COURSE STRUCTURE

For

B.Tech.

Computer Science and Engineering
(Data Science)

(*for 2023 Admitted batch only)*

PRAGATI ENGINEERING COLLEGE

(An Autonomous Institution)
ADB Road, Surampalem, Kakinada District, A.P.-533 437
(Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada)
(Recognized by UGC under sections 2 (f) and 12 (b) of UGC act, 1956)

Pragati Engineering College (Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

COURSE STRUCTURE

INDUCTION PROGRAMME

S.No.	Course Name	Category	L	T	P	Credits
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0	0	6	0
2	Career Counselling	MC	2	0	2	0
3	Orientation to all branches -- career options, tools, etc.	MC	3	0	0	0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2	0	3	0
5	Proficiency Modules & Productivity Tools	ES	2	1	2	0
6	Assessment on basic aptitude and mathematical skills	MC	2	0	3	0
7	Remedial Training in Foundation Courses	MC	2	1	2	0
8	Human Values & Professional Ethics	MC	3	0	0	0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2	1	2	0
10	Concepts of Programming	ES	2	0	2	0

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Department of Computer Science and Engineering (Data Science)

I YEAR – I SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	BS&H	23BP101T	Engineering Physics	3	0	0	3
2	BS&H	23BM101T	Linear Algebra and Calculus	3	0	0	3
3	Engineering Science	23EE101T	Basic Electrical and Electronics Engineering	3	0	0	3
4	Engineering Science	23ME101T	Engineering Graphics	1	0	4	3
5	Engineering Science	23CS101T	Introduction to Programming	3	0	0	3
6	BS&H	23BP101P	Engineering Physics Laboratory	0	0	2	1
7	Engineering Science	23EE101P	Electrical and Electronics Engineering Workshop	0	0	3	1.5
8	Engineering Science	23CS101P	Computer Programming Laboratory	0	0	3	1.5
9	Engineering Science	23IT101P	IT Workshop	0	0	2	1
10	BS&H	23MH102P	NSS/NCC/Scouts and Guides/Community Service	0	0	1	0.5
Total Credits							**20.5**

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Department of Computer Science and Engineering (Data Science)

I YEAR – II SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	BS&H	23BE201T	Communicative English	2	0	0	2
2	BS&H	23BM201T	Differential Equations and Vector Calculus	3	0	0	3
3	BS&H	23BC201T	Chemistry	3	0	0	3
4	Engineering Science	23CM201T	Basic Civil and Mechanical Engineering	3	0	0	3
5	Professional Core	23CS201T	Data Structures	3	0	0	3
6	Engineering Science	23ME203P	Engineering Workshop	0	0	3	1.5
7	BS&H	23BE201P	Communicative English Laboratory	0	0	2	1
8	Professional Core	23CS201P	Data Structures Laboratory	0	0	3	1.5
9	BS&H	23BC201P	Chemistry Laboratory	0	0	2	1
10	BS&H	23MH201P	Health and wellness, Yoga and sports	0	0	1	0.5
Total Credits							**19.5**

COURSE STRUCTURE

II YEAR – I SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	BS&H	23BM304T	Discrete Mathematics & Graph Theory	3	0	0	3
2	BS&H	23HM301T	Universal Human Values - Understanding Harmony and Ethical Human Conduct	2	1	0	3
3	Engineering Science	23DS301T	Introduction to Data Science	3	0	0	3
4	Professional Core	23CS301T	Advanced Data Structures & Algorithms Analysis	3	0	0	3
5	Professional Core	23CS302T	Object-Oriented Programming Through JAVA	3	0	0	3
6	Professional Core	23CS301P	Advanced Data Structures and Algorithms Analysis Laboratory	0	0	3	1.5
7	Professional Core	23CS302P	Object-Oriented Programming Through JAVA Laboratory	0	0	3	1.5
8	Skill Enhancement course	23AI301S	Python programming	0	1	2	2
9	Audit Course	23BC301T	Environmental Science	2	0	0	-
Total Credits							**20**

II YEAR – II SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	Management Course- I	23ME405T	Optimization Techniques	2	0	0	2
2	Engineering Science/Basic Science	23BM403T	Statistical methods for Data science	3	0	0	3
3	Professional Core	23DS401T	Data Engineering	3	0	0	3
4	Professional Core	23IT401T	DBMS	3	0	0	3
5	Professional Core	23EC306T	Computer Organization and Architecture	3	0	0	3
6	Professional Core	23DS401P	Data Engineering Lab	0	0	3	1.5
7	Professional Core	23IT401P	DBMS Lab	0	0	3	1.5
8	Skill Enhancement course	23DS401S	Exploratory Data Analysis with Python	0	1	2	2
9	BS&H	23HM401P	Design Thinking & Innovation	1	0	2	2
Total Credits							**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation							

PRAGATI ENGINEERING COLLEGE

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Department of CSE (Data Science)

COURSESTRUCTURE

III Year I Semester

S. No	Course Code	Category	Course Title	Hours per Week			Credits
				L	T	P	C
1	23AM504T	Professional Core	Machine Learning	3	0	0	3
2	23DS501T	Professional Core	Computer Networks	3	0	0	3
3	23CS507T	Professional Core	Software Engineering	3	0	0	3
4	1. 23AM502T 2. 23CS503T 3.23AI501T 4. 23EC5010T **MOOCs** 23DS502T	Professional Elective-I	1. Automata Theory and Compiler Design 2. Object Oriented Analysis and Design 3. Soft Computing 4. Internet of Things 5. Any of the below 12-Week SWAYAMNPTEL(MOOCs) Courses i. Privacy and Security in Online Social Media ii. Artificial Intelligence: Search Methods for Problem Solving iii. Learning Analytics Tools	3	0	0	3
5	1. 23CE507T 2. 23ME509T 3. 23EE508T 4. 23EC504T 5. 23HM501T	Open Elective-I	1. Construction Project Management 2. Sustainable Energy Technologies 3. Renewable Energy Sources 4. Electronic Devices and Circuits 5. Entrepreneurship and Venture Creation	3	0	0	3
6	23AM504L	Professional Core	Machine Learning Laboratory	0	0	3	1.5
7	23DS501L	Professional Core	Computer Networks Laboratory	0	0	3	1.5
8	23CS501S/ 23CS502S	Skill Enhancement Course	Full Stack Development -1 / SWAYAM Plus–Data Engineer/ SWAYAM Plus – AI Engineer / Salesforce Administrator Explorer	0	1	2	2
9	23CS503S/ 23DS501S	ES	User Interface Design using Flutter / SWAYAM Plus-Android Application Development (with Flutter)	0	0	2	1
10	23IT501P	Community Service Project Internship		-	-	-	2
						Total Credits	**23**

PRAGATI ENGINEERING COLLEGE

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Department of CSE (Data Science)

III Year II Semester

S. No	Course Code	Category	Course Title	Hours per Week			Credits
				L	T	P	
1	23AM601T	Professional Core	Deep Learning	3	0	0	3
2	23CS607T	Professional Core	Operating Systems	3	0	0	3
3	23DS601T	Professional Core	Data Visualization	3	0	0	3
4	1. 23DS602T 2. 23CY604T 3. 23DS603T 4. 23CY601T 5. 23EC6012T **MOOCs** 23DS606T	Professional Elective-II	1. Social Media Analytics 2. Cryptography and Network Security 3. Recommender Systems 4. Cloud Computing 5. Sensor Networks 6. Anyofthebelow12-WeekSWAYAM NPTEL (MOOCs) Courses i. Foundations of Virtual Reality ii. Design and Implementation of Human-Computer Interfaces iii. Real-Time Systems	3	0	0	3
5	1. 23IT603T 2. 23CS606T 3. 23AI602T 4. 23AM607T **MOOCs** 23DS607T	Professional Elective-III	1. Software Project Management 2. Quantum Computing 3. Computer Vision 4. No SQL databases 5. Anyofthebelow12-WeekSWAYAM NPTEL (MOOCs) Courses i. Responsible & Safe AI Systems ii. Introduction to Large Language Models (LLMs) iii. Advanced R Programming for Data Analytics in Business	3	0	0	3
6	1. 23CE6012T 2. 23EE6012T 3. 23ME6012T 4. 23EC6013T	Open Elective–II	1. Disaster Management 2. Fundamentals of Electric Vehicles 3. Additive Manufacturing 4. Principles of Communications	3	0	0	3
7	23AM601L	Professional Core	Deep Learning Laboratory	0	0	3	1.5
8	23DS601L	Professional Core	Data Visualization Laboratory	0	0	3	1.5
9	23HE601S/ 23CS602S	Skill Enhancement course	Softskills / Salesforce Developer Catalyst	0	1	2	2
10	23CM601T	Audit Course	Technical Paper Writing and IPR	2	0	0	-
						Total Credits	**23**

***Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation**

Pragati Engineering College (Autonomous)

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I Year I Semester
ENGINEERING PHYSICS
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Basic Sciences	**Course Code**	23BP101T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Intermediate Physics	**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Impart Knowledge of Physical Optics phenomena like Interference, Diffraction and Polarization required to design instruments with higher resolution.
2	Impart the knowledge of Dielectric & Magnetic materials, for engineering Applications.
3	Understand the basics of Semiconductors and their working mechanism for their utility in Engineering applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze the intensity variation of light due to polarization, interference and diffraction	K4
CO2	Familiarize with the basics of crystals and their structures.	K2
CO3	Applying the concepts of quantum mechanics for calculation of free quantum particle energies and phenomenon of electrical & thermal conductivities to sub microscopic particles	K3
CO4	Apply the basics of phenomenon related to dielectric materials and Magnetic Materials to study their dependence on temperature and frequency response.	K3
CO5	Understand the Band formation, electrical conductivities in semiconductors and study the types of semiconductors using Hall Effect.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	-	1	1	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-
CO3	2	2	-	1	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	1

COURSE CONTENT

UNIT - I

WAVE OPTICS

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

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

UNIT - II

CRYSTALLOGRAPHY AND X-RAY DIFFRACTION

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

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

UNIT - III

DIELECTRIC AND MAGNETIC MATERIALS

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

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

UNIT - IV

QUANTUM MECHANICS AND FREE ELECTRON THEORY

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

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

UNIT - V

BAND THEORY OF SOLIDS & SEMICONDUCTOR PHYSICS

BAND THEORY OF SOLIDS

Bloch's Theorem(Qualitative)-Kronig Penny Model(Qualitative)-E vs K diagram-V vs K diagram, Effective mass of electron- Classification of Crystalline Solids-Concept of hole

SEMICONDUCTOR PHYSICS

Semiconductors: Introduction-Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and

temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

TEXT BOOKS

"A Text book of Engineering Physics"by M.N.Avadhanulu, P.G.Kshirsagar -S.Chand Publications,

"Engineering Physics" by Tirupati Naidu & Veeranjaneyalu, V G S Publishers

"Engineering Physics" by P.K Palanisamy,Sci Tech Publication

REFERENCE BOOKS

Kettles Introduction to Solid state Physics-Charles Kittel, Wiley India Edition

Solid State Physics ,AJ Dekker, I Edition, Macmillan Publishers India Private Limited

"Engineering Physics" by M.R.Srinivasan, New Age international publishers.

"Solid State Physics" by SO Pilai., - New age International Publishers

WEB RESOURCES

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

Unit I: https://nptel.ac.in/courses/122/107/122107035/#

Unit II: https://nptel.ac.in/courses/113/104/113104014/

Unit III: https://nptel.ac.in/courses/113/104/113104090/
https://youtu.be/DDLljK1ODeg

Unit IV : https://study.com/academy/lesson/the-de-broglie-hypothesis-definition-significance.html
https://nptel.ac.in/courses/115/101/115101107/
https://nptel.ac.in/courses/115/105/115105122/

Unit V : https://www.electronics-tutorials.ws/diode/diode_1.html
https://nptel.ac.in/courses/115/105/115105099/
https://nptel.ac.in/courses/108/108/108108122/

Pragati Engineering College (Autonomous)

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I Year I Semester
LINEAR ALGEBRA AND CALCULUS
(Common to All Branches)

Course Category	Basic Sciences	**Course Code**	23BM101T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Matrix Algebra, Limits, Continuity, Differentiability and integrability	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Develop and use of matrix algebra techniques that are needed by engineers for practical applications.	K3
CO2	Find the Eigen values and Eigen vectors and able to reduce the given quadratic form into canonical form by orthogonal transformation.	K3
CO3	Utilize mean value theorems to real life problems.	K3
CO4	Familiarize with functions of several variables which is useful in optimization & learn important tools of calculus in higher dimensions	K3
CO5	Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

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COURSE CONTENT

UNIT I

Matrices:

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

UNIT II

Eigenvalues, Eigenvectors and Orthogonal Transformation:

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

UNIT III

Calculus:

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems. Taylor's and Maclaurin series.

UNIT IV

Partial differentiation and Applications (Multi variable calculus):

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

UNIT V

Multiple Integrals (Multi variable Calculus):

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

TEXT BOOKS

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

REFERENCE BOOKS

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)
6. Advanced Engineering Mathematics by H. K Dass, S. Chand Publications, 2022, 22nd Edition (Reprint 2022).

WEB RESOURCES

1. https://en.wikipedia.org/wiki/System_of_linear_equations
2. https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
3. https://www.math.hmc.edu/calculus/tutorials/eigenstuff/
4. https://en.wikipedia.org/wiki/Quadratic_form
5. https://en.wikipedia.org/wiki/Calculus
6. https://en.wikipedia.org/wiki/Partial_derivative
7. https://www.whitman.edu/mathematics/calculus_online/section14.03.html
8. https://en.wikipedia.org/wiki/Multiple_integral
9. http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx

Pragati Engineering College (Autonomous)

R23

I Year I Semester
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to CSE, CSE (AIML), CSE (AI) and CSE (DS))

Course Category	Engineering Science	**Course Code**	23EE101T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

PART-A: BASIC ELECTRICAL ENGINEERING

COURSE OBJECTIVES
To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Know the fundamental laws, operating principles of motors, generators, MC and MI instruments	K2
CO2	Apply the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.	K3
CO3	Apply the mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	-	-	-	-	-	-	-	-
CO2	2	2	2	-	-	2	-	-	-	-	-	-
CO3	3	3	-	-	-	-	2	2	-	-	-	-

COURSE CONTENT

UNIT - I

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, DhanpatRai& Co, 2013

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, McGraw 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

Pragati Engineering College (Autonomous)

PART-B : BASIC ELECTRONICS ENGINEERING

COURSE OBJECTIVES	
1	To impart knowledge on semiconductor devices.
2	To introduce concepts of biasing and applications of diodes and transistors.
3	To introduce fundamentals of digital electronics.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic concepts of diodes and transistors	K2
CO2	Understand the working principles of semiconductor devices and applications	K2
CO3	Understand number system, Boolean algebra, basics of combinational and sequential circuits	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	2										
CO3	2	2										

COURSE CONTENT

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

Textbooks:

1. Robert. L. Boylestad & Louis Nashelsky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. Digital Design by Morris Mano, 3E, Prentice Hall, India, 2001

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.

Web References:

1. NPTEL- https://archive.nptel.ac.in/courses/108/108/108108122/
2. Neso Academy- https://www.nesoacademy.org/ec/05-digital-electronics

Pragati Engineering College (Autonomous)

R23

I Year I Semester
ENGINEERING GRAPHICS
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Engineering Science	**Course Code**	23ME101T
Course Type	Theory	**L-T-P-C**	1-0-4-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing.
2	To impart knowledge on the projection of points, lines and plane surfaces.
3	To improve the visualization skills for better understanding of projection of solids.
4	To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
5	To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.	K2
CO2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.	K3
CO3	Understand and draw projection of solids in various positions in first quadrant.	K3
CO4	Explain principles behind development of surfaces.	K2
CO5	Prepare isometric and perspective sections of simple solids.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	-	-	-	-	-	-	-	1	-
CO3	3	2	2	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	1	-
CO5	3	2	2	-	3	-	-	-	-	-	1	-

COURSE CONTENT

UNIT - I

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

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

Scales: Plain scales, diagonal scales and vernier scales.

UNIT - II

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

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

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

UNIT - III

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

UNIT - IV

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

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

UNIT - V

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

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

Textbook:

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

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, Tata McGraw Hill, 2017.

Web References:

1. http://nptel.ac.in/courses/112103019/
2. https://www.cadtutor.net/tutorials/autocad/

Pragati Engineering College (Autonomous)

R23

I Year I Semester

INTRODUCTION TO PROGRAMMING

(Common to All Branches)

Course Category	Engineering Science	**Course Code**	23CS101T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To introduce students to the fundamentals of computer programming.
2	To provide hands-on experience with coding and debugging.
3	To foster logical thinking and problem-solving skills using programming.
4	To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
5	To encourage collaborative learning and teamwork in coding projects.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand basics of computers, the concept of algorithm and algorithmic thinking.	K3
CO2	Analyze a problem and develop an algorithm to solve it.	K4
CO3	Implement various algorithms using the C programming language.	K5
CO4	Understand more advanced features of C language.	K3
CO5	Develop problem-solving skills and the ability to debug and optimize the code.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

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COURSE CONTENT

UNIT- I

Introduction to Programming and Problem Solving

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

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT -II

Control Structures

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

UNIT -III

Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Arrays Applications , Introduction to Strings, String input and output functions, String handling functions.

UNIT -IV

Pointers & User Defined Data types

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

UNIT -V

Functions & File Handling

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

Note: The syllabus is designed with C Language as the fundamental language of implementation.

TEXT BOOKS

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 2005, 2nd Edition
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 4th edition, 2018

REFERENCE BOOKS

1. Computing fundamentals and C Programming, Balaguruswamy, E., McGraw-Hill Education, 7th Edition, 2017
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rdedition, 2009

WEB RESOURCES

1. http://nptel.ac.in/courses/106104128/
2. http://students.iitk.ac.in/programmingclub/course/#notes
3. http://c-faq.com/~scs/cclass/cclass.html

Pragati Engineering College (Autonomous)

R23

I Year I Semester
ENGINEERING PHYSICS LABORATORY
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Basic Sciences	**Course Code**	23BP101P
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites	Intermediate Physics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The student will have exposure to various experimental skills which is essential for an Engineering student.
2	To gain practical knowledge by applying the experimental methods to correlate with the Theoretical Physics.
3	Apply the Analytical techniques and graphical analysis to the experimental data

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basics of Interference, Diffraction in Physics using instruments like Spectrometer, Travelling microscope.	K2
CO2	Study the Mechanical Laws, Strength of materials, Magnetic and Dielectric constants of materials.	K3
CO3	Apply the basics of Current Electricity and Semiconductors in engineering application	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	-	1	-	-	-	-	-	-	-

COURSE CONTENT (Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode).

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

TEXT BOOKS

College Customized Manual

REFERENCE BOOKS

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

WEB RESOURCES

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

Pragati Engineering College (Autonomous)

R23

I Year I Semester
ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP
(Common to CSE, CSE (AIML), CSE (AI) and CSE (DS))

Course Category	Engineering Scince	**Course Code**	23EE101P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

PART-A:ELECTRICAL ENGINEERING WORKSHOP

COURSE OBJECTIVES
To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Know the Electrical circuit design concepts; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.	K2
CO2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.	K3
CO3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.	K3
CO4	Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.	K4
CO5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Measurement of Three- phase power in Three-phase induction motor using two wattmeter method
5. Speed control of DC shunt motor
6. Measurement of Power and Power factor using Single-phase wattmeter
7. Measurement of Earth Resistance using Megger
8. Calculation of Electrical Energy for Domestic Premises

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, DhanpatRai& Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed.

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R23

PART B: ELECTRONICS ENGINEERING LABORATORY

COURSE OBJECTIVES
To impart knowledge on the principles of digital electronics and fundamentals ofelectron devices & its applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO6	Identify & testing of various electronic components.	K3
CO7	Understand the usage of electronic measuring instruments.	K3
CO8	Plot and discuss the characteristics of various electron devices.	K3
CO9	Explain the operation of a digital circuit.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO6	2	2		2	2							
CO7	2	2		2	2							
CO8	2	2		2	2							
CO9	2	2		2	2							

List of experiments:

1. Introduction to Active and Passive devices must be experiment-1 (includes Resistors, Capacitors, Inductors, Diodes, Transistors, Power supplies, Ammeter(s), Voltmeter(s), necessary devices)
2. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
3. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
4. Determine ripple factor of full wave rectifier.
5. Plot Input & Output characteristics of BJT in CE and CB configurations.
6. Determining CE Amplifier input and output impedance with and without bypass capacitor.
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gatesusing ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices. Multisim/PSPICE software for Simulation.

References:

1. Robert. L. Boylestad & Louis Nashelsky, Electronic Devices & Circuit Theory, PearsonEducation, 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.

Pragati Engineering College (Autonomous)

R23

I Year I Semester
COMPUTER PROGRAMMING LABORATORY
(Common to All Branches)

Course Category	Engineering Science	**Course Code**	23CS101P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
The course aims to give students hands – on experience and train them on the concepts of the C-programming language.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Read, understand, and trace the execution of programs written in C language.	K3
CO2	Select the right control structure for solving the problem.	K3
CO3	Develop C programs which utilize memory efficiently using programming constructs like pointers.	K3
CO4	Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

WEEK 1

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

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

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

WEEK 2

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

Suggested Experiments /Activities:

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

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

Developing the algorithms/flowcharts for the following sample programs

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

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

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

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operatorsused in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator' precedence and associativity

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

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

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

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and

for loop in addition to structured jump constructs like break and continue including when each ofthese statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series

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

WEEK 7

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

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.
Lab 7:1D Array manipulation, linear search

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

WEEK 8

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

Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Matrix problems, String operations, Bubble sort

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

WEEK 9

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

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

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

WEEK 10

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

Suggested Experiments/Activities:

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

Lab10 : Bitfields, linked lists

i) Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields
ii) Create and display a singly linked list using self-referential structure.
iii) Demonstrate the differences between structures and unions using a C program.
iv) Write a C program to shift/rotate using bitfields.
v) Write a C program to copy one structure variable to another structure of the same type.

WEEK 11

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

Suggested Experiments/Activities:

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

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

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

WEEK 12

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

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

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

WEEK 13

Objective: Explore the basic difference between normal and pointer variables, Arithmeticoperations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

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

i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters usingpointers.

WEEK 14

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

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

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

TEXT BOOKS

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

REFERENCE BOOKS

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

WEB RESOURCES

1. https://www.researchgate.net/publication/322908864_C_Programming_Lab_Manual
2. https://www.javatpoint.com/c-programs

Pragati Engineering College (Autonomous)

R23

I Year I Semester
IT WORKSHOP
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Engineering Science	**Course Code**	23IT101P
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES

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

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Perform Hardware troubleshooting.	K3
CO2	Understand Hardware components and inter dependencies.	K3
CO3	Safeguard computer systems from viruses/worms.	K3
CO4	Document/ Presentation preparation.	K3
CO5	Perform calculations using spreadsheets.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

PC Hardware & Software Installation

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

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

Task 3: Every student should individually install MS windows, Linux / BOSS on the personal computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux / BOSS Lab instructor should verify the installation and follow it up with a Viva.

Internet & World Wide Web

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

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

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

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

WORD

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

Task 2: Using 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 Word.

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

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

EXCEL

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

and resources.

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

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

POWER POINT

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

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

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

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentencesto see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: Whatis the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2--3.
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2-13, 3rd edition.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2-12, 2nd edition.
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft).
5. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition.
6. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition.

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Web References:

1. PC Hardware & Software Installation:
   Peripheral Devices: Computer Peripherals - Wikipedia
   Components in a CPU: CPU Components and Their Functions - Guru99
2. Internet & World Wide Web:
   TCP/IP and Networking Basics: TCP/IP Explained - Lifewire
   Internet Browsing and Configuration: How Web Browsing Works - HowStuffWorks
3. Word:
   Microsoft Word Tutorials: Microsoft Word Basics - GCFGlobal
4. Excel:
   Excel Tutorial and Functions: Excel Tutorial - Microsoft
5. AI Tools - ChatGPT:
   GPT-3.5 and ChatGPT Information: GPT-3.5 Guide - OpenAI

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R23

I Year I Semester
NSS/NCC/SCOUTS AND GUIDES/COMMUNITY SERVICE
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Humanities	**Course Code**	23MH102P
Course Type	Theory	**L-T-P-C**	0-0-1-0.5
Prerequisites		**Continuous Evaluation**	90
		Viva Voce	10
		Total Marks	100

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

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the importance of discipline, character and service motto.	
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques.	
CO3	Explore human relationships by analyzing social problems.	
CO4	Determine to extend their help for the fellow beings and downtrodden people.	
CO5	Develop leadership skills and civic responsibilities.	

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

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

COURSE CONTENT

UNIT – I

Orientation

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

i) Conducting ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

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UNIT – II

Nature & Care

Activities:

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

UNIT – III

Community Service

Activities:

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

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. Red Book - National Cadet Corps Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M. Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

General Guidelines:

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

Evaluation Guidelines:

- 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, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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R23

I Year II Semester
COMMUNICATIVE ENGLISH
(Common to CSE, CSE (AIML), CSE(AI) and CSE(DS))

Course Category	Humanities	**Course Code**	23BE201T
Course Type	Theory	**L-T-P-C**	2-0-0-2
Prerequisites	LSRW Skills.	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

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

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the context, topic, and pieces of specific information from social or Transactional dialogues.	K2
CO2	Apply grammatical structures to formulate sentences and correct word forms.	K3
CO3	Analyze discourse markers to speak clearly on a specific topic in informal discussions.	K4
CO4	Evaluate reading / listening texts and to write summaries based on glob	K5
CO5	Create a coherent paragraph, essay, and resume.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

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COURSE CONTENT

UNIT I

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

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

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

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

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

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

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

UNIT II

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

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

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

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

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

Grammar: Cohesive devices - linkers, use of articles and zero article; 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; Compound words, Collocations.

Vocabulary: Compound words, Collocations.

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

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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

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: Technical Jargons.

TEXT BOOKS

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, OrientBlack 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 UniversityPress, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

WEB RESOURCES

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

R23

Pragati Engineering College (Autonomous)

I Year II Semester
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to All Branches)

Course Category	Basic Sciences	**Course Code**	23BM201T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Differentiation, Integration and Partial Differentiation. Differential Equations (Variable Separable)	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To enlighten the learners in the concept of differential equations and multivariable calculus
2	To familiarize the students with the foundations of line, surface and volume integrals.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Solve the first order differential equations related to various engineering fields.	K3
CO2	Solve the higher order differential equations to various engineering fields.	K3
CO3	Identify solution methods for partial differential equations that model physical processes.	K3
CO4	Interpret the physical meaning of different operators such as gradient, curl and divergence.	K3
CO5	Estimate the work done against a field, circulation and flux using vector calculus.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

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COURSE CONTENT

UNIT I

Differential equations of first order and first degree:

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

UNIT II

Linear differential equations of higher order (Constant Coefficients):

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

UNIT III

Partial Differential Equations:

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

UNIT IV

Vector differentiation:

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

UNIT V

Vector integration:

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

TEXT BOOKS

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

REFERENCE BOOKS

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

6. Advanced Engineering Mathematics by H. K Dass, S. Chand Publications, 2022, 22nd Edition (Reprint 2022).

WEB RESOURCES

1. https://mathworld.wolfram.com/First-OrderOrdinaryDifferentialEquation.html
2. https://en.wikipedia.org/wiki/Differential_equation
3. https://en.wikipedia.org/wiki/Partial_differential_equation
4. https://en.wikipedia.org/wiki/Vector_calculus
5. https://en.wikipedia.org/wiki/Vector_calculus

R23

Pragati Engineering College (Autonomous)

I Year II Semester
CHEMISTRY
(Common to CSE, CSE (AIML), CSE(AI) and CSE(DS))

Course Category	Basic Sciences	**Course Code**	23BC201T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To familiarize chemistry and its applications
2	To train the students on the principles and applications of electrochemistry and polymers
3	To introduce instrumental methods and to explain the Green Principles and applications

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	To introduce the quantum mechanical concepts of measurements for physical systems	K2
CO2	Apply the principle of Band diagrams in the application of conductors and semiconductors	K2
CO3	Compare the materials of construction for battery and electrochemical sensors	K2
CO4	Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.	K3
CO5	Summarize the concepts of Instrumental methods.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

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COURSE CONTENT

UNIT -I

Structure and Bonding Models:

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2. Molecular orbital theory – bonding in homo- and hetero nuclear diatomic molecules – energy level diagrams of O2 and CO, etc. π- molecular orbital of benzene, calculation of bondorder.

UNIT - II

Modern Engineering materials

Semiconductors – Introduction, types and applications.

Super Conductors-Introduction, types and applications.

Super capacitors: Introduction, Classification–Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, Carbon Nano tubes-Arc-Discharge & Chemical Vapour deposition method and Graphines Nano particles.

UNIT - III

Electrochemistry and Applications

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

potentiometric sensors with examples. Reference electrodes: Normal Hydrogen Electrode(NHE) and Calomel Electrode. Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC)

UNIT - 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. Free radical, Cationic and Anionic Mechanisms.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of

– PVC, Teflon, Bakelite, Nylon-6,6, Urea-Formaldehyde resin. Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – Types, Polyacetylene, – Mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT -V

Instrumental Methods its Applications and **Non-conventional energy sources and Green Chemistry**

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

Non-conventional energy sources: Solar energy- introduction to PV cell / Solar cell- construction, working and applications. Hydro power plant and Geo-thermal energy.

Green chemistry: Principles and applications.

TEXT BOOKS

1.Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.

2.Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,OxfordUniversity 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.Text book of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

WEB RESOURCES

UNIT -I

Structure and BondingModels:https://archive.nptel.ac.in/courses/104/106/104106096/

UNIT - II

ModernEngineeringmaterials :https://nptel.ac.in/courses/118104008

UNIT - III

Electrochemistry and Applications:https://archive.nptel.ac.in/courses/113/105/113105102/

UNIT - IV

Polymer Chemistry:https://archive.nptel.ac.in/courses/104/105/104105124/

UNIT -V

Instrumental Methods & Applications:https://onlinecourses.nptel.ac.in/noc22_cy45/preview

Pragati Engineering College (Autonomous)

R23

I Year II Semester
BASIC CIVIL AND MECHANICAL ENGINEERING
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Engineering Science	**Course Code**	23CM201T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

PART-A : BASIC CIVIL ENGINEERING

COURSE OBJECTIVES	
1	Get familiarized with the scope and importance of Civil Engineering sub-divisions
2	Introduce the preliminary concepts of surveying.
3	Acquire preliminary knowledge on Transportation and its importance in nation's economy.
4	Get familiarized with the importance of quality, conveyance and storage of water.
5	Introduction to basic civil engineering materials and construction techniques.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Enlist various basic characteristics and sub-divisions of Civil Engineering, pre-fabricated materials and technology to appreciate their role in ensuring better society.	K2
CO2	Illustrate the concepts of surveying and basics of Foundation Engineering.	K3
CO3	Know the significance of various domains in transportation engineering and be acquitted with types of pavements. Get an overview about Environmental Engineering and Water Resource Engineering.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	1
CO3	1	1	1	-	-	2	-	-	1	-	-	1

COURSE CONTENT

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering -Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement- Aggregate -Bricks-Stones-Sand-Cement Concrete-Steel-Timber. 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.

Foundations: Types of foundations — Bearing capacity and settlement — Requirement of good foundations.

UNIT III

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

WEB RESOURCES

1. https://nptel.ac.in/courses/105101087
2. https://nptel.ac.in/courses/105104101
3. https://nptel.ac.in/courses/105104103

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PART – B: BASIC MECHANICAL ENGINEERING

COURSE OBJECTIVES	
1	Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
2	Explain different engineering materials and different manufacturing processes.
3	Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the different manufacturing processes.	K2
CO2	Explain the basics of thermal engineering and its applications.	K3
CO3	Describe the working of different mechanical power transmission systems, power plants and basics of robotics and its applications.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-	-	-	-	-	-	2	-

COURSE CONTENT

UNIT -I

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

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

UNIT - II

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

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, 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.

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

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. AppuuKuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I.
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, 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, Tata McGraw Hill publications (India) Pvt. Ltd.

Web References:

1. https://ocw.mit.edu/courses/2-000-how-and-why-machines-work-spring-2002/
2. https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2004/
3. https://ocw.mit.edu/courses/2-12-introduction-to-robotics-fall-2005/

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I Year II Semester

DATA STRUCTURES

(Common to CSE, IT, CSE(AIML), CSE(AI), CSE(DS) and CSE(CS))

Course Category	Professional Core	**Course Code**	23CS201T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To provide the knowledge of basic data structures and their implementations.
2	To understand importance of data structures in context of writing efficient programs.
3	To develop skills to apply appropriate data structures in problem solving.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.	K2
CO2	Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation	K5
CO3	Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.	K3
CO4	Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges	K3
CO5	Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees,Graphs	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1	1	-	-	-	-	-	-
CO2	2	3	1	1	1	-	-	-	-	-	-	-
CO3	2	3	1	2	1	-	-	-	-	-	-	-
CO4	2	3	1	1	1	-	-	-	-	-	-	-
CO5	3	3	1	1	1	-	-	-	-	-	-	-

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COURSE CONTENT

UNIT - I

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

UNIT - II

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

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

UNIT - IV

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

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

UNIT - V

Trees: 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.

Graphs: Introduction, Graph Representation, Traversal techniques

TEXT BOOKS

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.2020
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, SiliconPress, 2nd Edition ,2014

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, andClifford Stein. 3rd Edition 2009
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and GraphAlgorithms" by Robert Sedge wick.

WEB RESOURCES

1. https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf
2. https://www.geeksforgeeks.org/data-structures/

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I Year II Semester
ENGINEERING WORKSHOP
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Engineering Science	**Course Code**	23ME203P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Identify workshop tools and their operational capabilities.	K2
CO2	Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.	K3
CO3	Apply knowledge in preparation of pipe joints and practice of Plumbing tools.	K3
CO4	Apply basic electrical engineering knowledge for House Wiring Practice	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

1.**Demonstration**: Safety practices and precautions to be observed in workshop.

2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.

a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint

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

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

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

a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tire

5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.

a) Parallel and series b) Two-way switch c) 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 joints with coupling for same diameter and with reducer for different diameters.

Note: Minimum of 12 Experiments to be conducted from the above covering all the trades.

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, Media Promoters and Publishers, Mumbai. 2007, 14th edition

2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.

3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

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I Year II Semester
COMMUNICATIVE ENGLISH LABORATORY
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Humanities	**Course Code**	23BE201P
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites	LSRW Skills	**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

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

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the different aspects of the English language proficiency with emphasison LSRW skills.	K2
CO2	Apply communication skills through various language learning activities.	K3
CO3	Analyze the English speech sounds, stress, rhythm, intonation and syllable divisionfor better listening and speaking comprehension.	K4
CO4	Evaluate and exhibit professionalism in participating in debates and group discussions.	K5
CO5	Able to present ideas effectively and manage interviews confidently.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

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COURSE CONTENT

UNIT - I

Vowels & Consonants.
Neutralization/Accent Rules.

UNIT - II

Communication Skills & JAM.
Role Play or Conversational Practice.

UNIT - III

E-mail Writing.
Resume Writing, Cover letter, SOP.

UNIT - IV

Group Discussions-methods & practice.
Debates - Methods & Practice.

UNIT - V

PPT Presentations/ Poster Presentation.
Interviews Skills.

Laboratory Manual Lab Book

1. Strengthen Your Steps: A Multi-Model Course in Communication Skills published by Maruti Publications

REFERENCE BOOKS

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India,2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed),Kindle, 2013
5.

WEB RESOURCES

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

Suggested Software:

1. Walden Infotech
2. Young India Films

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I Year II Semester
DATA STRUCTURES LABORATORY
(Common to CSE, IT, CSE(AIML), CSE(AI), CSE(DS) and CSE(CS))

Course Category	Professional Core	**Course Code**	23CS201P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES

The course aims to strengthen the ability of the students to identify and apply the suitable datastructure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.	K3
CO2	Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.	K3
CO3	Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.	K3
CO4	Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues and apply them appropriately to solve data management challenges.	K3
CO5	Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

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COURSE CONTENT

Exercise 1: Array Manipulation

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

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

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

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

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

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

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

i) Implementing a BST using Linked List.
ii) Traversing of BST.

Exercise 9: Hashing

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

TEXT BOOKS

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

Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, Silicon Press, 2008

REFERENCE BOOKS

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and PeterSanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E.Hopcroft

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I Year II Semester
CHEMISTRY LABORATORY
(Common to CSE, CSE (AIML), CSE(AI) and CSE(DS))

Course Category	Basic Sciences	**Course Code**	23BC201P
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
Verify the fundamental concepts with experiments.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Determine the cell constant and conductance of solutions.	K3
CO2	Prepare advanced polymer Bakelite materials.	K2
CO3	Estimate the given amount of dissolved compounds in a solution by using volumetric analysis and preparation of Nano particles	K3
CO4	Analyze the IR spectra of some organic compounds.	K4
CO5	Determine the concentration of different metal ions present in water by compelxo metric titrations.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

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List of Experiments:

1. Determination of Hardness of a groundwater sample
2. Conduct metric titration of strong acid vs. strong base
3. Conduct metric titration of weak acid vs. strong base
4. Preparation of Nano particles. (Cu/Zn)
5. Determination of Vitamin-C
6. Estimation of $KMnO_4$ by using standard oxalic acid solution
7. Preparation of Phenol-formaldehyde resin (Bakelite)
8. Determination of total alkalinity of given sample of water
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nano materials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Reference:

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

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I Year II Semester
HEALTH AND WELLNESS, YOGA AND SPORTS
(Common to CSE, CSE(AIML), CSE(AI) and CSE(DS))

Course Category	Humanities	**Course Code**	23MH201P
Course Type	Theory	**L-T-P-C**	0-0-1-0.5
Prerequisites		**Continuous Evaluation**	90
		Viva Voce	10
		Total Marks	100

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

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the importance of yoga and sports for Physical fitness and sound health.	
CO2	Demonstrate an understanding of health-related fitness components.	
CO3	Compare and contrast various activities that help enhance their health.	
CO4	Assess current personal fitness levels.	
CO5	Develop Positive Personality	

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

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

COURSE CONTENT

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

Activities:

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

UNIT – II: Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress

management and yoga, Mental health and yoga practice.

Activities:

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. Human Kinetics, Inc.2014

General Guidelines:

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

Evaluation Guidelines:

- 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, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

II Year I Semester
Discrete Mathematics and Graph Theory
(Common to CSE, CSE-AI&ML, CSE-AI, CSE-DS, CSE-CS and IT)

Course Category	Basic Sciences	**Course Code**	23BM304T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Mathematical Logic, Set Theory.	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning
2	To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply mathematical logic to solve problems	K3
CO2	Understand the concepts and perform the operations related to sets, relations and functions.	K3
CO3	Apply basic counting techniques to solve combinatorial problems and recurrence relations	K3
CO4	Apply Graph Theory in solving computer science problems	K3
CO5	Apply different theorems and algorithms to find BFS and DFS of spanning trees	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

UNIT I- Mathematical Logic:
Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof, Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT II - Set Theory:
Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties.

UNIT III -Combinatorics and Recurrence Relations:
Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems.
Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving In homogeneous Recurrence Relations

UNIT IV - Graph Theory:
Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations : Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs,

UNIT V - Multi Graphs:
Multi graphs, Bipartite and Planar Graphs, Euler's Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim's and Kruskal's Algorithms, BFS and DFS Spanning Trees.

TEXT BOOKS
1. Discrete Mathematical Structures with Applications to Computer Science, J.P. Tremblay and P.Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics – A Computer Oriented Approach, C.L.Liu and D.P.Mohapatra, 3rd Edition,Tata McGraw Hill.
3. Mathematical Foundations of Computer Science, Dr. D.S.C, Prism Books Pvt Ltd.

REFERENCE BOOKS
1. Discrete Mathematics for Computer Scientists and Mathematicians, J.L.Mott, A.Kandel and T.P.Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C.Busby and Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S.K.Chakraborthy and B.K.Sarkar ,Oxford, 2011.
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K.H.Rosen,7th Edition,Tata McGraw Hill.
5. Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill.

WEB RESOURCES
1. https://onlinecourses.nptel.ac.in/noc24_ma42/preview
2. https://en.wikipedia.org/wiki/Set_theory
3. https://www.geeksforgeeks.org/discrete-mathematics-types-of-recurrence-relations-set-2/
4. https://nptel.ac.in/courses/111106102
5. https://en.wikipedia.org/wiki/Multigraph

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year I Semester

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT

(Common to CE, EEE, ME, ECE, CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS) and CSE(CYBER SECURITY)

Course Category	HSMC	**Course Code**	23HM301T
Course Type	Theory	**L-T-P-C**	2-1-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Blooms Taxonomy Level**
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	K1
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	K2
CO3	Understand the role of a human being in ensuring harmony in Family And Society.	K1
CO4	Appraise the role of a human being in ensuring harmony in Nature/Existence.	K2
CO5	Distinguish between ethical and unethical practices to actualize a harmonious environment wherever they work.	K2

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

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

COURSE CONTENT

UNIT – I Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, self-exploration as the Process for Value Education, Continuous Happiness and Prosperity-the basic human aspirations, Happiness and Prosperity- Current Scenario, Method to Fulfill the Basic Human Aspirations.
Practice Sessions: PS1 Sharing about Oneself , PS2 Exploring Human Consciousness, PS3 Exploring Natural Acceptance

UNIT – II Harmony in Human Being: Understanding Human being as the Co-existence of the self and the body, Distinguishing between the Needs of the self and the body, The body as an Instrument of the self, Understanding Harmony in the self, Harmony of the self with the body, Programme to ensure self - regulation and Health
Practice Sessions: PS4 Exploring the difference of Needs of self and body, PS5 Exploring Sources of Imagination in the self, PS6 Exploring Harmony of self with the body

UNIT – III Harmony in the Family and Society: Harmony in the family - the Basic Unit of Human Interaction, 'Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Other Feelings, Justice in Human – to - Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.
Practice Sessions: PS7 Exploring the Feeling of Trust, PS8 Exploring the Feeling of Respect,
PS9 Exploring Systems to fulfil Human Goal

UNIT – IV Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual fulfillment among the Four Orders of Nature, Realizing Existence as Co- existence at All Levels, The Holistic Perception of Harmony in Existence
Practice Sessions: PS10 Exploring the Four Orders of Nature, PS11 Exploring Co-existence in Existence

UNIT – V Implications of the Holistic Understanding - a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value- based Life and Profession.
Practice Sessions: PS12 Exploring Ethical Human Conduct, PS13 Exploring Humanistic Models in Education, PS14 Exploring Steps of Transition towards Universal Human Order

Text books and Teachers Manual

1. A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 - R R Gaur, R Asthana, G P Bagaria
2. 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 - R R Gaur, R Asthana, G P Bagaria

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

Web References:

1. https://fdp-si.aicte-india.org
2. https://www.youtube.com/playlist?list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz

II Year I Semester
Introduction To Data Science

Course Category	Professional Core	**Course Code**	23DS301T
Course Type	Theory	**L-T-P-C**	3–0 –0–3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	Knowledge and expertise to become a data scientist.
2	Essential concepts of statistics and machine learning that are vital for data science.
3	Significance of exploratory data analysis (EDA) in data science.
4	Critically evaluate data visualizations presented on the dash boards
5	Suitability and limitations of tools and techniques related to data science process

COURSEOUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Enumerate various steps in data science process.	K2
CO2	Apply programming tips and general techniques for handling large data.	K3
CO3	Elaborate the application and principles of No SQL databases.	K2
CO4	Demonstrate the usage of graph databases and Python libraries for text mining and analytics.	K3
CO5	Create an interactive dashboard with relevant tools.	K4

K1:Remember,K2: Understand, K3:Apply, K4:Analyze,K5:Evaluate, K6:Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	1
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	3	1
CO4	3	2	2	2	2	-	-	-	-	-	-	-	3	3	1
CO5	3	2	3	2	3	-	-	-	-	-	-	-	3	3	2

COURSE CONTENT

UNIT I: Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science
Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT II: Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning
Handling large data: problems and general techniques for handling large data, programming tipsfor dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT III: NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT IV: Tools and Applications of Data Science: Introducing **Neo4j** for dealing with graph databases, graph query language **Cypher**, Applications graph databases, Python libraries like nltkand SQLite for handling Text mining and analytics, case study on classifying Reddit posts

UNIT V: Data Visualization and Prototype Application Development: Data Visualization options, Cross filter, the JavaScript Map Reduce 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) DavyCielen,ArnoD.B.Meysman,andMohamedAli,"IntroducingtoDataScienceusing Python tools", Manning Publications Co, Dream tech press, 2016
2) PrateekGupta,"DataSciencewithJupyter"BPBpublishers,2019forbasics

Reference Books:
1. Joel Grus, "Data Science FromScratch",OReilly,2019
2. DoingDataScience:StraightTalkFromTheFrontline,1stEdition,CathyO'Neiland Rachel Schutt, O'Reilly, 2013
3. Data Science and analyticswithPython,SandhyaAroraandLateshMalik,UniversitiesPress

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

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year I Semester

Advanced Data Structures & Algorithm Analysis

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

Course Category	Professional Core	**Course Code**	23CS301T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The main objectives of the course is to	
1	Provide knowledge on advance data structures frequently used in Computer Science domain
2	Develop skills in algorithm design techniques popularly used
3	Understand the use of various data structures in the algorithm design

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze algorithms for Height balanced trees such as AVL trees, B-Trees	K1
CO2	Analyze algorithms for Priority queues, Graph Traversals, Sortings	K2
CO3	List and describe various algorithmic approaches and Solve problems using divide and conquer &greedy Method	K3
CO4	Analyze design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches	K4
CO5	Demonstrate NP-Hard and NP-Complete problems, Cook's theorem	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution Of Course Outcomes Towards Achievement Of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I:
Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations AVL Trees – Creation, Insertion, Deletion operations and Applications B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II:
Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications
Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

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

UNIT – IV:
Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V:
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++, Ellis Horowitz; Sartaj Sahni; Dinesh Mehta 2nd Edition, ISBN: 9788173716065 ,Year: 2008, Universities Press.
2. Computer Algorithms in C++, Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, 2nd Edition ISBN:9788173716119, 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,2nd Edition, Published on 1 July 2017.
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, 31 August 2019 First Edition.
5. Algorithms + Data Structures & Programs:, N.Wirth, PHI, January 1988
6. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub, January 2008
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,Introduction to Algorithms (youtube.com)

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
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Department of Computer Science and Engineering (Data Science)

II Year I Semester
Object Oriented Programming Through Java
(Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), CSE (Cyber Security), IT)

Course Category	Professional Core	**Course Code**	23CS302T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The learning objectives of this course are to:	
1	Identify Java language components and how they work together in applications
2	Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3	Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
4	Understand how to design applications with threads in Java
5	Understand how to use Java APIs for program development

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply the fundamentals of Java to solve problems	K3
CO2	Differentiate the application of decision and iteration control structures	K2
CO3	Implement classes and method overloading concepts	K3
CO4	Apply the concepts of inheritance and packages	K3
CO5	Implement Java programs using exceptions and multithreading	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

UNIT I

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

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

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

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

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 Throw able, Unchecked Exceptions, Checked Exceptions.

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

UNIT V

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

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads. **Java Database Connectivity:** Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set 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 Books:

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.

References 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_01288046454761881634 7_shared/overview

II Year I Semester
Data Science Lab

Course Category	Professional Core	**Course Code**	23DS301P
Course Type	Laboratory	**L-T-P-C**	0–0 –3–1.5
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSEOBJECTIVES	
1	The main objective of the course is to inculcate the basic understanding of Data Science and its practical implementation using Python.

COURSEOUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Perform various operations on numpy arrays	K3
CO2	Importing data from different file formats using pandas	K3
CO3	Draw different types of charts using matplotlib	K3

K1:Remember,K2: Understand, K3:Apply, K4:Analyze,K5:Evaluate, K6:Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	3	-	-	-	-	-	-	-	3	3	3
CO2	2	2	3	2	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3

List o f Experiments

1. Creating a NumPy Array
   a. Basic nd array
   b. Array of zeros
   c. Array of ones
   d. Random numbers in nd array
   e. An array of your choice
   f. I matrix in NumPy
   g. Evenly spaced nd array
2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array
   a. Slicing1-D NumPy arrays
   b. Slicing2-D NumPy arrays
   c. Slicing3-D NumPy arrays
   d. Negative slicing of NumPy arrays
5. Stacking and Concatenating Numpy Arrays
   a. Stacking nd arrays
   b. Concatenating nd arrays
   c. Broadcasting in Numpy Arrays
6. Perform following operations using pandas
   a. Creating data frame
   b. concat()
   c. Setting conditions
   d. Adding a new column
7. Perform following operations using pandas
   a. Filling NaN with string
   b. Sorting basedon column values
   c. groupby()
8. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files
9. Read the following file formats
   a. Pickle files
   b. Image files using PIL
   c. Multiple files using Glob
   d. Importing data from database

10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
    a. Feature Scaling
    b. Feature Standardization
    c. Label Encoding
    d. One Hot Encoding
12. Perform following visualizations using matplotlib
    a. Bar Graph
    b. Pie Chart
    c. Box Plot
    d. Histogram
    e. Line Chart and Subplots
    f. Scatter Plot
13. Getting started with NLTK, install NLTK using PIP
14. Python program to implement with Python SciKit- Learn & NLTK
15. Python program to implement with Python NLTK/Spicy/PyNLPI.

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.
6. https://www.nltk.org/book/ch01.html

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
Department of Computer Science and Engineering (Data Science)

R23

II Year I Semester
Object Oriented Programming Through Java Laboratory
(Common to CSE, CSE (AI&ML), CSE (AI), CSE (DS), CSE (Cyber Security), IT)

Course Category	Professional Core	**Course Code**	23CS302T
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The aim of this course is to	
1	Practice object oriented programming in the Java programming language
2	Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
3	Illustrate inheritance, Exception handling mechanism, JDBC connectivity
4	Construct Threads, Event Handling, implement packages, Java FX GUI

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Implement object oriented concepts using Java	K3
CO2	Apply the concepts of inheritance and packages.	K3
CO3	Implement Java programs using exceptions and multithreading.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

Experiments covering the Topics:

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

Sample Experiments:

Exercise – 1:

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

b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

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

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

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

Exercise - 3

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

b) Write a JAVA program implement method overloading.

c) Write a JAVA program to implement constructor.

d)Write a JAVA program to implement constructor overloading.

Exercise - 4

a) Write a JAVA program to implement Single Inheritance

b) Write a JAVA program to implement multi level Inheritance

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

Exercise - 5

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

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

c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

a) Write a JAVA program that describes exception handling mechanism

b) Write a JAVA program Illustrating Multiple catch clauses

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

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

Exercise - 7

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

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

c) Write a Program illustrating Daemon Threads.

d) Write a JAVA program Producer Consumer Problem

Exercise – 8

a) Write a JAVA program that import and use the user defined packages

b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)

c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

Exercise – 9

a) Write a java program that connects to a database using JDBC

b)Write a java program to connect to a database using JDBC and insert values into it.

c) Write a java program to connect to a database using JDBC and delete values from it

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
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R23

Department of Computer Science and Engineering (Data Science)

II Year I Semester
Python Programming
Common to CSE,IT, CSE (AI&ML),CSE (AI), CSE (DS),CSE(Cyber Security)

Course Category	Skill Enhanced Course	**Course Code**	23AI301S
Course Type		**L-T-P-C**	0-1-2-2
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Introduce core programming concepts of Python programming language
2	Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
3	Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to :		**Cognitive Level**
CO1	Develop essential programming skills in computer programming concepts like data types, control statements.	K3
CO2	Apply the basics of programming in the Python language.	K3
CO3	Solve coding tasks related Dictionaries, tuples and sets.	K3
CO4	Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming.	K3
CO5	Apply the basics of Numpy and pandas related to the Data Science	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO2	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO3	3	2	1	1	1	-	-	-	-	-	-	1	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	1	3	3	2
CO5	3	2	2	3	3	-	-	-	-	-	-	1	3	3	2

COURSE CONTENT

UNTI-I:
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. Write a program to add and multiply complex numbers
5. Write a program to print multiplication table of a given number.

UNIT – II
Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.
Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

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

UNIT – III
Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

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

UNIT – IV

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

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

Sample Experiments:

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT – V

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

Visual Aids for EDA(Exploratory Data Analysis): Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. 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

6. Apply different visualization techniques using sample dataset

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

7. Generate Scatter Plot using seaborn library for iris dataset
8. Apply following visualization Techniques for a sample dataset

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

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2ndEdition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
4. Python : The Complete Reference, by Martin C Brown, McGraw Hill India.

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

II Year I Semester

Environmental Science

(Common to all branches)

Course Category	BASIC SCIENCES	**Course Code**	23BC301T
Course Type prerequisites	Theory	**L-T-P-C** **Internal Assessment** **Semester End Examination** **Total Marks**	2 -0-0--0 30 70 100

S.No.	Course Objectives
1	To make the students to get awareness on environment
2	To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
3	To save earth from the inventions by the engineers.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Grasp multi disciplinary nature of environmental studies and various renewable and non-renewable resources.	K2
CO2	Understand flow and bio-geo- chemical cycles and ecological pyramids.	K2
CO3	Understand various causes of pollution and solid waste management and related preventive measures.	K2
CO4	Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.	K2
CO5	Illustrate the casus of population explosion, value education and welfare programmes.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	0	1	0	0	1	2	0	0	0	1	0
CO2	0	1	0	0	0	0	1	0	0	0	0	0
CO3	0	0	0	0	2	0	1	0	0	0	0	0
CO4	0	0	0	0	1	1	3	0	0	0	0	0
CO5	0	0	0	0	0	0	3	1	0	0	0	0

COURSE CONTENT

UNIT – I

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

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

UNIT – II

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

a)Forest ecosystem, b)Grassland ecosystem, c)Desert ecosystem, e)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)(Primary Treatment)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hotspots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of: a)Air Pollution, b)Water pollution, c)Soil pollution, d)Marine pollution, e)Noise pollution, f)Thermal pollution, g)Nuclear hazards (Primarytreatment)

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

UNIT – IV

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

UNIT – V

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

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

Textbooks:

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

Reference Books:

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

Online Learning Resources:

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

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year II Semester
Optimization Techniques
(Common to IT, CSE(AIML), CSE(AI), CSE(DS))

Course Category	Management Course – I	**Course Code**	23ME405T
Course Type	Theory	**L-T-P-C**	2-0-0-2
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
2	To state single variable and multi variable optimization problems, without and with constraints.
3	To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method.
4	To state transportation and assignment problem as a linear programming problem to determine Simplex method.
5	To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.	K2
CO2	Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.	K3
CO3	Apply and Solve transportation and assignment problem by using Linear programming Simplex method.	K3
CO4	Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.	K3
CO5	Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

UNIT I

Introduction: Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization, multi variable Optimization without constraints, necessary and sufficient conditions for minimum/maximum, multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers, multivariable Optimization with inequality constraints, Kuhn – Tucker conditions

UNIT II

Linear Programming: Standard form of a linear programming problem, geometry of linear programming problems, definitions and theorems, solution of a system of linear simultaneous equations, pivotal reduction of a general system of equations, motivation to the simplex method, simplex algorithm.

UNIT III

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method, testing for optimality of balanced transportation problems, Special cases in transportation problem.

UNIT IV

Nonlinear Programming: Unconstrained cases, One – dimensional minimization methods: Classification, Fibonacci method, Univariate method, steepest descent method. Constrained cases– Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method, Basic approaches of Interior and Exterior penalty function methods,

UNIT V

Dynamic Programming: Dynamic programming multistage decision processes, types, concept of sub optimization and the principle of optimality, computational procedure in dynamic programming, examples illustrating the calculus method of solution, examples illustrating the tabular method of solution.

Textbooks:

1. Engineering optimization: Theory and practice, S. S. Rao, New Age International (P) Limited, 3rd edition, 1998.
2. Introductory Operations Research, H.S. Kasene & K.D. Kumar, Springer (India), Pvt. Ltd.

Reference Books:

1. "Optimization Methods in Operations Research and systems Analysis", by K.V. Mital and C. Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Operations Research, Dr. S. D. Sharma, Kedarnath, Ramnath& Co.

Online Learning Resources:

1. http://www.nptelvideos.in/2012/12/fundamentals-of-operations-research.html
2. https://nptel.ac.in/courses/110106062
3. https://nptel.ac.in/courses/111/105/111105039/
4. https://nptel.ac.in/courses/106/108/106108056/
5. https://nptel.ac.in/courses/112/105/112105235/
6. https://onlinecourses.nptel.ac.in/noc21_me43/preview
7. https://www.nptel.ac.in/content/syllabus_pdf/112103301.pdf

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year II Semester
Statistical Methods for Data Science
(CSE-DS)

Course Category	Basic Sciences	**Course Code**	23BM403T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Probability, Statistics, Algebra, and Calculus	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	This course aims at providing knowledge on basic concepts of Statistics, Estimation and testing of hypotheses for large and small samples

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze data and draw conclusion about collection of data and fitting of distributions	K3
CO2	Analyzing the testing of hypothesis for Large and Small samples.	K3
CO3	Develop skills in problem solving of the regression analysis	K3
CO4	Understanding the significance of Time Series data in various fields	K3
CO5	Understanding the classification using Logistic Regression	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

UNIT I

Data Visualization and Distributions:

Data Visualization Techniques: Introduction to Statistical methods – Exploratory Data Analysis-Charts (Line, Pie, Bar); Plots (Bubble, Scatter); Maps (Heat, Dot Distribution); Diagrams (Trees and Matrices) – Principal Components Analysis

Introduction to Data Distributions - Probability Distributions – discrete (binomial, Poisson), Continuous Distributions (Normal, exponential).

UNIT II

Hypothesis Testing:

Introduction to Parametric Estimation-Parametric Confidence Intervals

Choosing a Statistic-Hypothesis Testing – Parametric test : the T-test-Applications to Hypothesis Tests – Pair wise comparisons.

UNIT III

Linear Regression and Multiple Regression**:**

Regression: Linear Regression, Curvilinear Regression: Exponential Regression- Polynomial Regression - Power Model.

Practical Examples - The nature of the 'relationship' - Multiple Linear Regression – Important measurements of the regression estimate - Multiple Regression with Categorical Explanatory Variables – Inference in Multiple Regression-Variable Selection.

UNIT IV

Time Series:

Time series: Significance of Time series analysis, Components of Time series, Secular trend : Graphic method, Semi-average method, Method of moving averages, Method of least squares : straight line and non-linear trends, Logarithmic methods–Exponential trends, Growth curves, Seasonal Variations : Method of simple averages, Ratio-to-trend method, ratio-to-moving average method, Link relative method. **(Textbook:** K.Murugesan, P.Gurusamy, "Probability, Statistics and Random Processes"**)**

UNIT V

Logistic Regression:

The classification problem – Logistic Regression Setup-Interpreting the Results-Comparing Models-Classification Using Logistic Regression

TEXT BOOKS

1. Elizabeth Purdom, "Statistical methods for Data science"
2. K.Murugesan, P.Gurusamy, "Probability, Statistics and Random Processes"

REFERENCE BOOKS

1. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference–Testing of Hypotheses, Prentice Hall of India,2014.
2. Robert VHogg, Elliot A Tannis and DaleL. Zimmerman, Probability and Statistical Inference, 9th edition, Pearson publishers,2013.
3. Chris Chatfield, "The analysis of time series an introduction,"5th edition, Chapman &Hall/CRC.
4. Peter J.Brockwell, Richard A.Davis, "Introduction to Timeseries and Forecasting, "Second edition, Springer.

WEB RESOURCES

1. https://rafalab.dfci.harvard.edu/dsbook-part-1/dataviz/distributions.html
2. https://en.wikipedia.org/wiki/Statistical_hypothesis_test
3. https://en.wikipedia.org/wiki/Linear_regression
4. https://en.wikipedia.org/wiki/Time_series
5. https://www.spiceworks.com/tech/artificial-intelligence/articles/what-is-logistic-regression/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year II Semester
Data Engineering

Course Category	Professional Core	**Course Code**	23DS401T
Course Type	Theory	**L-T-P-C**	3–0 –0–3
Prerequisites	Introduction to Data Science	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	Explain basic concepts of Data Engineering.
2	Discuss about Data Engineering Life Cycle
3	How to design Good Data Architecture

COURSEOUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Describe the glossary of different roles involved in data engineering life cycle.	K2
CO2	Estimate the impact of various under currents across the data engineering life cycle.	K2
CO3	Apply the principles of good data architecture.	K3
CO4	List out the key engineering considerations for the data ingestion phase.	K2
CO5	Develop queries on streaming data and differentiate business, operational and embedded analytics.	K3

K1:Remember,K2: Understand, K3:Apply, K4:Analyze,K5:Evaluate, K6:Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	2	2	-	-	-	-	-	-	-	-	2	1	1
CO2	1	2	2	3	-	-	-	-	-	-	-	-	3	2	2
CO3	2	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO4	2	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	2	3	3	3	-	-	-	-	-	-	-	-	3	3	2

COURSE CONTENT

UNIT-I: Introduction to Data Engineering: Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities,
Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

UNIT-II: Data Engineering Life Cycle: Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.
Major undercurrents across the Data Engineering Life Cycle: Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

UNIT-III: Designing Good Data Architecture: Enterprise Architecture, Data Architecture**,** Principles of Good Data Architecture, Major Architecture Concepts.
Data Generation in Source Systems: Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details.

UNIT-IV: Storage: Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lake house.
Ingestion: Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

UNIT-V: Queries, Modeling and Transformation: Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing.
Serving Data for Analytics, Machine Learning and Reverse ETL: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL.

Text Books:

1. JoeReis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media,Inc.,June2022,ISBN: 9781098108304

ReferenceB ooks:

1. Paul Crickard, Data Engineering with Python, Packt Publishing,October2020.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling,Wiley, 3rd Edition, 2013
3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021

Web References:

1. https://courses.cs.duke.edu/fall15/compsci290.1/
2. https://www.youtube.com/playlist?list=PL3MmuxUbc_hKihpnNQ9qtTmWYy26bPrSb

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year II Semester
Database Management Systems
Common to AI, CSE(CS),CSE, DS, IT

Course Category	Professional Core	**Course Code**	23IT401T
Course Type	Theory	**L-T-P-C**	3–0 –0–3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	To introduce Data models and Entity Relationship Model Representation
2	To give a good formal foundation on the relational model of data and usage of Relational Algebra
3	To introduce the concepts of basic SQL as a universal Database language
4	To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
5	To provide an overview of concurrent execution ,deadlocks and indexing techniques

COURSEOUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Implementing E-R Models on different examples	K3
CO2	Describe a relational database and object-oriented database	K3
CO3	Create, maintain and manipulate a relational database using SQL	K3
CO4	Design a database with understanding on Normalization.	K2
CO5	Determining and describing the concurrent execution ,deadlocks	K3

K1:Remember,K2:Understand,K3:Apply,K4:Analyze,K5:Evaluate,K6: Create

Contribution of Course Outcomes towards achievement of Program Outcomes(1–Low,2-Medium,3–High)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	3	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	3	3	-	-	-	-	-	1	-	-	-	2	2	2
CO3	3	3	3	2	-	-	-	-	1	-	2	-	2	2	2
CO4	3	3	3	-	-	-	-	-	1	-	3	-	2	2	2
CO5	3	2	1	-	-	-	-	-	1	-	-	-	2	-	2

COURSECONTENT

UNIT-I

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance 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

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

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.

UNIT-IV

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

UNIT-V

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:

TEXT BOOKS

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)

REFERENCEBOOKS

1. Introduction to Database Systems,8/e CJDate, PEA.
2. Database Management System,6/e Ramez Elmasri, Shamkant B.Navathe, PEA
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

WEB RESOURCES

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

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year II Semester

Computer Organization And Architecture

Course Category	Professional Core	**Course Code**	23EC306T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basics of Number Systems	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
The student twil llearn:	
1	Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
2	Describe memory hierarchy concepts
3	Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understanding the data representation of a digital computer system. Relate Postulates of Boolean algebra and minimize combinational functions and analyze combinational circuits.	
CO2	Design and analyze sequential circuits and study the basic structure of computers	
CO3	Understand the basic concepts of computer arithmetic, organization.	
CO4	Understand the concepts of memory organization.	
CO5	Understand the concepts of I/O Organization.	

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	2						2	2	2	2
CO2	2	2	2	2	2						2	2	2	2
CO3	2	2	2	2	2						2	2	2	2
CO4	2	2	2	2	2						2	2	2	2
CO5	2	2	2	2	2						2	2	2	2

COURSE CONTENT

UNITI: Digital Computers and Data Representation : Introduction, Numbering Systems, Decimal to Binary Conversion, Binary Coded Decimal Numbers, Weighted Codes, Self-Complementing Codes, Cyclic Codes, Error Detecting Codes, Error Correcting Codes, Hamming Code for Error Correction, Alphanumeric Codes, ASCI Code
Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.
Boolean Algebra and Logical gates: Boolean Algebra :Theorems and properties, Boolean functions, canonical and standard forms , minimization of Boolean functions using algebraic identities; Karnaughma pre presentation and minimization using two and three variable Maps; Logical gates ,universal gates and Two- level realizations using gates : AND-OR, OR-AND, NAND-NAND and NOR-NOR structures

UNITII: Digital logic circuits: Combinatorial Circuits: Introduction, Combinatorial Circuit Design Procedure, Implementation using universal gates, Multi - bitadder, Multiplexers, De-multiplexers, Decoders Sequential Switching Circuits: Latches and Flip-Flops, Ripple counters using Tflip-flops;
Synchronous counters: Shift Registers; Ring counters

UNITIII: Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Booth multiplication algorithm, Division Algorithms, Floating–point Arithmetic Operations.
Register Transfer language and micro instructions: Bus memory transfer, arithmetic and logical micro-operations, shift and rotate micro-operations
Basic Computer Organization and Design: Stored program concept, computer Registers, common bus system, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input–Output configuration and program Interrupt.

UNITIV: Micro programmed Control: Control memory, Address sequencing, micro program example, design of control unit. Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation
Program Control: conditional Flags and Branching

UNITV: Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.
Input-Output Organization: Input-Output Interface, A synchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

Text Books:

1. Digital Logic and Computer Design,Moriss Mano,11th Edition, Pearson.
2. Computer System Architecture, 3rd Edition, M.MorrisMano, PHI

Reference Books:

1. Digital Logic and Computer Organization, Rajaraman, Radhakrishnan, PHI,2006
2. Computer Organization, 5Th Edition, Hamacher, Vranesic,Zaky,TMH,2002
3. Computer Organization & Architecture: Designing for Performance, 7thEdition, William Stallings, PHI, 2006

II Year II Semester
Data Engineering Lab

Course Category	Professional Core	**Course Code**	23DS4019
Course Type	Laboratory	**L-T-P-C**	0–0 –3–1.5
Prerequisites	Introduction to Data Science	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	The main objective of this course is to teach how build data engineering infrastructure and data pipelines.

COURSEOUTCOMES		
Upon successful completion of the course, the student will beable to:		**Cognitive Level**
CO1	Build our Data Engineering Infrastructure	K3
CO2	Demonstrate Reading and Writing files	K3
CO3	Build Data Pipelines and integrate with Dashboard	K3
CO4	Deploy the Data Pipeline in production	K3

K1:Remember,K2: Understand, K3:Apply, K4:Analyze,K5:Evaluate, K6:Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO2	2	3	2	2	2	-	-	-	-	-	-	-	3	3	2
CO3	2	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO4	2	3	3	2	2	-	-	-	-	-	-	-	3	3	2

Experiments:

1. Installing and configuring Apache NiFi, Apache Airflow
2. Installing and configuring Elastic search, Kibana, PostgreSQL,pgAdmin4
3. Reading and Writing files
    a. Reading and writing files in Python
    b. Processing files in Airflow
    c. NiFi processors for handling files
    d. Reading and writing data to data bases in Python
    e. Databases in Airflow
    f. Database processors in NiFi
4. Working with Databases
    a. Inserting and extracting relational data in Python
    b. Inserting and extracting NoSQL database data in Python
    c. Building database pipelines in Airflow
    d. Building database pipelines in NiFi
5. Cleaning, Transforming and Enriching Data
    a. Performing exploratory data analysis in Python
    b. Handling common data issues using pandas
    c. Cleaning data using Airflow
6. Building the Data Pipeline
7. Building a Kibana Dash Board
8. Perform the following operations
    a. Staging and validating data
    b. Building idempotent data pipelines
    c. Building atomic data pipelines
9. Version Control with the NiFi Registry
    a. Installing and configuring the NiFi Registry
    b. Using the Registry in NiFi
    c. Versioning your data pipelines
    d. Using git- persistence with the NiFi Registry
10. Monitoring Data Pipelines
    a. Monitoring NiFi in the GUI
    b. Monitoring NiFi using processors
    c. Monitoring NiFi with Python and the REST API
11. Deploying Data Pipelines
    a. Finalizing your data pipelines for production
    b. Using the NiFi variable registry
    c. Deploying your data pipelines
12. Building a Production Data Pipeline
    a. Creating a test and production environment
    b. Building a production data pipeline
    c. Deploying a data pipeline in production

Reference Books:

1. Paul Crickard, Data Engineering with Python, Packt Publishing, October2020.

Web References:

1. https://courses.cs.duke.edu/fall15/compsci290.1/
2. https://www.youtube.com/playlist?list=PL3MmuxUbc_hKihpnNQ9qtTmWYy26bPrSb

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year II Semester
Database Management Systems Laboratory
Common to AI,CSE(CS),CSE, DS ,IT

Course Category	Professional Core	**Course Code**	23IT401P
Course Type	Laboratory	**L-T-P-C**	0–0 –3–1.5
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	Populate and query a data base using SQL DDL/DML Commands
2	Declare and enforce integrity constraints on a database
3	Writing Queries using advanced concepts of SQL
4	Programming PL/SQL including procedures, functions, cursors, triggers and JDBC connection

COURSEOUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Create data base tables and perform various operations	K3
CO2	Implement PL/SQL programs	K3
CO3	Create stored packages for variables, cursors and JDBC connection	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Out comes to wards achievement of Program: Outcomes (1 – Low, 2 -Medium, 3 –High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	2	-	-	-	-	-	-	1	2	2	1
CO2	3	2	2	2	2	-	-	-	-	-	-	1	2	2	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1	2	3	2

LISTOFEXPERIMENTS

Note: For performing the experiments consider any case study(ATM/ Banking/Library/Hospital management systems)

1 Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.

2 Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.

3 Queries using Aggregate functions(COUNT, SUM, AVG, MAX and MIN),GROUP BY, HAVING and Creation and dropping of Views.

4 Queries using Conversion functions (to_ char, to_ number and to_ date),string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, in it cap, length, substr and instr), date functions (Sys date, next_ day, add_ months, last_ day, months_ between, least, greatest, trunc, round, to_ char, to_ date)

5
i. Create a simple PL/SQL program which includes declaration section, executable section, and exception handling section (Ex. Student mark scan be selected from the table and printed for those who secured first class and an exception can be raised if nore cords were found)
ii. Insert data into student table and use COMMIT,ROLL BACK and SAVEPOINT in PL/SQL block.

6 Develop program that includes the features NESTEDIF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.

7 Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.

8 Programs development using creation of procedures, passing parameters I N and OUT of PROCEDURES.

9 Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.

10 Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.

11 Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

12 Create a table and perform the search operation on table using indexing and non-indexing techniques.

13 Write a Java program that connects to a database using JDBC

14 Write a Java program to connect to a database using JDBC and insert values into it

15 Write a Java program to connect to a database using JDBC and delete values from it

TEXTBOOKS/SUGGESTEDREADING:

1 Oracle: The Complete Reference by Oracle Press

2 Nilesh Shah, "Database Systems Using Oracle", PHI, 2007

3 RickFVanderLans,"IntroductiontoSQL",FourthEdition,PearsonEducation,2007

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year II Semester

EXPLORATORY DATA ANALYSIS USING PYTHON

Course Category	Skill Enhancement Course	**Course Code**	23DS401S
Course Type		**L-T-P-C**	0–1 –2–2
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	This course introduces the fundamentals of Exploratory Data Analysis.
2	It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods

COURSEOUTCOMES		
Upon successful completion of the course, the student will beable to:		**Cognitive Level**
CO1	Enumerate the fundamentals of Exploratory Data Analysis.	K2
CO2	Visualize the data using basic graphs and plots.	K4
CO3	Apply different Data Transformation Techniques.	K3
CO4	Summarize the data using descriptive statistics.	K3
CO5	Evaluate the Models and select the best model.	K5

K1:Remember,K2: Understand, K3:Apply, K4:Analyze,K5:Evaluate, K6:Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO2	2	3	2	2	2	-	-	-	-	-	-	-	3	3	2
CO3	2	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO4	2	3	3	2	2	-	-	-	-	-	-	-	3	3	2
CO5	2	3	3	2	2	-	-	-	-	-	-	-	3	3	2

COURSE CONTENT

UNIT-I

Exploratory Data Analysis Fundamentals: Understanding data science, The significance of EDA, Steps in EDA, Making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, Getting started with EDA.

Sample Experiments:

1. a) Download Dataset from Kaggle using the following link:
   https://www.kaggle.com/datasets/sukhmanibedi/cars4u
   b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib, sea born)
2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
3. Loading Dataset into pandas data frame
4. Selecting rows and columns in the data frame

UNIT-II

Visual Aids for EDA: Technical requirements, Line chart, Bar charts, Scatter plot using sea born, Polar chart, Histogram, Choosing the best chart

Case Study: EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.

Sample Experiments:

1. Apply different visualization techniques using sample dataset
   a) Line Chart b)Bar Chart c)Scatter Plots d)Bubble Plot
2. Generate Scatter Plot using sea born library for iris dataset
3. Apply following visualization Techniques for a sample dataset
   b) Area Plot b) Stacked Plot c) Pie chart d)Table Chart
4. Generate the following charts for a dataset.
   c) Polar Chart b)Histogram c)Lollipop chart
5. Case Study: Perform Exploratory Data Analysis with Personal Email Data

UNIT-III

Data Transformation: Merging database-style data frames, Concatenating along with an axis, Merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges.

Sample Experiments:

1. Perform the following operations
   d) Merging Data frames
   e) Reshaping with Hierarchical Indexing
   f) Data Deduplication
   g) Replacing Values
2. Apply different Missing Data handling techniques
   h) NaN values in mathematical Operations
   i) Fillingin missing data
   j) Forward and Backward filling of missing values
   k) Filling within dex values
   l) Interpolation of missing values
3. Apply different data transformation techniques Renaming axis indexes
   m) Discretization and Binning
   n) Permutation and Random Sampling
   o) Dummy variables

UNIT-IV

Descriptive Statistics: Distribution function, Measures of central tendency, Measures of dispersion, Types of kurtosis, Calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis

Sample Experiments:

1. Study the following Distribution Techniques on asample data
   a) Uniform Distribution
   b) Normal Distribution
   c) Gamma Distribution
   d) Exponential Distribution
   e) Poisson Distribution
   f) Binomial Distribution
2. Perform Data Cleaning on a sample dataset.
3. Compute measure of Central Tendency on a sample dataset
   g) Mean b)Median c)Mode
4. Explore Measures of Dispersion on a sample dataset
   h) Variance b) Standard Deviation c) Skewness d) Kurtosis
5. a) Calculating percentile son sample dataset
   b)Calculate Inter Quartile Range(IQR) and Visualize using Box Plots
6. Perform the following analysis on automobile dataset.
   i) Bivariate analysis b)Multivariate analysis
7. Perform Time Series Analysis on Open Power systems dataset

UNIT-V

Model Development and Evaluation: Unified machine learning workflow, Data preprocessing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, Best model selection and evaluation, Model deployment

Case Study: EDA on Wine Quality Data Analysis

Sample Experiments:

1. Perform hypothesis testing using stats models library
   a) Z-Test b)T-Test
2. Develop model and Perform Model Evaluation using different metrics such as prediction score,R2 Score, MAE Score, MSE Score.
3. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset

Text Book:

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

References:

1. RonaldK .Pearson, Exploratory Data Analysis Using R, CRCPress, 2020
2. Radhika Datar,Harish Garg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, Ist Edition, Packt Publishing, 2019

Web References:

1. https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python
2. https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-data-analysis-eda-using-python/#h-conclusion
3. https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)

R23

Department of Computer Science and Engineering (Data Science)

II Year II Semester

DESIGN THINKING & INNOVATION

(Common to CE, EEE, ME, ECE, CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS) and CSE(CYBER SECURITY)

Course Category	BS&H	**Course Code**	23HM401P
Course Type	Theory	**L-T-P-C**	1 -0 -2-2
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70

Course Outcomes		**Blooms Taxonomy Level**
Upon successful completion of the course, the student will be able to		
CO 1	Define the concepts related to design thinking.	K1
CO 2	Explain the fundamentals of Design Thinking and innovation.	K2
CO 3	Apply the design thinking techniques for solving problems in various sectors.	K3
CO 4	Analyze to work in a multidisciplinary environment.	K4
CO 5	Evaluate the value of creativity.	K5

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

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

COURSE CONTENT

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

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

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

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

UNIT - IV Product Design

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

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

UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

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

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Web Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester for
Machine Learning
Common to CSE, CSE (CS), CSE (DS) & IT

Course Category	Machine Learning	**Course Code**	
Course Type	Professional Core	**L-T-P-C**	3-0-0-3
Prerequisites	Artificial Intelligence	**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The learning objectives of this course are:	
1	Define Machine Learning and its different types (supervised and unsupervised) and understand their applications.
2	Apply supervised learning algorithms including decision trees and k-nearest neighbours (k- NN).
3	Implement unsupervised learning techniques, such as K-means clustering

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO 1	Analyze the paradigm and stages involved in Machine Learning model development.	K2
CO 2	Apply nearest neighbor-based models and distance measures for classification and regression tasks.	K3
CO 3	Develop accurate classification and regression models using decision tree and Bayes classifier techniques	K4
CO 4	Design Machine Learning solutions using linear discriminants, SVMs, and multi-layer perceptrons.	K5
CO5	Implement clustering techniques to discover patterns and structure in datasets.	K3

K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

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

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	2	1	2	0	0	0	0	0	0	0	1	0	0
CO 2	3	3	2	1	3	0	0	0	0	0	0	0	1	2	0
CO 3	3	3	3	1	3	0	0	0	0	0	2	0	1	0	0
CO 4	3	3	3	1	3	0	0	0	0	0	2	0	1	0	0
CO 5	3	3	2	1	3	0	0	0	0	0	0	0	1	0	0

COURSE CONTENT

UNIT-I: Introduction to Machine Learning:
Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II: Nearest Neighbor-Based Models:
Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III: Models Based on Decision Trees:
Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.
The BayesClassifier: Introduction to the Bayes Classifier,Bayes'Rule and Inference, The BayesClassifier and its Optimality,Multi-Class Classification ,Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV: Linear Discriminants for Machine Learning:
Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier,PerceptronLearningAlgorithm,SupportVectorMachines,LinearlyNon- Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Back propagation for Training an MLP.

UNIT-V: Clustering: Introduction to Clustering, Partitioning of Data, Matrix Factorization
|Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, FuzzyC-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Text Books:

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

Reference Books:

1."MachineLearning",TomM.Mitchell,McGraw-HillPublication,2017
2."Machine Learning in Action", Peter Harrington, Dream Tech
3."IntroductiontoDataMining",Pang-NingTan,MichelStenbach,VipinKumar,7th Edition, 2019.

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III YEAR I SEMESTER
COMPUTER NETWORKS
(Common to CSE, CSE(AIML), CSE(AI), CSE(DS), IT)

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3 – 0 – 0 – 3
Prerequisites		**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Provide insight about networks, topologies, and the key concepts.
2	Gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
3	Understand the principles, key protocols, design issues, and significance of each layer in ISO and TCP/IP
4	Know the basic concepts of network services and various network applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Differentiate various types of computer networks, network topologies, reference models and guided media.	K2
CO2	Apply various techniques for error control, detection and correction during transmission of data frames using data link layer protocols.	K3
CO3	Demonstrate routing and congestion control algorithms in designing network systems.	K3
CO4	Employ network layer functions, routing, congestion control, and IP addressing in IPv4 and IPv6.	K3
CO5	Implement application layer protocols and socket programming.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO4	3	2	3	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	3	2	-

COURSE CONTENT

UNIT I: Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP.
Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.
UNIT II: Data link layer: Design issues, **Framing:** fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols:** simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel. **Sliding window protocol:** One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP)
UNIT – III: Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access (FDMA), time division multiple access (TDMA), code division multiple access (CDMA). **Wired LANs:** Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet (100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.
UNIT – IV: The Network Layer Design Issues – Store and Forward Packet Switching Services Provided to the Transport layer- Implementation of Connectionless Service Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.
Internet Working: How networks differ- How networks can be connected- Tunnelling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6.
UNIT –V: The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications Transmission control protocol: TCP services- TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.
Application Layer –- World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System.

TEXT BOOKS:

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

REFERENCES:

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

WEB REFERENCES:

1. https://onlinecourses.swayam2.ac.in/ntr25_ed138/preview
2. https://onlinecourses.swayam2.ac.in/ntr25_ed100/preview

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester
Software Engineering
(Common to CSE(AI&ML), CSE(DS))

Course Category	Professional Elective -I	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
The objectives of this course are to introduce	
1	Software life cycle models, Software requirements and SRS document.
2	Project Planning, quality control and ensuring good quality software.
3	Software Testing strategies, use of CASE tools, Implementation issues, validation &verification procedures.

COURSE OUTCOMES		
CO1	Ability to transform an Object-Oriented Design into high quality, Executable code	K3
CO2	Skills to design, implement, and execute test cases at the Unit and Integration level	K3
CO3	Compare conventional and agile software methods	K4
CO4	Skills to design Software Architectural components.	K3
CO5	Analyze the interface analysis and Testing strategies.	K4

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2	0	3	0	0	0	0	0	0
CO2	3	3	2	0	2	0	0	0	0	0	0
CO3	3	2	1	0	2	0	0	0	2	0	0
CO4	3	2	3	0	3	0	0	0	2	0	0
CO5	3	3	3	0	3	0	0	0	2	0	0

COURSE CONTENT :

UNIT I:

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

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

UNIT II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

Requirements Analysis And Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III:

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

Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV:

Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing**,** Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.

Software Reliability And Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000.SEI Capability maturity model. Few other important quality standards, and Six Sigma**.**

UNIT V:

Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

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

Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

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

Reference Books:

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

e-Resources:

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

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III YEAR I SEMESTER

AUTOMATA THEORY & COMPILER DESIGN

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES The objectives of the course is to	
1	Introduce the notion of formal languages and grammars
2	Design of Grammars, FAs and PDAs
3	Become familiar with the underlying theory and methods used in compiler design
4	Introduce the parsing techniques, code optimization techniques and generate code

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Describe regular expressions and finite automata to represent and process regular languages.	K2
CO2	Construct context-free grammars and pushdown automata for context-free languages.	K3
CO3	Implement lexical analysis and top-down parsing techniques for language processing.	K3
CO4	Analyze bottom-up parsing methods and syntax-directed translation schemes for given grammars.	K4
CO5	Develop and evaluate intermediate code and target code with basic optimizations	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	1	0	0	0	0	0	0	3	2	1
CO2	3	3	3	2	2	0	0	0	0	0	0	3	3	2
CO3	3	3	3	2	2	0	0	0	0	0	0	3	3	2
CO4	3	3	3	3	2	0	0	0	0	0	0	3	3	2
CO5	3	3	3	3	2	0	0	0	0	0	0	3	3	3

COURSE CONTENT

UNIT I - Regular Expressions, Languages and Finite Automata
Formal Languages and the Chomsky Hierarchy, Regular Expressions and Regular Languages, Algebraic Laws for Regular Expressions, Applications of Regular Expressions, Abstract model of Finite Automaton, Transition Tables and Transition Graphs, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Converting NFA to DFA, Finite Automata with ϵ transitions (NFA-ϵ), Converting NFA-ϵ to NFA/DFA, Minimization of Finite Automata, Equivalence of FA and Regular Expressions

UNIT II - Context Free Grammars and Push Down Automata:
Context Free Grammars (CFG) and Context Free Languages (CFL), Design of CFGs, Leftmost and Rightmost Derivations, Parse Trees, Applications of CFGs, Ambiguity in Grammars and Languages, Push Down Automata (PDA), The Language of a PDA, Equivalence of PDAs and CFGs.

UNIT III - Lexical Analysis and Top-Down Parsing
The structure of a compiler, Role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The Lexical Analyser Generator –LEX
Introduction to Syntax Analysis, Eliminating ambiguity and left recursion from a CFG, Recursive Decent Parsing, LL(1) Grammars, Nonrecursive Predictive Parsing

UNIT IV - Bottom-Up Parsing and Syntax Directed Translation
Shift-Reduce Parsing, Simple LR parsing, Canonical LR(1) Parsing, LALR Parsing, Parser Generators
Syntax Directed Definitions, Evaluation Orders for SDDs, Syntax Directed Translation Schemes.

UNIT V - Intermediate Code Generation, Code Generation and Optimization:
Three address code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Issues in the design of a Code Generator, The Target Language, A simple Code Generator Basic Blocks and Flow

TEXT BOOKS	
1.	Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008
2.	Compilers Principles, Techniques and Tools, 2nd Edition, Alfred V.Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson
REFERENCE BOOKS	
1.	Introduction to Languages and The Theory of Computation, John C. Martin, McGraw Hill.
2.	Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3rd Edition, PHI, 2007
3.	Compiler Construction, K.V.N. Sunitha, Pearson, 2013
4.	Compiler Design, SandeepSaxena, Rajkumar Singh Rathore, S.Chand publication
WEB RESOURCES	
1.	https://stucor.in/syllabus/s-cs8602/
2.	https://www.geeksforgeeks.org/compiler-design/compiler-design-tutorials/

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester

Object Oriented Analysis and Design

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

Course Category	Professional Elective - I	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	Become familiar with all phases of OOAD
2	Master the main features of the UML.
3	Master the main concepts of Object Technologies and how to apply them atworkand develop the ability to analyze and solve challenging problem in various domains.
4	Learn the Object design Principles and understand how to apply them towards Implementation.

COURSEOUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand complexity in software systems and principles for designing organized, complex architectures.	K2
CO2	Apply UML modeling principles, its architecture, and structural modeling concepts with case studies.	K3
CO3	Analyze class and object diagrams using advanced modeling concepts, interfaces, and packages.	K4
CO4	Design use case, interaction, and activity diagrams for behavioral modeling of systems.	K4
CO5	Design advanced behavioral and architectural models using state charts, component, and deployment diagrams.	K4

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	0	1	0	0	0	0	0	0
CO2	3	3	3	0	2	0	0	0	0	0	0
CO3	3	3	3	0	2	0	0	0	0	0	0
CO4	3	3	3	0	3	0	0	0	0	0	0
CO5	3	3	2	0	3	0	0	0	0	0	0

COURSE CONTENT

UNIT I:
Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation

UNIT II:
Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

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

UNIT IV:
Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System

UNIT V:
Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams. **Case Study:** Weather Forecasting

Text Books:

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

Reference Books:

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

e-Resources :
1. https://archive.nptel.ac.in/courses/106/105/106105153/

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year – I Semester

Soft Computing

(Common to CSE (AI) and CSE (DS))

Course Category	Professional Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

Course Objectives:	
1	Understand the fundamental concepts and architectures of **Artificial Neural Networks** and their applications.
2	Explore the principles and design of **Fuzzy Logic-based systems** for intelligent decision-making.
3	Learn the working mechanisms and optimization capabilities of **Genetic Algorithm-based systems**.
4	Examine **hybrid intelligent systems** that integrate neural networks, fuzzy logic, and genetic algorithms.
5	Apply soft computing techniques to solve complex, real-world problems.

Course Outcomes:

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	**Explain** the concepts and architectures of Artificial Neural Networks.	**K2**
CO2	**Describe** the design and applications of Fuzzy Logic-based systems.	**K2**
CO3	**Analyze** the working principles of Genetic Algorithm-based systems.	**K4**
CO4	**Integrate** neural networks, fuzzy logic, and genetic algorithms in hybrid systems.	**K5**
CO5	**Apply** soft computing techniques to solve real-world problems.	**K3**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	2	–	–	–	–	1	–	3	2	–
CO2	3	2	2	2	2	–	–	–	–	1	–	3	2	–
CO3	3	3	2	3	2	–	–	–	–	1	–	3	3	–
CO4	3	3	3	3	3	–	–	–	–	2	–	3	3	2
CO5	3	3	3	3	3	–	–	–	–	2	–	3	3	3

COURSE CONTENT :

UNIT - I:
Introduction to Soft Computing, Artificial neural networks, biological neurons, Basic models of artificial neural networks, Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

UNIT - II:
Perceptron networks, learning rule, Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network, Architecture, Training algorithm

UNIT - III:
Fuzzy logic, fuzzy sets, properties, operations on fuzzy sets, fuzzy relations, operations on fuzzy relations, Fuzzy membership functions, fuzzification, Methods of membership, value assignments, intuition, inference, rank ordering, Lambda –cuts for fuzzy sets, Defuzzification methods.

UNIT - IV:
Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules, Decomposition of rules, Aggregation of rules, Fuzzy Inference Systems, Mamdani and Sugeno types, Neuro-fuzzy hybrid systems, characteristics, classification.

UNIT - V:
Introduction to genetic algorithm, operators in genetic algorithm, coding, selection, crossover, mutation, stopping condition for genetic algorithm flow, Genetic-neuro hybrid systems, Genetic Fuzzy rule-based system

Text Books:

1. S. N. Sivanandamand S. N. Deepa, Principles of soft computing–John Wiley & Sons,2007.
2. Timothy J. Ross, Fuzzy Logic with engineering applications, John Wiley& Sons, 2016.

Reference Books:

1. N. K. Sinhaand M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications-Academic Press /Elsevier. 2009.
2. Simon Haykin, Neural Network- A Comprehensive Foundation-Prentice Hall International, Inc.1998
3. R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
4. Driankov D., Hellendoorn H.and Reinfrank M., An Introduction to Fuzzy Control Narosa Pub., 2001.
5. Bart Kosko, Neural Network and Fuzzy Systems- Prentice Hall, Inc., Englewood Cliffs, 1992
6. Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning Addison Wesley, 1989

Web Resources:

1. https://onlinecourses.swayam2.ac.in/nou20_cs11/preview
2. https://www.mathworks.com/help/fuzzy/

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester

INTERNET OF THINGS

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

Course Category	Professional Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will learn:	
1	fundamental concepts, architectures, and technologies underlying the Internet of Things (IoT) and Machine-to-Machine (M2M) communication
2	design principles, connectivity models, and communication protocols for connected devices.
3	business models, standardizations, and communication technologies for IoT/M2M systems.
4	methods of data acquisition, organization, analytics, and integration in IoT ecosystems
5	cloud computing concepts, service models, and sensor technologies in real-world IoT/M2M applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain IoT concepts, technologies, and protocols for connected devices.	K2
CO2	Describe IoT business models, architectures, and standardization approaches.	K2
CO3	Apply suitable web and message protocols for device connectivity	K3
CO4	Organize and analyze IoT data for business and application needs.	K4
CO5	Explain cloud platforms and sensor technologies for IoT applications	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

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COURSE CONTENT

UNIT-I:

The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles for Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT-II:

Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standardizations, Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High- level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT-III:

Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT-IV:

Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT-V:

Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

TEXTB OOKS:

1. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A. Bahgya and V. Madisetti, University Press, 2015

REFERENCE BOOKS:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley Getting Started with the Internet of Things, Cuno Pfister, Oreilly

PRAGATI ENGINEERING COLLEGE

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III Year– I Semester

Construction Project Management

Course Category	Open Elective	Course Code	
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites	Building materials Project management basics	Continuous Internal assessment Semester End Examination Total Marks	30 70 100

Course Objectives:	
1.	To introduce to the student, the concept of project management including network drawing and monitoring
2.	To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3.	To introduce the importance of safety in construction projects

Course Outcomes:

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	**Explain** the principles of construction project management, including planning, scheduling, monitoring, and coordination using CPM and PERT techniques.	**K2**
CO2	**Apply** project evaluation methods, cost analysis, and resource optimization techniques using construction management software like Primavera.	**K3**
CO3	**Analyze** the selection, capacity, and productivity of various construction equipment for earthwork, compaction, hoisting, and concreting operations.	**K4**
CO4	**Demonstrate** the operation and application of concreting equipment, including batching plants, mixers, and finishing tools for quality construction.	**K3**
CO5	**Evaluate** construction methods, formwork practices, and safety measures, incorporating BIM concepts for effective civil engineering project execution	**K5**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	-	1	2	2	1	3	2	1
CO2	3	3	2	2	3	1	-	1	2	3	1	3	2	1
CO3	3	3	2	2	2	2	-	1	2	2	1	3	3	1
CO4	3	2	3	2	2	2	-	2	2	2	1	3	3	1
CO5	3	3	3	3	3	3	2	2	3	3	2	3	3	2

COURSE CONTENT

UNIT–I

Construction project management and its relevance – qualities of project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT-II

Project evaluation and review technique– cost analysis updating crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent

UNIT-III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

Hoisting and earthwork equipment–hoists–cranes–tractors-bulldozers–graders–scrapers–draglines-clamshellbuckets

UNIT – IV

Concreting equipment— concrete mixers–Batching plants, mobile using plants like"Ajax"etc.mixing and placing of concrete – consolidating and finishing.

UNIT – V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection–quality control and safety engineering. BIM for Civil Engineers (Building Information Modeling)

Text Books:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata Mc Graw hill.
2. 'Construction Project Management Theory and Practice'by Kumar Neeraj Jha (2011), Pearson.
3. 'ConstructionTechnology'bySubirK.SarkarandSubhajitSarasvati,OxfordUniversity press

References:

1. 'Construction Project Management – An Integrated Approach'by Peter Fewings,Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning

Web References:

1. NPTEL :: Civil Engineering - NOC:Principles of Construction Management

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III Year I Semester

Sustainable Energy Technologies

Course Category	Open Elective-I	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	-	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To demonstrate the importance the impact of solar radiation, solar PV modules.
2	To understand the principles of storage in PV systems.
3	To discuss solar energy storage systems and their applications.
4	To get knowledge in wind energy and bio-mass.
5	To gain insights in geothermal energy, ocean energy and fuel cells.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate solar radiation principles and the design of PV modules.	K3
CO2	Discuss battery technologies and storage methods in PV systems.	K2
CO3	Explain solar energy collection, storage methods, and applications.	K2
CO4	Describe the principles and utilization of wind and bio-mass energy systems.	K2
CO5	Analyze geothermal, ocean, and fuel cell energy technologies.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

UNIT –I

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

SOLAR PV MODULES AND PV SYSTEMS:

PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant, Installation and Maintenance, **Real-time PV monitoring systems, Maximum Power Point Tracking)**algorithms in PV systems.

UNIT –II

STORAGE IN PV SYSTEMS:

Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

UNIT –III

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney, **Solar-assisted heat pump systems.**

UNIT – IV

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT – V

GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Relative Merits

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges.

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Text books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH.
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006.
3. Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013.

Reference Books:

1. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor &Francis.
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd.
3. Renewable Energy Technologies -Ramesh & Kumar /Narosa.
4. Non-conventional Energy Source- G.D Roy/Standard Publishers.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_me144/preview
2. https://archive.nptel.ac.in/courses/115/105/115105127/
3. https://archive.nptel.ac.in/courses/121/106/121106014/

PRAGATI ENGINEERING COLLEGE

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R23

III Year I Semester

Renewable Energy Sources

(Common to CE, ME, ECE, CSE, IT, CSE-CS, CSE-DS, CSE-AI, CSE-AIML)

Course Category	Open Elective Courses	**Course Code**	
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	Basic Electrical Engineering	**Internal Assessment**	**30**
		Semester End Examination	**70**
		Total Marks	**100**

COURSE OBJECTIVES	
1	To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics.
2	To understand the concept of Wind Energy Conversion & its applications.
3	To study the principles of biomass, hydel and geothermal energy.
4	To understand the principles of ocean Thermal Energy Conversion, waves and power associated with it.
5	To study the various chemical energy sources such as fuel cell and hydrogen energy along with their operation and equivalent circuit.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage.	K4
CO2	Illustrate the components of wind energy systems.	K3
CO3	Illustrate the working of biomass, hydel plants and Geothermal plants.	K3
CO4	Demonstrate the principle of Energy production from OTEC, Tidal and Waves.	K2
CO5	Evaluate the concept and working of Fuel cells & MHD power generation.	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1	-	-	-	**1**	-	-	-	-	3	3
CO2	3	2	1	-	-	-	1	-	-	-	-	2	3
CO3	3	1	1	-	-	-	1	-	-	-	-	2	3
CO4	3	1	1	-	-	-	1	-	-	-	-	3	3
CO5	3	1	1	-	-	-	1	-	-	-	-	2	3

COURSE CONTENT

UNIT 1
Solar Energy
Introduction - Renewable Sources - prospects, solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.

UNIT 2
Wind Energy
Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

UNIT 3
Biomass, Hydel and Geothermal Energy
Biomass: Introduction - Biomass conversion technologies- Photosynthesis. Factors affecting Bio digestion.
Hydro plants: Basic working principle – Classification of hydro systems: Large, small, micro hydel plants.
Geothermal Energy: Introduction, Geothermal Sources – Applications - operational and Environmental problems.

UNIT 4
Energy From oceans, Waves & Tides
Oceans: Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India.
Waves: Introduction - Energy and Power from the waves - Wave Energy conversion devices.
Tides: Basic principle of Tide Energy -Components of Tidal Energy.

UNIT 5
Chemical Energy Sources
Fuel Cells: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications.
Hydrogen Energy: Introduction - Methods of Hydrogen production - Storage and Applications.
Magneto Hydro Dynamic (MHD) Power generation: Principle of Operation - Types.

TEXT BOOKS

1 G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
2 John Twidell& Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

REFERENCE BOOKS

1 Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak,TMH, New Delhi, 3rd Edition.
2 John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.

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III Year I Semester

Electronic Devices And Circuits

Course Category	Open Elective 1	Course Code	
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Continuous Internal Assessment Semester End Examination Total Marks	30 70 100

COURSEOBJECTIVES	
The student will learn:	
1	To learn and understand the basic concepts of semiconductor physics and study the physical phenomena of PN junction diode
2	Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes, to learn and understand the application of diodes
3	Acquire knowledge about the principle of working and operation of Bipolar Junction Transistor, to learn and understand the purpose of transistor biasing and its significance
4	understand the small signal low frequency equivalent circuit analysis of BJT transistor amplifiers and compare different configurations
5	understand different types of FETs, their operation, characteristics, and analysis

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Apply the basic concepts of semiconductor physics and understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation	K2
CO2	Know the construction, working principle of special diodes and applications of diodes	K3
CO3	Understand the construction of BJT, principle of operation of BJT with their V-I characteristics in different configurations. Apply the concepts of transistor biasing, various biasing techniques for BJT	K2
CO4	Perform the analysis of small signal low frequency transistor amplifier circuits using BJT	K3
CO5	Understand the construction of FET, principle of operation of FET with characteristics in different configurations	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2									2	2
CO2	3	3	2									2	2
CO3	3	3	2									2	2
CO4	3	3	2									2	2
CO5	3	3	2	2								2	2

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COURSE CONTENT

UNIT-I:

Review of Semi Conductor Physics: Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors

Junction Diode Characteristics :Energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

UNIT-II:

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics.

Rectifiers and Filters: Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.

UNIT- III: Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristicsμ, g_m, $r_d$parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT- IV:

Transistor Biasing and Thermal Stabilization :Need for biasing, operating point, load line analysis, BJT biasing-methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S,S',S''), Bias compensation, Thermal runaway, Thermal stability.FET Biasing- methods and stabilization.

UNIT- V: Small Signal Low Frequency Transistor Amplifier Models:

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Circuits by David A. Bell, Oxford University Press
3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenth edition,2009

References:

1. Integrated Electronics-J. Millman, C. Halkias,Tata Mc-Graw Hill, Second Edition,2009
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016

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R23

III Year I Semester

ENTREPRENEURSHIP AND VENTURE CREATION

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

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**L-T-P-C**	3 -0 -0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes		**BTL**
Upon successful completion of the course, the student will be able to		
CO 1	Classify entrepreneurial and intrapreneurial concepts, attributes, and mindset to identify personal entrepreneurial potential using classroom discussions and case studies.	K2
CO 2	Apply design thinking principles to identify and validate problems and customer segments to achieve accurate problem–customer fit through field research and simulated venture activities.	K3
CO 3	Analyze solution designs and feasibility prototypes to determine their effectiveness in achieving proof-of-concept validation under iterative testing conditions.	K4
CO 4	Analyze business and revenue models along with financial plans to evaluate their potential for sustainability and profitability under simulated business planning scenarios.	K4
CO 5	Analyze investor pitch content to assess its effectiveness in communicating venture scale potential under simulated pitching conditions.	K4

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

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

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COURSE CONTENT

Unit – I Entrepreneurship Fundamentals & Context: Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skillsets, attributes and networks while on campus.

Unit – II Problem & Customer Identification: Understanding and analysing the macro-Problem and Industry perspective, technological, socio economic and urbanization trends and their implication on new opportunities. Identifying passion, identifying and defining problem using Design thinking principles. Analysing problem and validating with the potential customer. Iterating problem-customer fit. Understanding customer segmentation, creating and validating customer personas. Competition and Industry trends mapping and assessing initial opportunity.

Unit – III Solution design, Prototyping & Opportunity Assessment and Sizing: Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition. Developing Problem-solution fit in an iterative manner. Understanding prototyping and MVP. Developing a feasibility prototype with differentiating value, features and benefits. Initial testing for proof-of-concept and iterate on the prototype. Assess relative market position via competition analysis, sizing the market and assess scope and potential scale of the opportunity.

Unit – IV Business & Financial Model, Go-to-Market Plan: Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach. **Business planning:** components of Business plan- Sales plan, People plan and financial plan. **Financial Planning:** Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance.
Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options.

Unit – V Scale Outlook and Venture Pitch readiness: Understand and identify potential and aspiration for scale vis a vis your venture idea.
Persuasive Storytelling and its key components. Build an Investor ready pitch deck.

Textbooks:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business

Reference Books :

1. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.
2. Simon Sinek (2011) Start with Why, Penguin Books limited
3. Brown Tim (2019) Change by Design Revised & Updated: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Business
4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd

Web References:

Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester

Machine Learning Laboratory

Course Category	Machine Learning Laboratory	**Course Code**	
Course Type	Professional Core	**L-T-P-C**	0-0-3-1.5
Prerequisites	Artificial Intelligence	**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The learning objectives of this course are:	
1	The student should be made to study the concepts of Artificial Intelligence.
2	The student should be made to learn the methods of solving problems using Artificial Intelligence.
3	The student should be made to introduce the concepts of Expert Systems and Machine Learning.
4	To learn about computing central tendency measures and Data preprocessing techniques
5	To learn about classification and regression algorithms
6	To apply different clustering algorithms for a problem.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO 1	Apply the fundamental data structures of the Pandas library, such as Series and Data Frames.	K3
CO 2	Visualize data using Pandas' built-in plotting capabilities	K3
CO 3	Implement data preprocessing techniques to prepare datasets for analysis	K3

K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

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

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	1	0	1	0	0	0	0	0	1	0	1	1	0
CO 2	3	2	1	0	1	0	0	0	0	0	1	0	1	0	0
CO 3	3	2	1	0	1	0	0	0	0	0	1	0	1	0	0

Software's required: Python/R/Weka	
S. No.	**Experiment**
1	Compute Central Tendency Measures: Mean, Median, Mode; Measure of Dispersion: Variance, Standard Deviation.
2	Apply the following pre-processing techniques for a given data set: a. Attribute selection b. Handling missing values c. Discretization d. Elimination of outliers
3	Apply KNN algorithm for classification and regression.
4	Demonstrate Decision Tree algorithm for a classification problem and perform parameter tuning for better results.
5	Demonstrate Decision Tree algorithm for a regression problem.
6	Apply Random Forest algorithm for classification and regression.
7	Demonstrate Naïve Bayes Classification algorithm.
8	Apply Support Vector algorithm for classification.
9	Demonstrate Simple Linear Regression algorithm for a regression problem.
10	Apply Logistic Regression algorithm for a classification problem.
11	Demonstrate Multi-layer Perceptron algorithm for a classification problem.
12	Implement the K-Means algorithm and apply it to the selected data. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.
13	Demonstrate the use of Fuzzy C-Means Clustering.
14	Demonstrate the use of Expectation Maximization-based clustering algorithm.

Reference Books:

1. "Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller and Sarah Guido
2. Pattern Recognition and Machine Learning: Christopher M. Bishop, Springer Publications

Online Learning Resources/Virtual Labs:

1. https://pandas.pydata.org/pandas-docs/stable/
2. https://onlinecourses.nptel.ac.in/noc22_cs32/
3. https://scikit-learn.org/stable/

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester

COMPUTER NETWORKS LABORATORY

(Common to CSE, CSE(AIML), CSE(AI), CSE(DS), IT)

Course Category	Professional Core	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0 – 0 – 3 – 1.5
Prerequisites	C Programming	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES

1	Understand and simulate various networking concepts, devices, protocols, and error control techniques.
2	Analyze and implement routing, congestion control, and traffic shaping methods in computer networks.
3	Use network simulation and analysis tools (e.g., NS2, Wireshark, Nmap) to evaluate network performance.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Develop various data link layer functionalities	K3
CO2	Analyze appropriate routing algorithm for the network	K4
CO3	Analyze the network simulations in NS2	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	-	3	-	-	-	2	2	2	2	1	2
CO2	3	3	3	-	2	-	-	-	1	2	2	1	2	2
CO3	3	3	3	-	3	-	-	-	1	2	2	2	1	-

PRAGATI ENGINEERING COLLEGE

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Department of CSE (Data Science)

R23

COURSE CONTENT

List of Experiments:

1. Study of Network devices in detail and connect the computers in Local Area Network.
2. Write a Program to implement the data link layer farming methods such as
   i. Character stuffing ii. Bit stuffing
3. Write a Program to implement data link layer farming method checksum.
4. Write a program for Hamming Code generation for error detection and correction.
5. Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.
6. Write a Program to implement Sliding window protocol for Goback N.
7. Write a Program to implement Sliding window protocol for Selective repeat.
8. Write a Program to implement Stop and Wait Protocol.
9. Write a program for congestion control using leaky bucket algorithm
10. Write a Program to implement Dijkstra‘s algorithm to compute the Shortest path through a graph.
11. Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes).
12. Write a Program to implement Broadcast tree by taking subnet of hosts.
13. Wireshark
    i. Packet Capture Using Wire shark
    ii. Starting Wire shark
    iii. Viewing Captured Traffic
    iv. Analysis and Statistics & Filters.
14. How to run Nmap scan
15. Operating System Detection using Nmap
16. Do the following using NS2 Simulator
    i. NS2 Simulator-Introduction
    ii. Simulate to Find the Number of Packets Dropped
    iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
    iv. Simulate to Find the Number of Packets Dropped due to Congestion
    v. Simulate to Compare Data Rate& Throughput.

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester

Salesforce Administrator Explorer

(Common to All Branches)

Course Category	Skill Enhancement Course	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-1-2-2
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Help in collaborating with business and technical stake holders to design, configure, and implement Salesforce
2	Develop a mind set in solving business problems using the Salesforce Platform
3	Hands on practice on provide reporting on a regular basis to help users and executives gain insights and make decisions from Salesforce data
4	Learn how to create human-centered user experiences in Salesforce
5	UnderstandhowtoCreate,maintain,andenhanceautomatedbusinessprocesses

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Be able to understand how to manage changes to business processes, technology, and people with Salesforce.	K1
CO2	Be able to improve the efficiency of business operations by proactively undertaking regular process analysis and documentation.	K2
CO3	Be able to manage the end-to-end implementation of Salesforce, including the overall strategy and day-to-day activities involved in administering Salesforce.	K3

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2	2	0	3	1	1	1	2	3	2
CO2	2	3	2	0	2	1	1	1	2	2	1
CO3	3	3	3	0	3	1	1	2	3	3	2

COURSE CONTENT

Experiment 1:

Salesforce Platform Basics: Get Started with the Salesforce Platform, Discover Use Cases for the Platform, Understand the Salesforce Architecture, Navigate Setup, Power Up with AppExchange.

Prepare Your Salesforce Org for Users: Set Up the Exchange Rate, Update the Exchange Rate with ACM, Customize the Home Page, Create a Unique Account List View, Create Chatter Groups.

User Management: Add New Users, Control What Your Users Can Access — (3 Sessions)

Experiment 2:

Customize an Org to Support a New Business Unit: Manage User Access, Manage Chatter, Modify Your Data Model, Configure an Email Letterhead and Template, Automate Your Business Process.

Identity Basics: Get to Know Salesforce Identity, Get to Know Your Salesforce Identity Users, Learn the Language of Identity — (4 Sessions)

Experiment 3:
Data Security: Overview of Data Security, Control Access to the Org, Control Access to Objects, Control Access to Fields, Control Access to Records, Create a Role Hierarchy, Define Sharing Rules.
Permission Set Groups: Get Started with Permission Set Groups, Create a Permission Set Group, Mute Permissions in Permission Set Groups.
Protect Your Data in Salesforce: Restrict Login Hours and IP Ranges, Create New Users and Allow a User to Delete Accounts, Set Organization-Wide Defaults and Create a Role Hierarchy, Create Sharing Rules, Set Up Account Teams — (5 Sessions)

Experiment 4:
Data Modeling: Understand Custom & Standard Objects, Create Object Relationships, Work with Schema Builder.
Lightning Experience Customization: Set Up Your Org, Create and Customize Lightning Apps, Create and Customize List Views, Customize Record Highlights with Compact Layouts, Customize Record Details with Page Layouts, Create Custom Buttons and Links, Empower Your Users with Quick Actions.
Customize a Salesforce Object: Work with Standard and Custom Fields, Create Picklists and Field Dependencies, Create Lookup Filters, Create Formula Fields, Create Record Types, Create Account Page Layouts, Enable Account Field History Tracking, Create Validation Rules — (5 Sessions)

Experiment 5:
Lightning App Builder: Get Started with the Lightning App Builder, Build a Custom Home Page for Lightning Experience, Build a Custom Record Page for Lightning Experience and Salesforce Mobile App, Build an App Home Lightning Page, Work with Custom Lightning Components.
Formulas and Validations: Use Formula Fields, Implement Roll-Up Summary Fields, Create Validation Rules — (4 Sessions)

Experiment 6:
Accounts & Contacts for Lightning Experience: Store Information About Your Customers, Understand Account and Contact Relationships.
Leads & Opportunities for Lightning Experience: Create and Convert Leads as Potential Customers, Work Your Opportunities, Sell as a Team and Split the Credit, Visualize Success with Path and Kanban.
Products, Quotes, & Contracts: Create Price Books to Track Your Products, Configure Quotes for Your Customers, and Track Contracts.
Campaign Basics: Meet Salesforce Campaigns, Organize Campaigns, Determine Who You're Marketing To, Report on Your Campaigns.
Customize a Sales Path for Your Team: Customize a Sales Path, Customize Opportunity Stages, Work with Opportunities in the Kanban View — (5 Sessions)

Experiment 7:
Service Cloud for Lightning Experience: Begin Your Customer Service Journey, Administer Service Cloud, Automate Case Management, Create Digital Engagement on Multiple Channels.
Set Up the Service Console: Set Up the Lightning Service Console, Customize Your Lightning Service Console Pages, Add the Softphone Utility to Your App, Set Up Web Chats for Your Console.
Create a Process for Managing Support Cases: Create Support Processes, Create Record Types, Create an Escalation Rule.
Set Up Case Escalation and Entitlements: Create Support Processes, Create Case Queues and Assignment Rules, Create a Case Escalation Rule, Create an Automation with Flow Builder, Enable Entitlements and Set Up Service Contracts, Create an Entitlement Process, Create Service Contracts with Entitlements — (5 Sessions)

Experiment 8:
Chatter Administration for Lightning Experience: Get Started with Chatter, Work with Chatter Groups, Enable Feed Tracking, Approve Records from a Chatter Feed, Develop a Rollout Strategy.
App Exchange Basics: Get Started with AppExchange, Navigate AppExchange, Explore App Exchange Listings, Install App Exchange Packages, Connect and Contribute to the AppExchange Community — (3 Sessions)

Experiment 9:
Data Management: Import Data, Export Data.
Duplicate Management: Improve Data Quality in Salesforce, Resolve and Prevent Duplicate Data in Salesforce.
Import and Export with Data Management Tools: Use the Data Import Wizard, Use Data Loader.io to Export Data, Use Data Loader.io to Update Data — (3 Sessions)

Experiment 10:
Reports & Dashboards for Lightning Experience: Introduction to Reports and Dashboards in Lightning Experience, Create Reports with the Report Builder, Format Reports, Visualize Your Data with the Lightning Dashboard Builder, Extend Your Reporting Strategy with AppExchange.
Create Reports and Dashboards for Sales and Marketing Managers: Create Report and Dashboard Folders, Create a Simple Custom Report, Filter Your Reports, Group and Categorize Your Data, Use Summary Formulas in Your Reports, Manage Reported Data, Visualize Your Data — (3 Sessions)

Experiment 11:
Approve Records with Approval Processes: Customize How Records Get Approved, Build an Approval Process.
Build a Discount Approval Process: Prepare Your Org, Create an Approval Process, Create Initial Submission Actions, Specify Final Approval and Rejection Actions.
Build a Simple Flow: Collect Contact Info from Your User, Check for a Matching Contact in Your Org, Branch the Flow, Create or Update a Contact.
Flow Builder Basics: Get Started with Automation, Go with the Flow, Meet Flow Builder, Learn About Flow Variables — (3 Sessions)

Experiment 12:
Case Studies and Capstone Project: Complete the Capstone Project by taking a user case and working on the Trailhead Playground — (5 Sessions)

Text Books:

1. Sharif Shaalan and Timothy Royer, *"Salesforce for Beginners: A Step-by-Step Guide to Optimize Sales and Marketing and Automate Business Processes with the Salesforce Platform"*, 2nd Ed, 2022, PACKT Publishers.
2. Sharif Shaalan, *"Salesforce for Beginners: A Step-by-Step Guide to Creating, Managing, and Automating Sales and Marketing Processes"*, 2020, PACKT Publishers.
3. Paul Goodey, *"Salesforce CRM – The Definitive Admin Handbook: Build, Configure, and Customize Salesforce CRM and Mobile Solutions"*, 5th Ed, 2019, PACKT Publishers.
4. Rakesh Gupta, *"Mastering Salesforce CRM Administration"*, 2017, PACKT Publishers.
5. Felicia Duarte, Rachelle Hoffman, *"Learn Salesforce Lightning: The Visual Guide to the Lightning UI"*, 2018, Wiley Apress.

Reference Books:

1. Johan Yu, *"Salesforce Lightning Reporting and Dashboards: Create, Customize, and Manage Your Salesforce Reports and Dashboards in Depth with Lightning Experience"*, 2017, PACKT Publishers.
2. Ahsan Zafar, *"Salesforce Data Architecture and Management: A Pragmatic Guide for Aspiring Salesforce Architects and Developers to Manage, Govern, and Secure Their Data Effectively"*, 2021, PACKT Publishers.
3. Saifullah Saifi and Ashwini Kumar Raj, *"Cloud Computing Using Salesforce"*, 2021, BPB.

e-Resources:

1. Use the Trailhead Platform: https://www.salesforce.com/blog/what-is-trailhead/
2. The Salesforce Administrator Trailmix: https://trailhead.salesforce.com/users/srebello7/trailmixes/salesforce-administrator-explorer

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester

User Interface Design using Flutter

(Common to CSE, IT, CSE (AIML), CSE (AI), CSE (DS) and CSE (CS))

Course Category	Engineering Science	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Learns to Implement Flutter Widgets and Layouts
2	Understands Responsive UI Design and with Navigation in Flutter
3	Knowledge on Widges and customize widgets for specific UI elements, Themes

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand Dart language fundamentals and core Flutter framework components.	K2
CO2	Build responsive and adaptive UIs using Flutter layout widgets.	K3
CO3	Implement navigation, forms, and state management in Flutter applications.	K3

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	3	0	2	0	0	0	0	0	0
CO2	3	3	3	0	3	0	0	0	0	0	0
CO3	3	3	3	0	3	0	0	0	0	0	0

COURSE CONTENT

List of Experiments:

Students need to implement the following experiments

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

Text Books:

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester
Deep Learning
CSE (AI&ML), CSE (DS)

Course Category	Deep Learning	**Course Code**	
Course Type	Professional Core	**L-T-P-C**	3-0-0-3
Prerequisites	Machine Learning	**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The learning objectives of this course are:	
1	**Develop** skills in designing, training, and optimizing feedforward, convolutional, and recurrent neural networks.
2	**Introduce** advanced training techniques, regularization methods, and generative models for deep learning applications.
3	Expose students to recent advancements such as variational autoencoders, transformers, and GPT for applications in vision, NLP, and speech.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO 1	Analyze the foundational models of Perceptron.	K2
CO 2	Apply the back propagation algorithm to train Deep Neural Networks	K3
CO 3	Improve models by using optimizer algorithms.	K3
CO 4	Construct an RNN and a CNN for text and image classification.	K4
CO5	Analyze the principles of recent deep learning architectures	K3

K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	0	0	0	0	0	0	3	0	0	0	0
CO2	3	2	2	1	2	0	0	0	0	0	2	0	1	1	1
CO3	3	3	2	1	2	0	0	0	0	0	2	0	1	1	2
CO4	3	3	3	1	2	0	0	0	0	0	2	0	0	0	2
CO5	3	2	2	1	0	0	0	0	0	0	2	0	0	0	0

PRAGATI ENGINEERING COLLEGE

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Department of CSE (Data Science)

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COURSE CONTENT

UNIT-I: Basics- Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm.

UNIT-II: Feed forward Networks-Multilayer Perceptron, Gradient Descent, Back propagation, Empirical Risk Minimization, regularization, auto encoders.
Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

UNIT-III: Better Training of Neural Networks-Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

UNIT IV: Recurrent Neural Networks- Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.
Convolutional Neural Networks: LeNet, AlexNet. Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

UNITV: Recent trends-Variational Auto encoders, Transformers, GPT Applications: Vision, NLP, Speech

Text Books:

1. Deep Learning, Ian Good fellowandYoshuaBengioandAaronCourville,MITPress,2016.
2. Deep Learning with Python, François Chollet, Manning Publications,2017.

Reference Books:

1. Neural Networks:ASystematicIntroduction,RaúlRojas,1996.
2. Pattern Recognition and Machine Learning,ChristopherBishop,2007.
3. https://www.youtube.com/watch?v=sB4EaWfCIOU

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester
Operating Systems
(CSE(AI&ML) & CSE (DS))

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
2	Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
3	Illustrate different conditions for deadlock and their possible solutions

COURSE OUTCOMES		
CO1	Describe various generations of Operating System and functions of OS	K2
CO2	Comprehend the concept of program, process and thread and compare various CPU Scheduling Algorithms and IPC problems	K2
CO3	Compare various Memory Management Schemes especially paging and Segmentation in OS and apply various Page Replacement Techniques	K2
CO4	Apply process synchronization techniques to avoid deadlocks	K3
CO5	Outline File Systems in Operating System like UNIX/Linux and Windows	K2

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	0	0	1	0	0	0	0	0	0
CO2	3	3	3	0	1	0	0	0	0	0	0
CO3	3	3	2	0	1	0	0	0	0	0	0
CO4	3	3	3	0	1	0	0	0	0	0	0
CO5	3	3	3	0	1	0	0	0	0	0	0

COURSE CONTENT

UNIT - I

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

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

UNIT - II

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

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

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

UNIT – III

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

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

UNIT - IV

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

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

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

UNIT - V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing.

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

Text Books:

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

Reference Books:

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

e-Resources:

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III YEAR II SEMESTER
DATA VISUALIZATION
(Common to CSE(AIML), CSE(AI), CSE(DS))

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3 – 0 – 0– 3
Prerequisites	Introduction to Data Science	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES

1	Familiarize students with the basic and advanced techniques of information visualization and scientific visualization.
2	Learn key techniques of the visualization process.
3	A detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Recognize the applications of visual representation of data and Gestalt principles	K2
CO2	Apply visual analytics for visualization applications	K3
CO3	Implement visualization of multi-dimensional data and multi-modal data	K3
CO4	Demonstrate visualization of data in multiple structures	K3
CO5	Estimate the efficacy of various visualization techniques	K4

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	3	1	1
CO2	3	-	2	-	-	-	-	-	-	-	2	2	1	2
CO3	-	2	3	-	3	-	-	-	-	-	-	2	1	2
CO4	-	2	3	-	3	-	-	-	-	-	-	2	1	2
CO5	-	-	-	-	3	2	2	-	-	-	-	2	2	2

COURSE CONTENT :

UNIT – I: Introduction: What Is Visualization? History of Visualization, Relationship between Visualization and Other Fields, The Visualization Process, Introduction of visual perception, visual representation of data, Gestalt principles, information overloads**.**

UNIT – II: Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications

UNIT – III: Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

UNIT – IV: Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

UNIT – V: Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations **Recent trends** in various perception techniques, various visualization techniques, data structures used in data visualization.

TEXT BOOKS

1. WARD, GRINSTEIN, KEIM. Interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd.
2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

REFERENCES:

1. Tamara Munzner, Visualization Analysis & Design ,1st edition, AK Peters Visualization Series 2014
2. Scott Murray, Interactive Data Visualization for the Web ,2nd Edition, 2017

WEB REFERENCES:

1. https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main_6up.pdf/sed/DM14-visualisation.pdf
2. https://www.tutorialspoint.com/business_writing_skills/data_visualization.htm
3. https://www.geeksforgeeks.org/datavisualizationanditsimportance

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

SOCIAL MEDIA ANALYTICS
(CSE(DS))

Course Category	Professional Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3 – 0 – 0– 3
Prerequisites	Exploratory Data Analysis with Python	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES

1	Understand the concepts, types, and uses of social media and its evolution
2	Learn the fundamentals of social media analytics, including text, action, and hyperlink analysis
3	Apply social media analytics tools and case studies for real-world business and marketing insights

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Enumerate various characteristics and types of social media.	K2
CO2	Classify different layers of social media analytics.	K2
CO3	Apply text analysis tools on social media data.	K3
CO4	Inspect the application of action analytics tools.	K3
CO5	Appraise the application of hyperlink analytics tools.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	-	-	2	-	-	-	-	2	2	2	-	2
CO2	3	2	-	-	3	-	-	-	-	-	2	3	2	2
CO3	2	3	2	-	3	-	-	-	-	-	2	3	3	3
CO4	2	3	2	-	3	-	-	-	-	-	2	3	2	2
CO5	2	3	2	-	3	-	-	-	-	2	2	3	3	3

COURSE CONTENT :

UNIT - I: Introduction to Social Media, World Wide Web, Web 1.0, Web 2.0, Web 3.0, Social Media, Core Characteristics of Social Media, Types of Social Media, Social Networking Sites, Using Facebook for Business Purposes, Content Communities

UNIT - II: Social Media Analytics Overview, Purpose of Social Media Analytics, social media Vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, social media Analytics Tools. Case Study: The Underground Campaign That Scored Big

UNIT - III: Social Media Text Analytics, Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text Analysis Tools. CaseStudy: Tapping Into Online Customer Opinions

UNIT - IV: Social Media Actions Analytics, Introduction to Actions Analytics, Common Social Media Actions, Actions Analytics Tools. Case Study: Cover-More Group

Unit - V: Social Media Hyperlink Analytics Types of Hyperlinks, Hyperlink Analytics, Types of Hyperlink Analytics, Hyperlink Analytics Tools. Case Study: Hyperlinks And Viral YouTube Videos

TEXT BOOKS:

1. Seven Layers of Social Media Analytics Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, And Location Data by Gohar F. Khan Isbn: 1507823207, Isbn-13: 9781507823200.

REFERENCES:

1. Social Media Analytics: Techniques And Insights for Extracting Business Value Out of Social Media by Matthew Ganis, Avinash Kohirkar, Pearson Education.
2. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, MGH.
3. Big Data and Analytics, Seema Acharya, Subhasinin Chellappan, Wiley Publications.
4. Big Data, Black Booktm, DreamtechPress,2015Edition.

WEB REFERENCES:

1. https://www.apu.apus.edu/docs/shared/course-syllabus/ANLY646.pdf
2. https://comm.osu.edu/courses/comm-4558
3. https://www.si.umich.edu/sites/default/files/SIADS_682_Social_Media_Analytics_F21_Gilbert.docx_.pdf
4. https://www.jou.ufl.edu/assets/syllabi/202408/PUR4501-Social-Listening-and-Analytics-Fitzsimmons%5B50%5D.pdf

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

Cryptography & Network Security

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

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Computer Networks and Discrete Mathematics	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
The objectives of the course is to	
1	Explain the objectives of information security
2	Explain the importance and application of each of confidentiality, integrity, authentication and availability
3	Understand the basic categories of threats to computers and networks
4	Discusses the Mathematics of Cryptography
5	Discuss the fundamental ideas of Symmetric and Asymmetric cryptographic Algorithms
6	Discusses the Network layer, Transport Layer and Application layer Protocols Enhanced security mechanisms

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Explain fundamental security concepts, attacks, services, and mechanisms in network security	**K2**
CO2	Apply classical encryption techniques and mathematical foundations of symmetric and asymmetric cryptography	**K3**
CO3	Implement symmetric (DES, AES, Blowfish, IDEA) and asymmetric (RSA, Diffie-Hellman, ECC) algorithms	**K3**
CO4	Analyze cryptographic hash functions, message authentication codes, and digital signature schemes for data integrity and authentication	**K4**
CO5	Evaluate network and internet security protocols (TLS, IPsec, S/MIME, PGP) for secure communication	**K5**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	0	0	0	0	0	0	0	0	0	0	3	0	0
CO2	3	2	3	0	0	0	0	0	0	0	0	3	2	0
CO3	3	0	3	0	0	0	0	0	0	0	0	3	3	2
CO4	3	0	2	3	0	0	0	0	0	0	0	2	3	0
CO5	3	0	2	3	3	0	0	0	0	0	0	2	3	0

COURSE CONTENT

UNIT I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Stenography.

UNIT II

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2^n) fields, Polynomials.

Mathematics of Asymmetric cryptography: Primes, Checking For Primness, Euler's phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT III

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography**.**

UNIT IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA). Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based On Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC. Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT V

Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol.

Electronic-Mail Security: Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

TEXT BOOKS

1. Cryptography and Network Security- Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A.Forouzan Debdeep,Mc GrawHill,3rd Edition, 2015

REFERENCE BOOKS

1. Cryptography and Network Security: Atul Kahate, McGraw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice By Wenbo Mao.Pearson

WEB RESOURCES

1. https://nptel.ac.in/courses/106/105/106105031/
2. https://www.coursera.org/learn/crypto

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

RECOMMENDER SYSTEMS

(Common to CSE(AIML), CSE(AI), CSE(DS))

Course Category	Professional Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3 – 0 – 0– 3
Prerequisites	Introduction to Data Science	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES

1	Understand the principles, techniques, and challenges of recommender systems.
2	Design and implement collaborative, content-based, knowledge-based, and hybrid approaches.
3	Evaluate recommender systems using datasets, metrics, and user-centric methods.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Enumerate functions, applications and issues in recommender systems.	K2
CO2	Apply collaborative filtering techniques for recommendations.	K3
CO3	Implement content-based recommendation using item features & user profiling and knowledge-based recommendation using representation & reasoning.	K3
CO4	Inspect various hybridization designs.	K4
CO5	Employ various evaluation metrics for recommendation systems.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	-	1	-	-	-	-	1	2	3	2	-
CO2	3	3	3	-	2	-	-	-	-	2	3	3	3	2
CO3	3	3	3	-	2	-	-	-	-	2	3	3	3	2
CO4	3	3	3	-	2	-	-	-	-	2	3	3	3	2
CO5	3	3	2	-	2	-	-	-	-	2	3	3	3	2

COURSE CONTENT :

UNIT - I: Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

UNIT - II: Collaborative Filtering: User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.

UNIT - III: Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content-based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.
Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

UNIT - IV: Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT - V: Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics.
Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, social tagging recommender systems, Trust and recommendations

TEXT BOOKS:

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

REFERENCES:

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems for Learning, Springer (2013), 1st ed.

WEB REFERENCES:

1. https://nptel.ac.in/courses/127105390
2. https://en.wikipedia.org/wiki/Recommender_system
3. https://recommender-systems.com

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

CLOUD COMPUTING

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

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Fundamentals of Computer Science & Networking	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES The objectives of the course is to	
1	To explain the evolving utility computing model called cloud computing
2	To introduce the various levels of services offered by cloud
3	To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization
4	To emphasize the security and other challenges in cloud computing
5	To introduce the advanced concepts such as containers, server less computing and cloud- centric Internet of Things

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Explain cloud computing concepts, service models, deployment models, and major cloud service providers.	K2
CO2	Analyze enabling technologies	K4
CO3	Implement virtualized environments and container-based solutions	K3
CO4	Evaluate cloud challenges and security solutions	K5
CO5	Apply advanced cloud concepts	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	0	0	1	0	0	2	0	0	1	3	0	0
CO2	2	3	0	0	2	0	0	3	0	0	2	3	0	0
CO3	3	2	3	2	3	0	0	3	0	0	2	3	0	0
CO4	3	2	2	3	3	0	0	3	0	0	3	3	0	0
CO5	3	2	3	3	3	0	0	3	0	0	3	3	0	0

COURSE CONTENT

UNIT I

Introduction to Cloud Computing Fundamentals: Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).

UNIT II

Cloud Enabling Technologies: Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT III

Virtualization and Containers: Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. AmazonEC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT IV

Cloud computing challenges: Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT V

Advanced concepts in cloud computing: Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g.AWSLambda) and open-source (e.g.OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing

.

TEXT BOOKS

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, McGraw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier,2012.

REFERENCE BOOKS

1. Cloud Computing, Theory and Practice, DanCMarinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K.Chandrasekhran, CRC press,2014.
3. Online documentation and tutorials from cloud service providers (e.g.,AWS,Azure,GCP)

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs18/preview
3. https://www.coursera.org/learn/introduction-to-cloud
4. https://www.coursera.org/learn/gcp-fundamentals

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester
SENSOR NETWORKS
(for CSE (DS))

Course Category	**Professional Elective**	**Course Code**	
Course Type	**Theory**	**L-T-P-C**	**3-0-0-3**
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
The student will learn:	
1	**the basics of wireless networks, MANETs, and sensor networks with their uses, challenges, and applications**
2	**the structure of sensor nodes and networks, including hardware, energy needs, and design principles**
3	**the key communication protocols in sensor networks at physical, MAC, and routing levels.**
4	**how networks are built using topology control, synchronization, and localization methods.**
5	**the hardware, software tools, and simulators used for sensor network development**

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	**provide an overview about sensor networks and emerging technologies**	**K3**
CO2	**study about the node and network architecture of sensor nodes and its execution environment**	**K3**
CO3	**understand the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN**	**K2**
CO4	**learn about topology control and clustering in networks with timing synchronization for localization services with sensor tasking and control**	**K2**
CO5	**study about sensor node hardware and software platforms and understand the simulation and programming techniques**	**K2**

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	**1**												
CO2	**1**	**1**											
CO3	**1**	**1**											
CO4	**1**	**1**											
CO5	**1**												

COURSE CONTENT

UNIT-I: Introduction and Overview:
Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characterise, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.

UNIT-II: Architectures:
Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes, operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks - single hop vs. multi hop networks, multiple sources and sinks - mobility, optimization goals and figures of merit, gateway concepts, design principles for WNs, service interfaces for WSNs.

UNIT- III: Communication Protocols:
Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC, the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocols- classification, gossiping, flooding, energy-efficient routin inicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.

UNIT- IV: Infrastructure Establishment:
Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range-based localization algorithms - location services, sensor tasking and control.

UNIT-V: Sensor Network Platforms and Tools:
Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM

Text Books:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

Reference Books:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3. Thomas Haenselmann, "Sensor Networks", available online for free, 2008.
4. Edgar Callaway, "Wireless Sensor Networks: Architectures and Protocols", Auerbach, 2003.

PRAGATI ENGINEERING COLLEGE

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Department of CSE (Data Science)

R23

III Year II Semester

SOFTWARE PROJECT MANAGEMENT

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

Course Category	Professional Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Software Engineering	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES The objectives of the course is to	
1	Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
2	Compare and differentiate organization structures and project structures
3	Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

COURSE OUTCOMES		**Cognitive level**
Upon successful completion of the course, the student will be able to:		
CO1	Describe conventional software management approaches and the core principles of software economics	K2
CO2	Analyze methods for improving software processes, product quality, and team effectiveness in modern development	K4
CO3	Apply iterative life cycle phases, artifacts, and model-based architectures for effective software development	K3
CO4	Prepare project plans and organizational structures	K3
CO5	Implement process automation, agile practices, and DevOps methodologies for efficient software delivery	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	0	0	0	1	0	0	3	2	0
CO2	2	3	2	3	1	0	0	0	2	0	0	3	3	0
CO3	3	2	3	2	1	0	0	0	2	0	0	3	2	2
CO4	2	1	1	1	2	0	0	0	3	2	2	2	0	3
CO5	3	1	1	1	2	0	0	0	3	2	2	3	0	3

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

COURSE CONTENT

UNIT I

Conventional Software Management: The waterfall model, conventional software Management performance.
Evolution of Software Economics: Software Economics, pragmatic software cost estimation.
Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.
The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT II

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.
Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT III

Model based software architectures: A Management perspective and technical perspective.
Work Flows of the process: Software process workflows, Iteration workflows. **Checkpoints of the process: Major** mile stones, Minor Milestones, Periodic status assessments.
Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT IV

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.
Process Automation: Automation Building blocks, The Project Environment.
Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

UNIT V

Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.
Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

TEXT BOOKS	
1.	Software Project Management, Walker Royce, PEA, 2005.
2.	Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3.	The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.
REFERENCE BOOKS	
1.	Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2.	Software Project Management, Joel Henry, PEA
3.	Software Project Management in practice, Pankaj Jalote, PEA, 2005
4.	Effective Software Project Management, Robert K.Wysocki, Wiley,2006
5.	Project Management in IT, Kathy Schwalbe, Cengage
WEB RESOURCES	
1.	https://www.coursera.org/learn/introduction-devops
2.	https://www.geeksforgeeks.org/software-engineering/evolution-of-software-economics/
3.	https://en.wikipedia.org/wiki/Artifact_%28software_development%29

4.	https://www.coursera.org/learn/software-processes-and-agile-practices

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year I Semester

Quantum Computing

(Common to CSE, IT, CSE (AIML), CSE (AI), CSE (DS) and CSE (CS))

Course Category	Professional Elective - I	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To introduce the fundamentals of quantum computing, the problem-solving approach using finite dimensional mathematics
2	To develop the ability to model and analyze quantum systems using qubits and quantum circuits, including the application of quantum gates, Bloch sphere representation, and Bell states.
3	To equip students with the knowledge of fundamental quantum algorithms and principles of quantum error correction and cryptography, enabling them to compare classical and quantum paradigms in computational complexity and secure communication.

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the evolution of quantum computing and differences between classical and quantum systems.	K2
CO2	Apply mathematical, physical, and biological foundations essential for understanding quantum computing principles.	K3
CO3	Understand qubits, their physical implementation, Bloch sphere, and design quantum logic circuits using gates.	K2
CO4	Analyze and implement quantum algorithms like Deutsch's, Shor's, and Grover's for computational problems.	K4
CO5	Understand quantum noise, error correction, quantum cryptography, teleportation, and their difference from classical approaches.	K2

K1-Remembering, K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	0	2	0	0	0	0	0	0
CO2	3	3	2	0	2	0	0	0	0	0	0
CO3	3	3	2	0	3	0	0	0	0	0	0
CO4	3	3	3	0	3	0	0	0	0	0	0
CO5	3	3	2	2	3	0	0	0	0	0	0

COURSE CONTENT

UNIT - I
History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits VsQubits, Classical Vs Quantum logical operations

UNIT - II
Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements.
Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT - III
Qubit: Physical implementations of Qubit, Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT - IV
Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT - V
Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

Text Books:
1. Quantum Computation and Quantum Information, Nielsen M. A.,Cambridge
2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, NicHarrigan, Mercedes Ginemo, Segovia, Oreilly

Reference Books:
1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci
2. Principles of Quantum Computation and Information,Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

e- Resources: https://onlinecourses.nptel.ac.in/noc25_cs61/preview

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year – II Semester

Computer Vision

(Common to CSE (AI), CSE (AIML), CSE (DS))

Course Category	Professional Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

Course Objectives:	
1	To understand the Fundamental Concepts related to sources, shadows and shading
2	To understand the Geometry of Multiple Views

Course Outcomes:

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Implement fundamental image processing techniques required for computer vision	**K3**
CO2	Implement boundary tracking techniques	**K3**
CO3	Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections.	**K3**
CO4	Apply 3D vision techniques and Implement motion related techniques.	**K3**
CO5	Develop applications using computer vision techniques.	**K4**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	–	–	–	–	1	–	3	3	2
CO2	3	2	2	3	2	–	–	–	–	1	–	3	3	2
CO3	3	3	3	3	2	–	–	–	–	1	–	3	3	3
CO4	3	3	3	3	2	–	–	–	–	1	–	3	3	3
CO5	3	3	3	3	3	–	–	–	–	2	–	3	3	3

COURSE CONTENT :

UNIT – I:
CAMERAS: Pinhole Cameras Radiometry–Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Inter reflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT - II:
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge **Detection:** Noise, Estimating Derivatives, Detecting Edges Texture 0: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT - III:
The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT - IV:
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, **Tracking With Linear Dynamic Models:** Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT - V:
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photo grammetry,
Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration in Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008. 3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

Web Resources:
1. **https://docs.opencv.org/**
2. **http://szeliski.org/Book/**

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

NOSQL DATABASES

(Common to CSE(AIML), CSE(DS))

Course Category	Professional Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3 – 0 – 0– 3
Prerequisites	Database Management Systems	**Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Understand the concepts and evolution of NoSQL databases
2	Distinguish between various types of NoSQL databases
3	Explore the architecture, scalability, and use cases of different NoSQL databases
4	Evaluate the trade-offs between consistency, availability, and partition tolerance
5	Use NoSQL tools and technologies for real-world applications

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Compare different types of NoSQL Databases.	K2
CO2	Differentiate RDBMS with different NoSQL databases.	K4
CO3	Demonstrate the application of Document-oriented NoSQL databases.	K3
CO4	Illustrate the performance tuning of Key-Value Pair NoSQL databases.	K2
CO5	Apply various development tools on different types of NoSQL Databases.	K3

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	-	1	1	-	-	1	-	-	3	-	-
CO2	3	3	2	-	1	1	-	-	1	1	-	3	-	-
CO3	1	2	3	-	3	1	-	-	1	1	1	3	3	-
CO4	3	2	1	-	2	1	-	-	1	-	-	3	-	-
CO5	1	2	3	-	3	1	-	-	1	1	2	-	3	3

COURSE CONTENT :

UNIT - I: Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

UNIT - II: Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT - III: NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT - IV: Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT - V: NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases

TEXT BOOKS:

Sadalage, P. & Fowler, M. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition, 2019.

RFERENCES:

1. McCreary, D. & Kelly, A. M. – Making Sense of NoSQL, Manning Publications, 2013.
2. Meier, A. & Kaufmann, M. – SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management, Springer, 2019.

WEB REFERENCES:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-database

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

Disaster Management

Course Category	Engineering Science	Course Code	
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Continuous Internal Assessment Semester End Examination Total Marks	30 70 100

Course Objectives:	
1.	Develop an understanding of why and how the modern disaster manager is involved with pre- disaster and post-disaster activities
2.	Describe the three planning strategies useful in mitigation.
3.	Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
4.	Describe public awareness and economic incentive possibilities.
5.	Understand the tools of post-disaster management.

Course Outcomes:

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Affirm the usefulness of integrating management principles in disaster mitigation work	**K3**
CO2	Distinguish between the different approaches needed to manage pre- during and post- disaster periods	**K2**
CO3	Understanding the functioning of national disaster management authority	**K2**
CO4	Explain the process of risk management	**K3**
CO5	Relate to risk transfer	**K3**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes : (1 – Low, 2 - Medium, 3 – High)														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	--	--	3	3	2	2	3	2	2	--	3
CO2	2	3	2	2	--	3	3	2	2	3	2	2	--	3
CO3	2	2	2	--	--	3	3	2	--	2	2	2	--	3
CO4	3	3	3	2	2	3	3	2	--	2	3	2	--	3
CO5	2	2	2	--	--	3	2	--	--	3	2	2	--	2

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

COURSE CONTENT

UNIT-I : Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II: Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism - threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

UNIT-III: Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV: Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges-mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V: Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

TEXT BOOKS:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Publishers& Distributors Pvt. Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh- Rawat Publications
3. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt.Ltd.

REFERENCE BOOKS:

1. 'Disaster Management' edited by H K Gupta (2003), Universities press.
2. 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy (2009), Universities press.R. Nishith, Singh AK

WEBREFERENCE:

1) https://archive.nptel.ac.in/courses/124/107/124107010/

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

Fundamentals of Electric Vehicles

(Common to CE, ME, ECE, CSE, IT, CSE-CS, CSE-DS, CSE-AI, CSE-AIML)

Course Category	Open Elective Courses	**Course Code**	
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	Basic knowledge in Physics, Chemistry and Basics of Electrical and Electronics.	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
2	To understand various power converters used in electric vehicles.
3	To be familiar all the different types of motors suitable for electric vehicles.
4	To know various architecture of hybrid electric vehicles.
5	To have knowledge on latest developments in batteries and other storage systems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate the use and advantages of different types of electric vehicles.	K2
CO2	Use suitable power converters for EV application.	K2
CO3	Select suitable electric motor for EV power train.	K3
CO4	Design HEV configuration for a specific application.	K3
CO5	Analyse various storage systems and battery management system for EVs.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	-	-	-	-	2	2	-	-	-	2	1	1
CO2	2	3	-	-	-	1	1	-	-	-	-	2	2
CO3	-	3	-	-	-	1	-	-	-	2	2	1	2
CO4	3	2	-	-	-	2	1	-	-	2	-	1	2
CO5	2	-	-	-	-	2	-	-	-	-	2	2	2

COURSE CONTENT

UNIT 1

Fundamentals of vehicles: Vehicle model – Calculation road load and tractive force –Components of conventional vehicles – Drawbacks of conventional vehicles – Need for electric vehicles– Advantages and applications of Electric Vehicles – History of Electric Vehicles – EV Market in India and outside India – Types of Electric Vehicles.

UNIT 2

Components of Electric Vehicles

Main components of Electric Vehicles – Electric Traction Motor and Controller – Power Converters – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.

UNIT 3

Motors for Electric Vehicles

Characteristics of traction drive – requirements of electric machines for EVs – Comparison of Different motors for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only).

UNIT 4

Hybrid Electric Vehicles

Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs – Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples – Merits and Demerits.

UNIT 5

Energy Sources for Electric Vehicles

Batteries– Types of Batteries – Lithium-ion – Nickel-metal hydride – Lead-acid – Comparison of Batteries – Battery Charging – Fast Charging –Battery Management System – Ultra capacitors – Flywheels – Compressed air energy storage (CAES)– Fuel Cell – it's working.

TEXT BOOKS

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2. Tom Denton, Hayley Pells - Electric and hybrid vehicles, Third Edition, 2024

REFERENCE BOOKS

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design – analysis and application. John Wiley & Sons - 2015.
3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

WEB RESOURCES (Suggested)

1. https://www.edx.org/learn/electric-cars

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester
Additive Manufacturing

Course Category	Open Elective -II	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Manufacturing Processes	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the principles of prototyping, classification of Rapid Prototyping processes and liquid-based Rapid Prototyping systems
2	To understand and apply different types of solid-based Rapid Prototyping systems.
3	To understand and apply different types of powder-based Rapid Prototyping systems.
4	To understand and apply various rapid tooling techniques
5	To understand different types of data formats and to explore the applications of Additive Manufacturing processes in various fields.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the principles, classification, and operation of liquid-based Rapid Prototyping systems.	K2
CO2	Describe various solid-based Rapid Prototyping systems.	K2
CO3	Analyze different powder-based Rapid Prototyping systems.	K4
CO4	Apply direct and indirect rapid tooling techniques.	K3
CO5	Interpret Rapid Prototyping data formats and applications of Additive Manufacturing.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

COURSE CONTENT

UNIT –I

INTRODUCTION: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

LIQUID-BASED RAPID PROTOTYPING SYSTEMS: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT –II

SOLID-BASED RAPID PROTOTYPING SYSTEMS: Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT –III

POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Three-dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – IV

RAPID TOOLING: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting process. Direct rapid tooling: Direct AIM, LOM Tools, and Direct Metal Tooling using 3DP

UNIT – V

RAPID PROTOTYPING DATA FORMATS: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file Repairs: Generic Solution, other Translators, and Newly Proposed Formats.

RP APPLICATIONS: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, RP medical and bioengineering applications: customized implants and prosthesis, forensic sciences.

Textbooks:

1. Rapid prototyping: Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific publications
2. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003

Reference Books:

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.
2. Rapid Manufacturing / D.T. Pham and S.S. Dimov/Springer
3. Rapid Prototyping & Manufacturing / Paul F.Jacobs/ASME Press

Web References:

1. https://www.ijeast.com/papers/254-260,Tesma505,IJEAST.pdf
2. https://theswissbay.ch/pdf/Books/Survival/Workshop/Rapid%20Tooling%20Technologies%20%26%20Industrial%20Applications.pdf
3. https://www.scribd.com/document/410103053/Patri-K-Venuvinod-Weiyin-Ma-auth-Rapid-Prototyping-Laser-based-and-Other-Technologies-Springer-US-2004-pdf
4. https://onlinecourses.nptel.ac.in/noc25_me151/preview

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

PRINCIPLES OF COMMUNICATIONS

Course Category	Open Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
The student will learn:	
1	Understand basic communication tools such as Fourier analysis, spectral properties, and AM concepts.
2	Know the principles and features of DSB-SC, SSB, and VSB modulation schemes.
3	Understand FM and PM systems, their bandwidth rules, and demodulation methods.
4	Understand sampling, quantization, and reconstruction techniques for digital signal representation.
5	Know probability and random processes for modeling noise in wireless communication.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain Fourier analysis, autocorrelation, and AM parameters for given communication signals.	K2
CO2	Apply DSB-SC, SSB, and VSB modulation schemes using spectrum and demodulation methods.	K3
CO3	Analyze FM and PM signals using modulation index and Carson's rule.	K4
CO4	Apply sampling and quantization to reconstruct signals meeting Nyquist and noise requirements.	K3
CO5	Evaluate wireless channel noise using probability theory and Gaussian process concepts.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

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

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

COURSE CONTENT

UNIT1 : Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parsevals Relation, Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index.

UNIT2 : Double Sideband Suppressed Carrier (DSB-SC) Modulation, Demodulation, Costas Receiver, Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)

UNIT 3 : Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency, Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation

UNIT 4 : Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation**,** Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, , Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM)

UNIT 5: : Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels, Basics of Random Processes ,Gaussian Random Process, Noise.

TEXTBOOKS:

1. Simon Haykin, Communications Systems, 4th Edition. John Wiley and Sons, Inc
2. Fundamentals of Wireless Communication by David Tse
3.

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester
Deep Learning Laboratory
CSE (AI&ML), CSE (DS)

Course Category	Deep Learning Laboratory	**Course Code**	
Course Type	Professional Core	**L-T-P-C**	0-0-3-1.5
Prerequisites	Python	**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
The learning objectives of this course are:	
1	**Provide** hands-on experience in implementing and training neural networks for classification and prediction tasks using standard datasets.
2	**Develop** skills in building and applying convolutional, recurrent, and pre-trained deep learning models.
3	Implementation of one-hot encoding and word embeddings to achieve efficient text representation.
4	**Enable** students to evaluate and optimize model performance.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO 1	**Implement** neural network models for image and text classification	K3
CO 2	**Design** convolutional and recurrent neural network architectures to solve classification and prediction problems.	K4
CO 3	**Implement** word embeddings and one-hot encoding techniques	K3

K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

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

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	3	1	1	0	0	0	0	0	2	0	1	0	1
CO 2	3	2	3	1	2	0	0	0	0	0	2	0	1	0	1
CO 3	2	2	3	1	1	0	0	0	0	0	1	0	1	0	1

COURSE CONTENT

Software Packages required:

- Keras
- Tensorflow
- PyTorch

List of Experiments:

1. Implement multi-layer perceptron algorithm for MNIST and written Digit Classification.
2. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural Network for classifying news wires (Multiclass classification) using Reuters dataset.
4. DesignaneuralnetworkforpredictinghousepricesusingBostonHousingPricedataset.
5. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
6. BuildaConvolutionNeuralNetworkforsimpleimage(dogsandCats)Classification
7. Use a pre-trained convolution neural net work (VGG16)for image classification.
8. Implement one hot encoding of words or characters.
9. Implement word embedding for IMDB dataset.
10. Implement a Recurrent Neural Network for IMDB movie review classification problem.

Text Books:

1. RezaZadehandBharathRamsundar,"TensorflowforDeepLearning",O'Reilly publishers, 2018

References:

1. https://github.com/fchollet/deep-learning-with-python-notebooks .
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

DATA VISUALIZATION LABORATORY

(Common to CSE(AIML), CSE(AI), CSE(DS))

Course Category	Professional Core	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0 – 0 – 3– 1.5
Prerequisites	Exploratory Data Analysis with Python	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES

1	Develop the ability to use different plotting techniques for visualization of data.
2	Learn advanced graphs such as correlogram, heatmap and 3D graphs.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Visualize datasets using different plotting techniques.	K3
CO2	Use R to create scatter, mosaic, and map-based plots.	K3
CO3	Generate advanced graphs such as correlograms, heatmaps, and 3D graphs.	K6

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	3	1	-	-	1	-	1	3	3	1
CO2	3	2	3	-	3	1	-	-	1	-	1	3	3	1
CO3	3	3	3	-	3	1	-	-	1	1	2	3	3	3

List of Experiments:

1. a) Load VADeaths (Death Rates in Virginia) dataset in R and visualize the data using different histograms.
   b) Load air quality dataset in R and visualize La Guardia Airport's daily maximum temperature using histogram.
2. Load AirPassengers dataset in R and visualize the data using line chart that shows increase in air passengers over given time period.
3. a) Load iris dataset in R, visualize the data using different Bar Charts and also demonstrate the use of stacked plots.
   b) Load air quality dataset in R and visualize ozone concentration in air.
4. a) Load iris dataset in R, visualize the data using different Box plots including group by option and also use color palette to represent species.
   b) Load air quality dataset in R and visualize air quality parameters using box plots.
5. Visualize iris dataset using simple scatter, multivariate scatter plot and also visualize scatter plot matrix to visualize multiple variables across each other.
6. Load diamonds dataset in R and visualize the structure in datasets with large data points using hexagon binning and also add color palette.
7. Load HairEyeColor dataset in R and plot categorical data using mosaic plot.
8. Load mtcars dataset in R and visualize data using heat map.
9. Install leaflet library in R and perform different map visualizations.
10. Visualize iris dataset using 3D graphs such as scatter3d, cloud, xyplot.
11. Make use of correlogram to visualize data in correlation matrices for iris dataset.
12. Install maps library in R and draw different map visualizations.

TEXT BOOKS:

1. R Graphics Cookbook by Winston Chang, O'Reilly Media.
   https://osctr.ouhsc.edu/sites/default/files/2020-02/rcourse/3/RGraphicsCookbook.pdf
2. Data Visualization with R by Thomas Rahlf, Springer.
   https://link.springer.com/book/10.1007/978-3-030-28444-2

REFERENCES:

1. Hadley Wickham, Danielle Navarro, and Thomas Lin Pedersen – ggplot2: Elegant Graphics for Data Analysis, Springer, 3rd Edition, 2023.
2. Paul Teetor – R Cookbook, O'Reilly Media, 2nd Edition, 2019.
3. Kieran Healy – Data Visualization: A Practical Introduction, Princeton University Press, 2018.

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester
Salesforce Developer Catalyst
(Common to All Branches)

Course Category	Skill Enhancement Course	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-1-2-2
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To be intended for an individual who has experience developing and deploying basic business logic and user interfaces.
2	Train the individuals to the next level, who have the knowledge, skills, and experience in building custom applications on the Lightning Platform.
3	To learn the fundamental programmatic capabilities of the Lightning Platform to develop custom business logic and interfaces to extend Salesforce using Apex, Visualforce, and basic Lightning Components.
4	To use the programmatic capabilities in practice with the Lightning Platform, including practical application of the skills and concepts.

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Acquire a fundamental understanding of the CRM and Salesforce tools necessary to effectively generate useful applications on the Salesforce platform to support the customer requirements.	K3
CO2	Gain experience in using the Salesforce tools and techniques of CRM to complete projects focused on obtaining actionable insights from complex data.	K3
CO3	Dive deeply into a Salesforce Developer practice to fully prepare to use knowledge gained in the course to add significant value in a professional setting.	K3

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	0	2	0	0	0	0	0	1
CO2	2	2	1	0	1	0	0	0	0	0	1
CO3	2	2	1	0	1	0	0	0	0	0	1

COURSE CONTNT :

Experiment 1
Platform Developer I Exam Overview; Apex & .NET Basics: Map .NET Concepts to the Lightning Platform, Understand Execution Context, Use Asynchronous Apex, Debug and Run Diagnostics. Formulas and Validations: Use Formula Fields, Implement Roll-Up Summary Fields, Create Validation Rules.
Data Modeling: Understand Custom & Standard Objects, Create Object Relationships, Work with Schema Builder.
Data Management: Import Data, Export Data. (Sessions- 04)

Experiment-2
Approve Records with Approval Processes: Customize How Records Get Approved, Build an Approval Process.
Record-Triggered Flows: Triggered Flows, Build a Record-Triggered Flow, Add a Scheduled Task to Your Flow, Meet Flow Trigger Explorer.
Search Solution Basics: Choose the Right Search Solution, Build Search for Common Use Cases, Optimize Search Results.
Apex Basics & Database: Get Started with Apex, Uses Objects, Manipulate Records with DML, Write SOQL Queries, Write SOSL Queries.
Apex Triggers: Get Started with Apex Triggers, Bulk Apex Triggers. (Sessions-07)

Experiment 3 :
Triggers and Order of Execution: Performing a sequence of events in an order when a record is saved with an insert, update, or upsert statement.
Asynchronous Apex: Asynchronous Processing Basics, Use Future Methods, Use Batch Apex, Control Processes with Queueable Apex, Schedule Jobs Using the Apex Scheduler, Monitor Asynchronous Apex. (Sessions-06)

Experiment 4:
Visual force & Lightning Experience: Use Visualforce in Lightning Experience, Develop Visual force Pages for Lightning Experience, Explore the Visualforce App Container, Share Visual force Pages Between Classic and Lightning Experience, Manage Navigation, Understand Important Visual Design Considerations, Know Which Features to Avoid in Lightning Experience.
Visual force Basics: Get Started with Visual force, Create & Edit Visual force Pages, Use
Simple Variables and Formulas, Use Standard Controllers, Display Records, Fields, and Tables, Input Data Using Forms, Use Standard List Controllers, Use Static Resources, Create & Use Custom Controllers. (Sessions-06)

Experiment 5:
Lightning Web Components Basics: Discover Lightning Web Components, Create Lightning Web Components, Deploy Lightning Web Component Files, Handle Events in Lightning Web Components, Add Styles and Data to a Lightning Web Component.
Secure Server-Side Development: Write Secure Apex Controllers, Mitigate SOQL Injection, Mitigate Cross-Site Request Forgery. (Sessions-04)

Experiment 6:
Developer Console Basics: Get Started with the Developer Console, Navigate and Edit
Source Code, Generate and Analyze Logs, Inspect Objects at Checkpoints, Execute SOQL and SOSL Queries.
Command-Line Interface: Learn About the Command-Line Interface, Explore Command Structure and Navigation, Set Up Command-Line Tools.
Org Development Model: Plan for Changes to Your Org, Develop and Test Changes Locally, Test and Deploy Changes. (Sessions-04)

Experiment 7:
Apex Testing: Get Started with Apex Unit Tests, Test Apex Triggers, Create Test Data for Apex Tests.
Find and Fix Bugs with Apex Replay Debugger: Launch Your Trailhead Playground, Set Up Visual Studio Code, Set Up Apex Replay Debugger, Debug Your Code.
Debug Logs: Debug Log Details, Debug Log Order of Precedence, Debug Log Levels, Searching a Debug Log, Delete Debug Logs, Debug Log Filtering for Apex. (Sessions-05)

Experiment 8:
Project with Case Study:
Apex Specialist: Concepts Tested in This Superbadge, Apex Triggers, Asynchronous Apex, Apex Integration, Apex Testing. (Sessions-12)

TEXTBOOKS:
1. Michael Wicherski, "Beginning Salesforce Developer", 2018, Wiley Apress Publisher.
2. Paul Battisson, "Learning Salesforce Development with Apex", 2020, BPB Publishers.
3. Dan Appleman, "Advanced Apex Programming in Salesforce", 2018, PACKT Publisher.
4. Paul Battisson, "Mastering Apex Programming", 2020, PACKT Publisher.

REFERENCE BOOKS:
1. Mohith Shrivastava, "Learning Salesforce Lightning Application Development: Build and test Lightning Components for Salesforce Lightning Experience using Salesforce DX", 2018, PACKT.
2. Brian Cline, "Lightning Web Components (LWC) Development on the Salesforce Platform: A Salesforce developer's guide to building, testing, and deploying Lightning Web Components", 2023, PACKT Publisher.
3. Saifullah Saifi and Ashwini Kumar Raj, "Cloud Computing Using Salesforce", 2021 BPB.

e-Resources :
1. Use the Trailhead Platform: https://www.salesforce.com/blog/what-is-trailhead/
The Salesforce Developer Trailmix:
2. https://trailhead.salesforce.com/users/trjha3/trailmixes/salesforce-developer-catalyst-v-3-0

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of CSE (Data Science)

R23

III Year II Semester

Technical Paper Writing & IPR

(Common to CSE, IT, CSE (AIML), CSE (AI), CSE (DS),CSE (CS), ECE,ME & CE)

Course Category	Audit Course	**Course Code**	
Course Type	Theory	**L-T-P-C**	2-0-0-
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	To develop the ability to write and present technical research papers.
2	To impart knowledge on IPR and its importance in innovation and research.
3	To guide students in understanding patents, copyrights, trademarks, and their application in computing and engineering.

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Identify and apply the structure and principles of technical writing to prepare clear and well-organized technical documents.	K2
CO2	**Conduct a literature survey** using academic databases and reference management tools to support research and identify gaps in existing knowledge.	K2
CO3	Draft and format technical papers suitable for submission to conferences and journals, adhering to ethical and publication standards.	K3
CO4	**Explain the fundamental concepts of Intellectual Property Rights (IPR)** including patents, copyrights, trademarks, and trade secrets, especially in the context of computing and innovation.	K2
CO5	**Analyze patentability criteria** and outline the procedure for filing a patent in India and internationally.	K4

K1-Remembering, K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	3	1	0	1	3	1	1	1	1	1
CO2	1	2	3	0	1	2	1	1	1	1	1
CO3	1	3	1	0	1	3	1	1	1	1	1
CO4	3	2	1	0	3	1	1	1	2	2	2
CO5	1	2	2	0	3	1	1	1	2	2	2

PRAGATI ENGINEERING COLLEGE

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Department of CSE (Data Science)

R23

CURSE CONTENT

UNIT 1:

Introduction to Technical Writing

Meaning and importance of technical writing in research and development Types of technical documents: journal papers, conference papers, white papers, reportsStructure of a technical paper (IMRAD format) Characteristics of effective writing: clarity, conciseness, coherence Common mistakes in technical writing Tools for writing and formatting (LaTeX, MS Word)

Practical: *Write a 300-word abstract on a chosen technical topic*

UNIT 2:

Research Methodology and Literature Survey

Research problem identification and formulation Research process and ethics Literature review: importance, sources (journals, patents, databases) Referencing styles (APA, IEEE, MLA) Use of digital tools (Google Scholar, Scopus, Mendeley, Zotero) Plagiarism: types, detection tools (Turnitin, Grammarly)

Practical: ***Conduct a literature survey and create a reference list for a chosen topic***

UNIT 3:

Manuscript Preparation and Publication

Components of a manuscript: abstract, keywords, introduction, methodology, results, discussion, conclusion, references Guidelines for authors (IEEE, Springer, Elsevier, ACM) Peer review process and revisions Journal selection and impact factor Ethics in publishing and copyright issues Predatory journals and conferences

Practical: Draft a technical paper on a mini-project done in earlier semesters

UNIT 4:

Introduction to Intellectual Property Rights (IPR)

Definition and need for IPR Categories of IPR: patents, copyrights, trademarks, trade secrets Indian and international IPR laws (WIPO, TRIPS) Role of IPR in academic and industrial R&D Case studies of IPR in computer science and software

P*ractical: Identify the IPR involved in a case study (e.g., a software product or invention)*

UNIT 5:

Patent Filing and Commercialization :

Patentability criteria: novelty, inventive step, industrial application Patent filing procedure in India and USA Provisional vs complete specification Patent databases: Espacenet, INPADOC, IP India Patent search and analysis Commercialization of IP: licensing, technology transfer, startups

Practical: *Draft a simple provisional patent specification based on a student project*

Textbooks :

1.M.A. Jayaram, *Technical Communication*, Himalaya Publishing House
2.Deborah B. Stanley, *Practical Guide to Writing Technical Reports*, OUP
3.R. Subbaram, *Handbook of Indian Patent Law and Practice*

Reference Books

1.P. Narayanan, *Intellectual Property Law*
2.WIPO & Indian Patent Office websites for updates and resources