT – III	9Hrs

Computer Arithmetic : Addition and Subtraction of Signed Numbers,Ripple carry adder,Ripple carry multiplier, 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	9Hrs

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

UNIT – V	9Hrs

Input /Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Synchronous and Asynchronous bus, Interface Circuits, Standard I/O Interfaces

Textbooks

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

Reference Books

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

Online Learning Resources:

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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	3								1		
CO2	2	1	3								1		
CO3	3	2	2						1		1		
CO4	2	3	3	3									
CO5	3			2	3				2		2		

Correlation matrix

Unit No.	CO						Program Outcome(PO)	PO(s) :Action Verband BTL(for PO1 to PO12)	Level of Correlation (0-3)
		Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1		9	20	2	CO1 : Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO11: Thumb rule	2 1 3 1
2		9	20	2	CO2 : Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO11: Thumb rule	2 1 3 1

3	9	20	2	CO3 : Evaluate	L5	PO1	PO1: Apply(L3)	3
						PO2	PO2: Analyze (L4)	2
						PO3	PO3: Design (L6)	2
						PO9	PO9: Thumb rule	1
						PO11	PO12: Thumb rule	1
4	9	20	2	CO4 : Analyze	L4	PO1	PO1: Apply(L3)	2
						PO2	PO2: Analyze (L4)	3
						PO3	PO3: Design (L6)	3
						PO4	PO4: Design (L6)	3
5	9	20	2	CO5 : Apply	L3	PO1	PO1: Apply(L3)	3
						PO4	PO4: Analyze (L4)	2
						PO5	PO5: Develop (L6)	3
						PO9	PO9: Thumb rule	2
						PO11	PO12: Thumb rule	2
	45	100						

Justification Statements:

CO1: Understand the number system concepts, number conversions, logic gates using binary numbers
Action Verb: Understand(L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)
PO3: Design (L6)
CO1 Action verb is less than PO3 verb . Therefore, the correlation is high (3)
PO11: Thumb rule
updating the logical circuits and combinational circuits. Therefore, the correlation is low (1)

CO2: **Understand** the sequential circuits, flip-flops, registers and computer fundamentals.
Action Verb: Understand(L2)
PO1: Apply(L3)
CO2 Action verb is greater than level PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Analyze(L4)
CO2 Action verb is less than PO2 verb by two level. Therefore, the correlation is low (1)
PO3: Design (L6)
CO2 Action verb is less than PO3 verb . Therefore, the correlation is high (3)
PO11: Thumb rule
Update sequential circuits and registers. Therefore, the correlation is low (1)

CO3: Evaluate the Arithmetic operations for understanding execution process
Action Verb: Evaluate(L5)
PO1: Apply(L3)
CO3 Action verb is higher level than PO1 verb level by two level. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO9: Thumb rule
Team work is required. Hence the correlation is low (1)
PO11: Thumb rule
Updating the Numbers and execution process. Therefore the correlation is low (1)

CO4: Analyze the memory concepts, cache memory, virtual memory and managing requirements.
Action Verb: Analyze(L4)
PO1: Apply(L3)
CO4 Action verb is less than PO1 by one level. Therefore, the correlation is moderate (2)
PO2: Analyze (L4)
CO4 Action verb is same as PO2 verb. Therefore, the correlation is High (3)
PO3: Design (L6)
CO4 Action verb is less than PO3 verb by two levels. Therefore, the correlation is High (3)
PO4: Design (L6)
CO4 Action verb is less than PO4 verb by two levels. Therefore, the correlation is High (3)

CO5: Apply Input/Output devices and Interfaces
Action Verb: Apply (L3)
PO1: Apply(L3)
CO5 Action verb is same as PO1. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Develop(L6)
CO5 Action verb is less than PO5 verb . Therefore, the correlation is high (3)
PO9 : Thumb rule
Team work is required to provide the solutions on different numbers. Hence the correlation is moderate (2)
PO11: Thumb rule
Updating the Numbers and execution process. Therefore, the correlation is moderate (2)

Course Code	Year & Sem	Artificial Intelligence Lab	L	T	P	C
20APC3002	II-II		0	0	3	1.5

Course Outcomes:

After studying the course, students will be able to

CO1: Analyze the various searching algorithms for finding solutions.

CO2: Apply the various searching algorithms for finding shortest path to a problem. **CO3: Apply** the machine learning methods using atomic sentences for finding solutions. **CO4: Analyze** the reasoning system to find conclusions using knowledge based system.

CO5: Apply the reasoning concepts through python programming

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	the various searching algorithms		for finding solutions	L4
CO2	Apply	the various searching algorithms		for finding shortest path to a problem	L3
CO3	Apply	machine learning methods	using atomic sentences	for finding solutions	L3
CO4	Analyze	the reasoning system to find conclusions	using knowledge based system		L4
CO5	Apply	the reasoning concepts through python programming			L3

List of Experiments:
1. Write a Program to Implement Breadth First Search using Python.(CO1)
2. Write a program to implement Best First Searching Algorithm(CO1)
3. Write a Program to Implement Depth First Search using Python. (CO1)
4. Write a program to implement the Heuristic Search(CO2)
5. Write a python program to implement A* and AO* algorithm. (Ex: find the shortest path) (CO2)
6. Write a Program to Implement Water-Jug problem using Python. (CO3)
7. Write a Program to Implement Alpha-Beta Pruning using Python. (CO3)
8. Write a Program to implement 8-Queens Problem using Python. (CO3)
9. 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. (CO4)
10. Write a program to implement the Unification algorithm(CO4)
11. Develop a knowledge base system consisting of facts and rules about some specialized knowledge domain(CO5)
12. 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. (CO5)

Textbooks:
1. PrateekJoshi,Artificial Intelligence with Python,Packt Publishing, 2017.
2. Xiao, Perry. Artificial intelligence programming with Python: from zero to hero. John Wiley & Sons, 2022.

Reference Books:
1. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Fourth Edition, Pearson,2020

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3										1	
CO2	3	2	2									1	
CO3	3	2	3	2					1		1		1
CO4	2	3											1
CO5		2	3	2	3			2	1		2		1

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1 : Analyze	L4	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 3
2	CO2 : Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO12: Thumb rule	3 2 2
3	CO3 :Apply	L3	PO1 PO2 PO3 PO4 PO9 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO4: Analyze (L4) PO9: Thumb rule PO12: Thumb rule	3 2 3 2 1 1
4	CO4 :Analyze	L4	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 3
5	CO5 : Apply	L3	PO2 PO3 PO4 PO5 PO8 PO9 PO11	PO2: Analyze (L4) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO8: Thumb rule PO9: Thumb rule PO12: Thumb rule	2 3 2 3 2 1 2

Justification Statements :
CO1: Analyze the basic concepts of Python Programming
Action Verb : Analyze (L4)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the loops and conditional statements of python using IDLE and programs.
Action Verb : Apply (L3)
PO1 Verb : Apply(L3)
CO1 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO11: Thumb rule
For usage of the loops and conditional statements of python using IDLE is medium. Therefore the correlation is medium (2)

CO3: Analyze the compound data using Lists, Tuples and dictionaries using functions.
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is medium (2)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb . Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is greater than PO4 verb by one level. Therefore the correlation is medium (2)
PO9 : Thumb rule
Team work is required to Analyze the compound data using. Hence the correlation is low (1)
PO11: Thumb rule
Construct real time applications using functions can be lifelong learning. Therefore the correlation is low (1)

CO4: Apply the development applications using python datatypes to read and write data from files.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO4 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2: Analyze (L4)
CO4 Action verb is same as PO2 verb. Therefore the correlation is high (3)

CO5: Design the solutions using OOPs concepts for real world problems in python.
Action Verb : Apply (L3)
PO2: Analyze (L4)
CO5 Action verb is less than PO2 verb by one levels. Therefore the correlation is medium (2)
PO3: Develop (L3)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is greater than PO4 verb by one level. Therefore the correlation is medium (2)
PO5: Apply(L3)
CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO8 : Thumb rule
IOT Applications can be used to make society better place. Therefore the correlation is medium(2)
PO9 : Thumb rule
Team work is required to Create AI applications. Hence the correlation is low (1)
PO11: Thumb rule
In real time oops concepts are used to solve the societal problems by using Artificial intelligence applications. Therefore the correlation is medium (2)

Course Code	Year & Sem	Data Science using Python Lab	L	T	P	C
23APC0509	II-II		0	0	3	1.5

Course Outcomes:

After studying the course, students will be able to
CO1: Understand the concepts of Data frames, pandas and NumPy in Python programming for solving complex problems.
CO2: Apply the python libraries for basic statistical and descriptive analytics on the data sets.
 CO3:Apply the corelation and regression analytics and standard data sets.
 CO4: Analyse the python programs to present and interpret data using visualization reports
CO5: Understand the basic Python libraries for data science to optimize numeric applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the concepts of Data frames, pandas and NumPy		for solving complex problems.	L2
CO2	**Apply**	the python libraries for basic statistical and descriptive analytics on the data sets			L3
CO3	**Apply**	the corelation and regression analytics and standard data sets			L3
CO4	**Analyse**	the python programs to present and interpret data		Visualization reports	L4
CO5	**Understand**	the basic Python libraries for data science		to optimize numeric applications	L2

List of Experiments

1. Creating a NumPy Array[CO1]
  a. Basic ndarray
  b. Array of zeros
  c. Array of ones
  d. Random numbers in ndarray
  e. An array of your choice
  f. Imatrix in NumPy
  g. Evenly spaced ndarray
2. The Shape and Reshaping of NumPy Array[CO1]
  a. Dimensions of NumPy array
  b. Shape of NumPy array
  c. Size of NumPy array
  d. Reshaping a NumPy array
  e. Flattening a NumPy array
  f. Transpose of a NumPy array

3. Expanding and Squeezing a NumPy Array[CO1]
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array[CO2]
   a. Slicing 1-D NumPy arrays
   b. Slicing 2-D NumPy arrays
   c. Slicing 3-D NumPy arrays
   d. Negative slicing of NumPy arrays
5. Stacking and Concatenating NumPy Arrays[CO2]
   a. Stacking ndarrays
   b. Concatenating ndarrays
   c. Broadcasting in NumPy Arrays
6. Perform following operations using pandas[CO3]
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column
7. Perform following operations using pandas[CO3]
   a. Filling NaN with string

   b. Sorting based on column values
   c. groupby()
8. Read the following file formats using pandas[CO4]
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files
9. Read the following file formats[CO4]
   a. Pickle files
   b. Image files using PIL
   c. Multiple files using Glob
   d. Importing data from database
10. Demonstrate web scraping using python[CO4]
11. Perform following preprocessing techniques on loan prediction dataset[CO5]
   a. Feature Scaling
   b. Feature Standardization
   c. Label Encoding
   d. One Hot Encoding
12. Perform following visualizations using matplotlib[CO5]
   a. Bar Graph
   b. Pie Chart
   c. Box Plot
   d. Histogram
   e. Line Chart and Subplots
   f. Scatter Plot
13. Getting started with NLTK, install NLTK using PIP[CO5]
14. Python program to implement with Python Sci Kit-Learn & NLTK[CO5]
15. Python program to implement with Python NLTK/Spicy/Py NLPI. [CO5]

Web References:
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.https://www.nltk.org/book/ch01.html

Maping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	1	2						2		
CO2	3	3	3	3	2								
CO3	3	3	3	3									
CO4	3	3	3	3									
CO5	2	3	2	1							2		

Correlation matrix

Unit No.	CO"s Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5 : Apply(L3) PO11: Thumb rule	3 3 2 1 2 2
2	CO2: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5 : Apply(L3)	3 3 3 3 2
3	CO3: Apply	L3	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
4	CO4:Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
5	CO5: Understand	L2	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO11: Thumb rule	2 3 2 1 2

Justification Statements:

CO 1: Understand the concepts of Data frames, pandas and NumPy in Python programming for solving complex problems.
Action Verb: Understand (L2)
PO1 Verb: Apply(L3)
CO1 Action verb is greater level of PO1 verb by one level. Therefore, the correlation is high (3)
PO2 Verb: Review(L2)
CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO1 Action verb is less than PO3 verb. Therefore the correlation is medium (2)
PO4: Analyze (L4)
CO1 Action verb is greater than PO4 verb. Therefore the correlation is Low (1)
PO5 Verb: Apply(L3)
CO1 Action verb is less than PO5 verb. Therefore, the correlation is medium (2)
PO11: Thumb rule
To solve the different mathematical functions by using python data science predefine libraries to writing simple programs. Therefore, the correlation is medium (2)

CO 2: Apply the python libraries for basic statistical and descriptive analytics on the data sets.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is same as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is greater than PO4 verb. Therefore the correlation is high (3)
PO5 Verb: Apply(L3)
CO2 Action verb is less than PO5 verb. Therefore, the correlation is medium (2)

CO 3: Apply the correlation and regression analytics and standard data sets.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO3 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb. Therefore the correlation is medium (2)

CO 4: Analyze the python programs to present and interpret data using visualization reports
Action Verb: Analyze (L4)
PO1: Apply(L3)
CO5 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
PO2: Review (L2)
CO5 Action verb is greater level of PO2 verb. Therefore, the correlation is High (3)
PO3: Develop (L3)
CO5 Action verb is greater level of PO3 verb. Therefore, the correlation is High (3)

PO4: Analyze (L4)

CO5 Action verb is same as PO4 verb. Therefore, the correlation is High (3)

CO 5: Understand the basic Python libraries for data science to optimize numeric applications

Action Verb: Understand (L2)

PO1 Verb: Apply(L3)

CO5 Action verb is less than of PO1 verb by one level. Therefore, the correlation is medium (2)

PO2 Verb: Review(L2)

CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO5 Action verb is less than PO3 verb. Therefore the correlation is medium (2)

PO4: Analyze (L4)

CO5 Action verb is less than PO4 verb. Therefore the correlation is low (1)

PO11: Thumb rule

To deployment of application need suitable visualization reports to be generated by project team members. Therefore, the correlation is medium (2)

Course Code	Year & Sem	FULL STACK DEVELOPMENT – 1 (Skill Enhancement Course) (Common to CSE/CIC/AIDS/AIML)	L	T	P	C
23ASC0503	II-II		0	0	3	2

Course Outcomes:

CO 1: Understand the web page and identify basic tags and properties in HTML.
CO 2: Apply the concept of CSS properties to design web pages.
CO 3: Analyze the web pages in real time applications of JavaScript for dynamic web pages.
CO 4: Apply the concepts of objects and methods in JavaScript for solving complex problem
CO 5: Evaluate the web pages for developing applications by using events and forms

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the web page and identify basic tags andproperties in HTML.			L2
CO2	Apply	the concept of CSSproperties		to design web pages.	L3
CO3	Analyze	the web pages in realtime applications of JavaScript		for dynamic web pages.	L4
CO4	Apply	the concepts of objectsand methods in JavaScript		for solving complex problems	L3
CO5	Evaluate	the web pages for developing applicationusing events and forms		using events and forms	L5

List of Experiments:

1. Lists, Links and Images**[CO-1]**
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 anunordered 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[CO-1]

3. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>,
<td> and attributes: border, rowspan, colspan) **[CO-1]**

4. 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.). **[CO-1]**

5. 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). **[CO-1]**

6. 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). **[CO-1]**

7. HTML 5 and Cascading Style Sheets, Types of CSS[CO-2]

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 andvalue).

8. Selector forms[CO-2]

a. Write a program to apply different types of selector forms
  - Simple selector (element, id, class, group, universal)
  - Combinator selector (descendant, child, adjacent sibling, general sibling)
  - Pseudo-class selector
  - Pseudo-element selector
  - Attribute selector

9. CSS with Color, Background, Font, Text and CSS Box Model[CO-2]

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

10. Applying JavaScript - internal and external, I/O, Type Conversion[CO-2]

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

11. JavaScript Pre-defined and User-defined Objects[CO-3]

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.

1. JavaScript Conditional Statements and Loops[CO-4]

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 if a given number is ARMSTRONG NUM" or not. [Eg: 153 is an Armstrong num, since sum of 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)

2. Javascript Functions and Events[CO-5]

a. Design a appropriate function should be called to display
- Factorial of that number
- Fibonacci series up to that number
- Prime numbers up to that number
- Is it palindrome or not

b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime,and Palindrome. When a button is pressed an appropriate function should be called to display
   11. Factorial of that number
   12. Fibonacci series up to that number
   13. Prime numbers up to that number
   14. 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)

Textbooks:

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.

Web Links:

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

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3			3						2		
CO2	3	3									2		
CO3	3	3	3	3	3					2			
CO4	3	3	3	3	3						2		
CO5	3	3	3	3	3								

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3) PO11: Thumb rule	2 3 3 2
2	CO2: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO10	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO10: Thumb rule	3 3 3 3 3 2
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3 2
5	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
5	CO1: Understand	L2	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3) PO11: Thumb rule	2 3 2 2

Justification Statements:

CO1: Understand the web page and identify basic tags and properties in HTML.
Action Verb : Understand (L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO2 verb by one, Therefore the correlation is medium (2)
PO2 Verb : Review(L2)
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO5 Verb : Apply(L2)
CO1 Action verb is less than PO2 verb by one, Therefore the correlation is medium (2)
PO11: Thumb rule
To make use of HTML elements and tags in application, need to upgrade for long period.
Therefore, the correlation is medium (2)

CO 2: Apply the concept of CSS properties to design web pages.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Review(L2)

CO2 Action verb is greater than PO2 verb by one, Therefore the correlation is high (3)

PO11: Thumb rule

The application can be designed specifically all kind of users and web browsers.
Therefore the correlation is medium (2)

CO 3: Analyze the web pages in real time applications of JavaScript for dynamic web pages.

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO3 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)

PO2: Review (L2)

CO3 Action verb is greater than level as PO2 verb by one. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is same PO4 verb. Therefore the correlation is high (3)

PO5: Apply(L3)

CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO10: Thumb rule

To make web site and web pages should be interactive understand by user, so need to provide proper forms.

Therefore, the correlation is medium (2)

CO4: Apply the concepts of objects and methods in JavaScript for solving complex problem

Action Verb: Apply (L3)

PO1: Apply(L3)

CO4 Action verb is same level of PO1 verb. Therefore the correlation is high (3)

PO2: Review(L2)

CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop(L2)

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze(L2)

CO4 Action verb is same level of PO4 verb. Therefore the correlation is high (3)

PO5: Apply(L3)

CO4 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

The design application needs to upgrade for future specific requirement. Therefore the correlation is medium (2)

CO 5: Evaluate the web pages for developing applications by using events and forms

Action Verb : Evaluate (L5)

PO1: Apply(L3)

CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2: Review (L2)

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is greater than two as PO4 verb. Therefore the correlation is high (3)

PO5: Apply(L3)

CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

Course Code	Year & Sem	Design Thinking & Innovation	L	T	P	C
23AES0304	II-II		0	1	2	2

Course Outcomes:

After studying the course, student will be able to

CO: 1   **Understand** the concepts and principles of design thinking process.

CO: 2   **Apply** the design thinking techniques for solving problems in various sectors.

CO: 3   **Analyze** the art of innovation & creativity in product development.

CO: 4   **Apply** the design guidelines for produced development.

CO: 5   **Analyze** the design thinking strategies for solving real time business issues.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concepts and principles of design thinking process.			L1
CO2	Apply	the design thinking techniques for solving problems in various sectors.			L3
CO3	Analyze	the art of innovation & creativity in product development.			L4
CO4	Apply	the design guidelines for produced development.			L3
CO5	Analyze	the design thinking strategies for solving real time business issues.			L4

Unit I:

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Unit II

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development
Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Unit III

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.
Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Unit IV

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies
Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Unit V

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes
Activity: How to market our own product, About maintenance, Reliability and plan for startup.
Text Books:
1. Tim Brown, Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:
1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritina holden, Jill Butter.
4. Chesbrough. H, The Era of Open Innovation – 2013

Online Learning Resources:
1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview

Course Title	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Design Thinking & Innovation	CO1	2		2									2	2
	CO2	2	2	2									2	2
	CO3	2	2	2			1						2	2
	CO4	2	2	2			1						2	2
	CO5	2	2	2			2						2	2

Correlation matrix

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	11	20.3	L3	Understand	L2	PO1 PO3	Apply (L3) Develop (L3)	2 2
2	10	18.5	L2	Apply	L3	PO1 PO2 PO3	Apply (L3) Identify (L3) Develop (L3)	3 3 3
3	11	20.3	L3	Analyze	L4	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 1
4	12	22.2	L3	Apply	L3	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 1
5	10	18.5	L2	Analyze	L4	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 2
Total	54	100						

Justification Statements:

CO1: Understand the concepts and principles of design thinking process.
Action Verb: Understand (L2)
PO1Verb: **Apply (L3)**
CO1 Action verb is lower than PO1 verb. Therefore, the correlation is medium (2)
PO3 Verb: **Develop (L3)**
CO1 Action verb is lower than PO3 verb. Therefore, the correlation is medium (2)

CO2: Apply the design thinking techniques for solving problems in various sectors.
PO1 Verb: **Apply (L3)**
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO2 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

CO3: Analyze the art of innovation & creativity in product development.
Action Verb: **Analyze** (L4)
PO1 Verb: **Apply (L3)**
CO3 Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO3 Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO3 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is high (3)
PO6 Verb: Thumb Rule
As per thumb rule CO3 co-relates slightly with PO6 verb. Therefore, the correlation is high (3)

CO4: Apply the design guidelines for produced development.
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO6 Verb: Thumb Rule
As per thumb rule CO4 co-relates slightly with PO6 verb. Therefore, the correlation is high (3)

CO5: Analyze the design thinking strategies for solving real time business issues.
Action Verb: Analyze (L4)
PO1 Verb: **Apply (L3)**
CO5 Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO5 Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO5 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is low (1)
PO6 Verb: Thumb Rule
As per thumb rule CO5 co-relates moderately with PO6 verb. Therefore, the correlation is high (3)

Course Code				L	T	P	C
23AMC9901		**ENVIRONMENTAL SCIENCE**		**2**	**0**	**0**	**0**
Pre-Requisites		ENVIRONMENTAL SCIENCE	Semester	**II**			

Course Outcomes (CO): Student will be able to

1. Understand the multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.

2. Understand the ecosystem and biodiversity to solve complex environmental problems

3. Apply various types of pollution and solid waste management and related preventive measures

4. Apply rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation.

5. Understand the population explosion

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	Multidisciplinary nature of environmental studies and various renewable and nonrenewable resources			**L2**
2	**Understand**	Ecosystem and biodiversity to solve complex environmental problems			**L2**
3	**Apply**	Various types of pollution and solid waste management and related preventive measures			**L3**
4	**Apply**	Rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation			**L3**
5	**Understand**	Population explosion			**L2**

UNIT – I   **(10Hr)**

Multidisciplinary Nature o**f Environmental Studies:** Introduction – Multidisciplinary Nature of Environmental Studies – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable energy resources – Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and sub-surface – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies.

Energy resources: Renewable and non-renewable energy resources.

UNIT – II   **(15Hr)**

Ecosystems: Concept of an ecosystem. – Structure and functions 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: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity And Its Conservation : Introduction- Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity:

habitat loss, poaching of wildlife, man – wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III   **(8Hr)**

Environmental Pollution: Definition, Causes, effects and its control measures of: Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, and Thermal pollution and Nuclear hazards.

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

UNIT – IV   (9Hr)

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

UNIT – V   (8Hr)

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

TEXT BOOKS:
1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

REFERENCES:
1. Environmental studies by R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.
4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1						2	2						
2							2						
3						2	2						
4						2	2						
5							2						

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	**10**	**12**	23	3	**Understand**	**L2**	PO6,PO7	PO6: PO7:	2,2
2	**15**	**15**	28	3	**Understand**	**L2**	PO7	PO7:	2,2
3	**8**	**8**	15	2	**Apply**	**L3**	PO6 PO7	PO6: PO7:	2,2
4	**9**	**10**	19	2	**Apply**	**L3**	PO6,PO7	PO6: PO7:	2,2
5	**8**	**8**	15	2	**Understand**	**L2**	PO7	PO7:	2,2
	50	**53**	**100**						

JUSTIFICATION:

CO1: Understand the multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
Action Verb: Understand (L2)
CO1 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO2: Understand the ecosystem and biodiversity to solve complex environmental problems
Action Verb: Understand (L2)
CO2 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO3: Apply various types of pollution and solid waste management and related preventive measures
Action Verb: APPLY (L3)
CO3 Action Verb is **APPLY** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO4: Apply rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation.
Action Verb: APPLY (L3)
CO4 Action Verb is **APPLY** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO5: Understand the population explosion
Action Verb: Understand (L2)

CO5 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

COMMUNITY SERVICE PROJECT

......Experiential learning through community engagement

Introduction
- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.

- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

Procedure
- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

EXPECTED OUTCOMES
BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes
- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes
- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes
- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development
- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution
- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES
- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY
- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables

25. Organic farming

26. Crop rotation

27. Floury culture

28. Access to safe drinking water

29. Geographical survey

30. Geological survey

31. Sericulture

32. Study of species

33. Food adulteration

34. Incidence of Diabetes and other chronic diseases

35. Human genetics

36. Blood groups and blood levels

37. Internet Usage in Villages

38. Android Phone usage by different people

39. Utilisation of free electricity to farmers and related issues

40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children
1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment
1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days Programs for

Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs
1. Awareness on RTI
2. Health intervention programmes
3. Yoga

4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture
    vi. Fisheries
    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
    xiv. Energy

Role of Students:
- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like
- Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity
Duration: 8 weeks

1. **Preliminary Survey (One Week)**
   - A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
   - A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
   - The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. **Community Awareness Campaigns (One Week)**
   - Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmesto be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. **Community Immersion Programme (Three Weeks)**
   Along with the Community Awareness Programmes, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. **Community Exit Report (One Week)**
   - During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.