I SEMESTER SYLLABI
COMMON FOR ALL BRANCHES

Applicable to the students admitted to

R-2021: CBCS

Academic year 2021-2022
onwards

VEL TECH HIGH TECH

Dr. RANGARAJAN Dr. SAKUNTHALA ENGINEERING COLLEGE
An Autonomous Institution
#60, Avadi – Vel Tech Road, Vel Nagar,
Avadi, Tamil Nadu 600062

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LIST OF ABBREVIATIONS

S. No.	Abbreviations	Detailed Description
1	HSMC	Humanities & Social Science including Management Courses
2	BSC	Basic Science Courses
3	ESC	Engineering Science Courses
4	PCC	Professional Core Courses
5	PEC	Professional Elective Courses
6	OEC	Open Elective Courses
7	PROJ	Project Work
8	EEC	Employability Enhancement Courses
9	MC	Mandatory Courses

Curriculum (R2021)

S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	Credits			
							L	T	P	C
SEMESTER I										
THEORY										
1	21EN11T	Communicative English	HSMC	40	60	100	3	0	0	3
2	21MA12T	Matrices and Differential Calculus	BSC	40	60	100	3	1	0	4
3	21PH13T	Engineering Physics I	BSC	40	60	100	3	0	0	3
4	21CY14T	Engineering Chemistry	BSC	40	60	100	3	0	0	3
5	21CS15IT	Problem Solving and Python Programming	ESC	40	60	100	2	0	4	4
6	21ME16T	Engineering Graphics	ESC	40	60	100	4	0	0	4
PRACTICAL										
7	21BS17P	Physics and Chemistry Laboratory	BSC	40	60	100	0	0	4	2
8	21ME18P	Engineering Practices Laboratory	ESC	40	60	100	0	0	4	2
TOTAL										**25**

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Course code	**21EN11T**	Semester		I		
Category	**HUMANITIES & SOCIAL SCIENCE INCLUDING MANAGEMENT COURSES (HSMC)**		**L**	**T**	**P**	**C**
Course Title	**COMMUNICATIVE ENGLISH (COMMON FOR ALL BRANCHES)**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To exhibit the students of Engineering and Technology to develop their listening and to recall the pattern of listening.

- To facilitate the learners to develop speaking skills to convey their ideas and views in the real context.

- To develop their reading skills and grasp the central ideas of the text.

- To expose them to acquire writing technique with basic grammar.

- To motivate the students to use appropriate vocabulary in academic and categorize the inferences in writings.

PREREQUISITE:

- Foundation of language with Basic English Grammar.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C101. 1	*Listen* to different talks and lectures and understand them easily.	K1
C101. 2	*Communicate* their thoughts confidently using communicative strategies	K2
C101. 3	*Read* and grasp different genres of texts effortlessly	K2
C101. 4	*Write* grammatically correct academic, business and technical texts	K3
C101. 5	*Apply* the appropriate vocabulary to communicate efficiently in all forms of communication.	K4

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C101. 1	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
C101. 2	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
C101. 3	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
C101. 4	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
C101. 5	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
C101. 6	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
C101	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   BASIC GRAMMAR I AND READING FOR INFORMATION   9

PRACTICAL

LISTENING: Listening to short dialogues with good accent
SPEAKING : Introducing oneself - Exchanging personal information

TUTORIAL

READING : Reading short comprehension passages- practice skimming and scanning for
                       specific information
WRITING: Parts of speech - Sentence patterns – Tenses – 'wh'- questions - Yes/No questions
                  -Countable and Uncountable nouns
VOCABULARY AND GRAMMAR: Affixation – word formation - Synonyms and
                                                       Antonyms.

UNIT II   BASIC GRAMMAR II AND SHARING INFORMATION   9

PRACTICAL

LISTENING : Listening to documentaries - inspiring speeches of great leaders and practicing
opinion sharing
SPEAKING : Self-introduction - peer introduction - picture description - JAM

TUTORIAL

READING: Note-making- Critical reading finding key information in a given text - shifting
facts from opinions and paraphrasing
WRITING: Autobiographical writing (writing about one's leisure time activities, hometown
- favourite place and school life) - Biographical writing (place, people)
VOCABULARY AND GRAMMAR: Compound Words – Guessing meaning of words contexts
- One Word substitutes – Pronouns- Adjectives – Adverbs – Imperatives - Direct and
Indirect questions.

UNIT III   BASIC GRAMMAR III AND FREE WRITING   9

PRACTICAL

LISTENING : News Bulletins - Ted talks - telephonic conversations
SPEAKING : functions of Language - giving reasons - talking about future plans - comparing
                        and contrasting - making suggestions
TUTORIAL

READING: Current Affairs - newspaper reading /magazines - loud in the classroom
WRITING: Coherence and cohesion in writing- cause and effect - compare & contrast and
narrative & analytical paragraphs.
VOCABULARY AND GRAMMAR: Discourse marker - Reference words - Process
description - Conjunctions – Prepositions - Articles - Degrees of comparison.

UNIT IV   BASIC GRAMMAR IV AND FREE WRITING   9

PRACTICAL
LISTENING : Listen to audio/ Conversation from BEC/IELTS /TOFEL.
SPEAKING : Interpersonal Skills: Role play/group discussion/debate/ conduct of meeting

TUTORIAL
READING: Reading different types of texts /genres/ for comprehension and pleasure – related with human values.
WRITING: Letter writing (informal letters) and formal letters – rejecting and accepting Letters - Personal emails and etiquette.
VOCABULARY AND GRAMMAR: Single Word substitutes - Use of abbreviations Acronyms - Cloze reading - interpreting visual materials - Jumbled sentences - Subject verb agreement - Modal verbs - Phrasal verbs.

UNIT V   BASIC GRAMMAR V AND LANGUAGE DEVELOPMENT   9

PRACTICAL
LISTENING : Listen to official meetings to know about the project proposal.
SPEAKING : Discussing the project and the proposals in the group - Creative writing and speaking - Poster making and description - project proposals.

TUTORIAL
READING: Reading comparison and contrast text with the deeper level of meaning **WRITING :** Essay writing - different types of essays - dialogue writing
VOCABULARY AND GRAMMAR: Word association (connotations) - Lexical items (fixed / semi fixed expressions) - Clause - Direct and indirect speech - Correction of errors.

Total: 45 Periods

Extensive Reading:

Kalam , Abdul. The Wings of Fire , Universities Press, Hyderabad. 19

LEARNING RESOURCES:

TEXT BOOKS:

1. Board of Editors, Department of English, Anna University, Chennai. Using English:A Course Book for Undergraduate Engineers and Technologists, Orient Black Swan: Chennai,2017.

2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Black Swan Publications, Chennai,2011.

REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma, Technical Communication: English Skills for Engineers. Oxford University Press, NewDelhi.2011.

2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006

3. Rizvi M, Ashraf. Effective Technical Communication. Tata McGraw- Hill Publishing Company Limited, New Delhi, 2007.

4. Rutherford, Andrea J. Basic Communication Skills for Technology. Pearson Edition (II Edition), NewDelhi, 2001.

5. Mandel, Steve. *Effective Presentation Skills*. New Delhi: Viva Books Pvt. Ltd., 2004.

6. Kilmet, Stephen. "The Resume and "The Computerized Resume." In Writing for Design Professionals.

7. Writing Cover Letters-Kilmet, Stephen. "Cover Letter, "and" Enclosures and Attachments." in Writing for Design Professionals New York.

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Course code	21MA12T	Semester	I			
Category	**BASIC SCIENCE COURSE (BSC)**		**L**	**T**	**P**	**C**
Course Title	**MATRICES AND DIFFERENTIAL CALCULUS (COMMON FOR ALL BRANCHES)**		**4**	**0**	**0**	**4**

COURSE OBJECTIVES:

- To apply advanced matrix knowledge to solve engineering problems

- To improve their ability in solving geometrical applications of differential calculus

- To familiarize with the application of differential equations

PREREQUISITE:

- Basic Mathematics skills at 12th level

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
At the end of the course students are able to		
C102.1	*Solve* Engineering problems using matrices.	K3
C102.2	*Use* various test to discuss the convergence of infinite series.	K2
C102.3	*Apply* the geometrical concepts to solve differential calculus.	K4
C102.4	*Compute* partial derivatives of functions of several variables.	K2
C102.5	*Apply in Engineering many physical initial* and boundary value problems can be described by ODE.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C102.1	3	3	-	-	-	-	-	-	-	-	-	-
C102.2	3	2	-	-	-	-	-	-	-	-	-	-
C102.3	3	3	-	-	-	-	-	-	-	-	-	-
C102.4	3	2	-	-	-	-	-	-	-	-	-	-
C102.5	3	2	-	-	-	-	-	-	-	-	-	-
C102	3	2	-	-	-	-	-	-	-	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   MATRICES   12

Matrix operations, special types of matrices, matrices as linear transformations, linear independence, Orthogonalization, Eigen values and Eigen vectors of a real matrix – Properties of Eigen values – Cayley – Hamilton theorem, Orthogonal reduction of a symmetric matrix to diagonal form – Orthogonal matrices – Reduction of quadratic form to canonical form by orthogonal transformations- Nature of quadratic forms.

UNIT II   INFINITE SERIES   12

Sequences of real numbers-Series-General properties of series-Comparison test- Integral test, D' Alemberts ratio test and Cauchy's root test- Power series, radius and interval of convergence of power series, Convergence of exponential, logarithmic and Binomial Series, Properties of uniformly convergence series

UNIT III   APPLICATIONS OF DIFFERENTIAL CALCULUS   12

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelops – Evolute as envelope of normals

UNIT IV   DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES   12

Limits and Continuity –Partial derivatives –Homogeneous Functions-Total derivative –Change of variables –Jacobian and properties –Taylor's series for functions of two variables –Maxima and minima of functions of two variables –Lagrange's method of undetermined multipliers.

UNIT V   ORDINARY DIFFERENTIAL EQUATIONS   12

Second and Higher Order Equations, homogeneous and non-homogeneous linear equations and linear systems with constant coefficients, method of variation of parameters, method of undetermined coefficients, Equations reducible to linear equations with constant coefficients-Simultaneous linear equations with constant coefficients.

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:
1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2015.

REFERENCES:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. Singapore, 10thEdition, 2015.
2. M.K. Venkataraman, Engineering Mathematics- First Year, 2nd Edition, National Publishing., Chennai 2001.
3. T. Veerarajan, Engineering Mathematics-I, Tata McGraw Hill Publishing Co, New Delhi, 2017.

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Course code	21PH13T	Semester		I		
Category	BASIC SCIENCE COURSE (BSC)		L	T	P	C
Course Title	ENGINEERING PHYSICS I (COMMON FOR ALL BRANCHES)		3	0	0	3

COURSE OBJECTIVES:

- To understand the importance of polarization, optical fiber and Lasers
- To familiar the knowledge of electromagnetic waves oscillations
- To understand the importance of quantum physics
- To cognize the basics of heat and thermodynamics
- To express the basics of crystal physics

PREREQUISITE:

- High School Maths and Physics

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C103.1	*Utilize* the concepts of polarization, optical fiber and Lasers for engineering applications	K3
C103.2	*Apply* the knowledge of electromagnetic waves oscillations	K3
C103.3	*Understand* the importance of quantum physics.	K2
C103.4	*Cognize* the basics of heat and thermodynamics	K2
C103.5	*Express* the basics of crystal physics	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C103.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
C103.2	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
C103.3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
C103.4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
C103.5	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
C103	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   PHOTONICS   9

Polarization and Fiber Optics: Electromagnetic waves - Production and analysis of linearly, elliptic and circularly polarized light-Polaroid and applications of polarization. Fiber optics - principle of operation – numerical aperture - acceptance angle and applications of fiber optics.

Optical Sources: Characteristics of Lasers - Spontaneous and Stimulated Emission of Radiation - Population Inversion - Einstein's Coefficients and Relation between them - Applications of Lasers.

UNIT II   WAVES AND OSCILLATION   9

Oscillatory motion: Differential equation of SHM- Velocity and acceleration- Restoring Force-Frequency response - phase response and resonance-Analogy with LCR circuits and oscillators-Energy and energy loss- Damped oscillations- Significance in control systems - vibration and vibration isolation.

Wave motion: Definition of a plane progressive wave- Attenuation of waves- Phase Velocity-Introduction to numerical methods for solution of wave equation- Importance of spherical and plane wave fronts.

UNIT III   QUANTUM MECHANICS   9

Need for Quantum Physics-Historical overviews - Matter waves - De-Broglie's concept of matter waves - Properties of matter waves - Photo electric effect - Heisenberg's uncertainty principle – Statement - Interpretation and application - Schrödinger's time dependent and time independent equations - Operators - Eigen values and Eigen functions - Expectation values -Physical significance of wave function-Quantum superposition and entanglement for Qbits (quantitatively)

UNIT IV   HEAT AND THERMODYNAMICS   9

Heat and internal energy - Specific heat and calorimetry - Latent Heat coefficient of linear thermal expansion - Methods of measurement of thermal expansion - Thermal expansion -Applications - The bimetallic strip - Differential equation of one-dimensional heat flow - Lee's disc apparatus for determination of thermal conductivity - Thermal Insulation- Heat dissipation and heat sinking of electronic devices-solid state refrigerators (qualitatively)

UNIT V   CRYSTAL PHYSICS   9

Introduction of Crystallography - Space Lattice - Unit Cell - Lattice Parameters – Crystal Systems - Bravais Lattices - Miller Indices and its applications - Crystal Planes and Directions- Inter Planar Spacing of Orthogonal Crystal Systems - Atomic Radius - Co-ordination Number and Packing Factor of SC, BCC, FCC – Crystal growth –Solution growth -Structure determination by x-ray diffraction method (cubic structure).

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Richard Wolfson, "Essential University Physics", Vols. 1 and 2. Pearson Education, Singapore, 2011.
2. Gaur R K, Gupta S L, "Engineering Physics", DhanpatRai Publications, 2013.

REFERENCES:

1. Halliday D., Resnick R. and Walker J., "Fundamentals of Physics", Wiley Publications,2008.
2. Avadhanulu M. N., "Engineering Physics", S. Chand & Co., 2007.
3. Purcell E. M., "Electricity and Magnetism – Berkeley Physics Course", Vol. 2, Tata McGraw-Hill, 2008.
4. Paul A. Tipler and Geene Mosca, "Physics for Scientists and Engineers", W.H. Freeman and Company, New York, 2004.

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Course code	**21CY14T**	**Semester**		**I**		
Category	**BASIC SCIENCE COURSE (BSC)**		**L**	**T**	**P**	**C**
Course Title	**ENGINEERING CHEMISTRY (COMMON FOR ALL BRANCHES)**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To make the students conversant with water quality parameters and treatment techniques.
- To get the basic idea about the polymers, electrochemistry and corrosion.
- To deal with the information about various types of fuels and energy sources.

PREREQUISITE:
- Basic Chemistry Skills

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
At the end of the course students are able to		
C104.1	*Understand* the water related problems and their treatment techniques.	K2
C104.2	*Explain* the applications of polymers and reinforced plastics.	K2
C104.3	*Acquire* knowledge on electrochemistry and corrosion.	K2
C104.4	*Summarize* the types of fuels and its production process and calculate the CV values.	K2
C104.5	*Classify* the non-conventional energy sources and its applications.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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	PSO-4
C104.1	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
C104.2	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
C104.3	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
C104.4	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
C104.5	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-
C104	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   WATER AND ITS TREATMENT   9

Introduction - characteristics - alkalinity - types and determination - hardness - types expression of hardness - units - estimation of hardness of water by EDTA - numerical problems -boiler feed water-requirements-boiler troubles – scale & sludge -disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) -softening of hard water - external treatment process - demineralization and zeolite, internal treatment - boiler compounds (carbonate, phosphate, Calgon, sodium aluminate and colloidal conditioning methods) – desalination of brackish water –reverse osmosis.

UNIT II   POLYMERS AND REINFORCED PLASTICS   9

Introduction - classification of polymers - Natural and synthetic - Thermoplastic and Thermosetting, Functionality - Degree of polymerization, Properties of polymers: Tg, Tacticity, Molecular weight - weight average, number average and polydispersity index. Types – addition, condensation and Copolymerization – free radical, cationic and anionic polymerization mechanism - Preparation, properties and uses of PVC, Nylon- 6,6, Teflon and Epoxy resin. Plastics - Compounding of plastics – moulding methods – injection, extrusion and compression – Engineering plastics-applications-fibre-reinforced plastics (FRP) – carbon and glass– applications.

UNIT III   ELECTROCHEMISTRY AND CORROSION   9

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential-oxidation potential-reduction potential - measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types: chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function Electroplating of Copper and electroless plating of nickel-Chemical conversion coatings-phosphate, chromate, chemical oxide, and anodized coatings.

UNIT IV   FUELS AND COMBUSTION   9

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum – refining- manufacture of synthetic petrol (Bergius process) – knocking - octane number- cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) – synthesis, advantages and commercial application of power alcohol and biodiesel. Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value –problems- ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

UNIT V   ENERGY SOURCES AND STORAGE DEVICES   9

Energy-Types- Non-renewable energy- Nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries - primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells - H_2-O_2 fuel cell.

                                                                   Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:
1. P.C. Jain and Monika Jain, Engineering Chemistry, DhanpatRai, Publishing Company (P) Ltd., New Delhi, 2015.
2. S.S Dara&S.S Umare, A Text book of Engineering Chemistry, S.Chand & Company Ltd., New Delhi, 2015.

REFERENCES:

1. S. Vairam,P. Kalyani and Suba Ramesh., Engineering Chemistry, Wiley India Pvt. Ltd, New Delhi, 2013.
2. B.K.Sharma, Engineering Chemistry, Krishna Prakasan Media (P) Ltd., Meerut, 2014.
3. Prasanta Rath, Engineering Chemistry, Cengage Learning India Pvt. Ltd, Delhi, 2015.
4. Shikha Agarwal, Engineering Chemistry-Fundamentals and Applications, Cambridge University Press, Delhi, 2015.
5. V.R.Gowariker, N.V.Viswanathan, J.Sreedhar, Polymer Science, New Age International (P) Ltd., Publishers, New Delhi, 2011.

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Course code	**21CS15IT**	Semester		I		
Category	**ENGINEERING SCIENCE COURSE (ESC)**		**L**	**T**	**P**	**C**
Course Title	**PROBLEM SOLVING AND PYTHON PROGRAMMING (COMMON FOR ALL BRANCHES)**		**2**	**0**	**4**	**4**

COURSE OBJECTIVES:

- To be familiar with the basics of algorithmic problem solving.

- To construct python programs with conditionals, loops and functions.

- To use python data structures-Lists, Tuples and Dictionaries.

PREREQUISITE:

- Basic Mathematics Skills and Computer Knowledge

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
At the end of the course students will be able to		
C105. 1	***Develop*** algorithmic solutions to simple computational problems	K3
C105. 2	***Construct*** simple Python programs for solving problems.	K3
C105. 3	***Build*** Python programs with conditionals and loops.	K3
C105. 4	***Demonstrate*** a Python program into functions.	K2
C105. 5	***Show*** compound data using Python lists, tuples, and dictionaries.	K2
C105. 6	***Read*** and write data from/to files in Python Programs.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C105. 1	3	2	1	-	-	-	-	-	-	-	-	-	2	2
C105. 2	3	2	1	-	-	-	-	-	-	-	-	-	2	2
C105. 3	3	2	1	-	-	-	-	-	-	-	-	-	2	2
C105. 4	3	2	1	-	-	-	-	-	-	-	-	-	2	2
C105. 5	3	2	1	-	-	-	-	-	-	-	-	-	2	2
C105. 6	3	2	1	-	-	-	-	-	-	-	-	-	2	2
C105	3	2	1	-	-	-	-	-	-	-	-	-	2	2

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS	No. of Credits: 4

UNIT- I ALGORITHMIC PROBLEM SOLVING AND BASICS OF PYTHON 8

Algorithms-building blocks of algorithms (statements, state, control flow, functions), simple Strategies for developing algorithms (iteration, recursion)-pseudo code- flow chart-programming language. Introduction to Python-Features of Python-Python Interpreter: Interactive and script mode- Values and types, variables, Keywords, Identifiers, operators, precedence of operators, expression, Comments.

UNIT-II CONTROL FLOW, FUNCTIONS 8

Conditional statements-Iterative statements, Functions: Built-in functions, user defined function-Function Arguments-Fruitful functions and void functions- local and global variable - function composition- recursion-Lambda Functions.

UNIT-III MODULES, PACKAGES, STRINGS 4

Modules-Packages-Strings-string operations, string functions and methods.

UNIT-IV LISTS, TUPLES, DICTIONARIES 5

Lists- list operations, list methods, list loop, mutability, aliasing, cloning lists-Tuples-Tuple assignment, Operations on Tuples, Tuple as return value- Dictionaries- operations and methods-Sets-Operations on sets.

UNIT-V FILES AND EXCEPTIONS 5

Files –Types of files, file operations, file methods, format operator-command line arguments-Errors and Exceptions, handling exceptions.

List of Experiments: 30 Periods

1. Write a python program to demonstrate basic data types in python.
2. Write a python program using conditional statements.
3. Write a python program using Iterative statements.
4. Write a python program using built-in and user defined functions.
5. Write a python program using lambda functions and recursions.
6. Write a python program to demonstrate Strings and its Operations.
7. Write a python program to demonstrate lists, tuples and its operations.
8. Write a python program to demonstrate Sets and its operations.
9. Write a python program to demonstrate Dictionaries and its operations.
10. Write a python program to demonstrate Files and its Operations.

30 Periods

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Reema Thareja, "Python Programming using Problem Solving Approach", OXFORD University Press, 2017.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.

REFERENCES:

1. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 2018.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd, 2016.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.

Sl. No.	Description of Equipment	Required numbers (For batch of 30 students)
1	Standalone desktops with Python [Open Source]	30 Nos

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Course code	21ME16T	Semester		I		
Category	**ENGINEERING SCIENCE COURSE (ESC)**		**L**	**T**	**P**	**C**
Course Title	**ENGINEERING GRAPHICS (COMMON FOR ALL BRANCHES)**		**1**	**3**	**0**	**4**

COURSE OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

PREREQUISITE:

- Engineering Drawing Skills

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
At the end of the course students are able to		
C106.1	***Familiarize*** with the fundamentals and standards of Engineering graphics.	K2
C106.2	***Develop*** freehand sketching of basic geometrical constructions and multiple views of objects.	K3
C106.3	***Draw*** orthographic projection of lines and plane surfaces.	K3
C106.4	***Construct*** projection of solids, Section and development of surfaces.	K3
C106.5	***Visualize*** isometric and perspective projections	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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	PSO-4
C106. 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C106. 2	3	3	-	-	-	-	-	-	-	-	-	1	1	-	-	-
C106. 3	3	3	2	-	-	1	-	1	-	1	-	1	1	-	-	-
C106. 4	3	3	2	-	-	1	-	1	-	1	-	1	1	-	-	-
C106. 5	3	3	2	-	-	1	-	1	-	1	-	1	1	-	-	-
C106	3	3	2	-	-	1	-	1	-	1	-	1	1	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS	**No. of Credits: 4**

CONCEPTS AND CONVENTIONS (Not for Examination)   **1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I   PLANE CURVES AND FREEHAND SKETCHING   7+12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square, Triangle and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views– Freehand sketching of multiple views from pictorial views of objects.

UNIT II   PROJECTION OF POINTS, LINES AND PLANE SURFACE   6+12

Orthographic projection– principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method. Applications – Drawing interpretation and process planning, circuit design.

UNIT III   PROJECTION OF SOLIDS   5+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method, auxiliary plane method. Applications – Engineering design, automotive modelling, X-rays.

UNIT IV   PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
**   5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Applications – Design of piping, Fabrication, body building, defect analysis.

UNIT V   ISOMETRIC AND PERSPECTIVE PROJECTIONS   6 + 12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones– combination of two solid objects in simple vertical positions – Perspective projection of simple solids–Prisms, pyramids and cylinders by visual ray method and vanishing point method. Applications–constructions, photography, animation and image processing.

Total: 90 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2010.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 51th Edition, 2019.

REFERENCES:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited,2015.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 3rd Edition, 2013.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to Semester End Examination on Engineering Graphics:

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. Students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

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Course code	21BS17P	Semester		I		
Category	**BASIC SCIENCE COURSE (BSC)**		**L**	**T**	**P**	**C**
Course Title	**PHYSICS AND CHEMISTRY LABORATORY (COMMON FOR ALL BRANCHES)**		**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

- To test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To encourage the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

PREREQUISITE:

- Basic measurement skills

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C107.1	*Estimate* the various water quality parameters like alkalinity, hardness (total, temporary, & permanent), dissolved oxygen content, and chloride content.	K2
C107.2	*Investigate* the metals and ions present in any given sample using various analytical techniques.	K2
C107.3	*Analyze* the properties such as conductance of solutions, and redox potentials.	K2
C107.4	*Determine* various moduli of elasticity and also various thermal and optical properties of materials.	K2
C107.5	*Determine* the velocity of ultrasonic waves, band gap determination and viscosity of liquids.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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	PSO-4
C107.1	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
C107.2	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
C107.3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
C107.4	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
C107.5	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
C107	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

PHYSICS LABORATORY
LIST OF EXPERIMENTS
(Any SIX Experiments)

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young's modulus
3. Lee's disc Determination of thermal conductivity of a bad conductor
4. Laser- Determination of the wave length of the laser using grating, Estimation of laser parameters
5. Optical fibre -Determination of Numerical Aperture and acceptance angle
6. Ultrasonic interferometer - determination of the velocity of sound and compressibility of Liquids
7. Determination of Band gap of a semiconductor
8. Spectrometer- Determination of wavelength using gating

Total: 30 Periods

REFERENCES:

1. Physics Practicals, Department of Physics, Vel Tech High Tech Dr.Rangarajan Dr.Sakunthala Engineering College 2021

2. Wilson J.D. and Hernandez C.A., "Physics Laboratory Experiments", Houghton Mifflin Company, New York 2005

Lab Requirements

Sl. No.	Description of Equipment	Required numbers (For batch of 30 students)
1.	Torsional Pendulum, stop clock, suspension metallic wire: two different thickness, two identical cylindrical mass, screw gauge, wooden scale	5
2.	Uniform bending: 1-meter wooden scale, two-knife edges, travelling microscope, two weight hanger with slotted weights, screw gauge, Vernier calliper, pin	5
3.	Non-uniform bending: 1 meter wooden scale, two-knife edges, travelling microscope, weight hanger with slotted weights, screw gauge, Vernier calliper, pin	5
4.	Diode laser (green or red), fiber optic cable, movable arrangement with a screen for measuring spot size (zig), meter scale, stand	5
5.	He-Ne/Diode laser (red), Green diode laser, Grating, Screen, Iron stand (3 Nos), 1m wooden scale, thread.	5
6.	Ultrasonic interferometer apparatus with high frequency wave generator, cell, micrometer, PZ crystal, water or other liquids	5
7.	450 inclined glass plate set-up, two optically plane glass plates, sodium vapour lamp, travelling microscope, thin wire/thin strip of paper	5
8.	Post office box, 5V power supply, thermometer, galvanometer, semiconductor (thermistor), variable temperature bath set-up (oil, temperature controller, vessel, hot plate.	5

CHEMISTRY LABORATORY
LIST OF EXPERIMENTS
(Any SIX Experiments)

1. Determination of permanent, total and temporary hardness of water sample.
2. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
3. Determination of DO Content of water sample by Wrinkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Determination of strength of given HCl using pH meter.
6. Estimation of Fe^{2+} by Potentiometric titration.
7. Determination of molecular weight of PVA using Ostwald viscometer.
8. Estimation of Iron content in water sample using spectrophotometer (1,10 – Phenanthroline/thiocyanate method).
9. Conductometric titrations of strong acid Vs strong base.
10. Determination of strength of acid in a mixture using conductivity meter.
11. Corrosion experiment-weight loss method.
12. Estimation of sodium and potassium present in water using flame photometer.

Total: 30 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
2. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.
3. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook ofpractical organic chemistry", LBS Singapore (1994).

Lab Requirements

Sl. No.	Description of Equipment	Required numbers (For batch of 30 students)
1.	PH meter	10 nos
2.	Conductivity meter	10 nos
3.	Potentiometer	10 nos
4.	Flame photometer	2 nos
5.	Electronic Balance (Four digit)	1 no
6.	Hot Air Oven	1 no
7.	Spectrophotometer	2 nos
8.	Magnetic stirrer	2 nos

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Course code	**21ME18P**	**Semester**		**I**		
Category	**ENGINEERING SCIENCE COURSE (ESC)**		**L**	**T**	**P**	**C**
Course Title	**ENGINEERING PRACTICES LABORATORY (COMMON FOR ALL BRANCHES)**		**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering

PREREQUISITE:

- Basic knowledge of engineering skills

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
At the end of the course students will be able to		
C108. 1	Demonstrate on Smithy operations, Foundry operations models and machine assembly practice of centrifugal pump and air-conditioner	K2
C108. 2	Experiment with pipe connections and plumbing works	K3
C108. 3	Make use of welding equipment to join the structures.	K3
C108. 4	Explain carpentry components, for the joint used in roofs, doors, windows and furniture.	K5
C108. 5	Develop sheet metal models, fitting models and do basic machining operations	K6

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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	PSO-4
C108. 1	3	-	-	-	-	2	2	-	2	1	1	2	-	-	-	-
C108. 2	3	-	-	-	-	2	2	-	2	1	1	2	-	-	-	-
C108. 3	3	-	-	-	-	2	2	-	2	1	1	2	-	-	-	-
C108. 4	3	-	-	-	-	2	2	-	2	1	1	2	-	-	-	-
C108. 5	3	-	-	-	-	2	2	-	2	1	1	2	-	-	-	-
C108	3	-	-	-	-	2	2	-	2	1	1	2	-	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

I   CIVIL ENGINEERING PRACTICE   12

Buildings:

   a) Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects.

Plumbing Works:

   a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers and elbows in household fittings.

   b) Study of pipe connections requirements for pumps and turbines.

   c) Preparation of plumbing line sketches for water supply and sewage works.

   d) Hands-on-exercise:

   Basic pipe connections-Mixed pipe material connection-Pipe connections with different joining components

   e) Demonstration of plumbing requirements of high-rise buildings

Carpentry using Power Tools only:

   a) Study of the joints in roofs, doors, windows and furniture.

   b) Hands-on-exercise:

   Wood work, joints by sawing, Planning and cutting.

II   MECHANICAL ENGINEERING PRACTICE   18

Welding:

   a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.

   b) Gas welding practice

Basic Machining:

   a) Simple Turning and Taper turning

   b) Drilling Practice

Sheet Metal Work:

   a) Forming & Bending:

   b) Model making – Trays and funnels.

   c) Different type of joints.

Machine assembly practice:

   a) Study of centrifugal pump

   b) Study of air conditioner

Demonstration on:

   a) Smithy operations, upsetting, swaging, setting down and bending. Example –Exercise – Production of hexagonal headed bolt.

   b) Foundry operations like mould preparation for gear and step cone pulley.

   c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

Total: 30 Periods

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE   14

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.

2. Fluorescent lamp wiring.

3. Stair case wiring

4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

5. Measurement of energy using single phase energy meter.

6. Measurement of resistance to earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE   16

1. Study of Electronic components and equipments – Resistor, colour coding

measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.

2. Study of logic gates AND, OR, EX-OR and NOT.

3. Generation of Clock Signal.

4. Soldering practice – Components Devices and Circuits – Using general purpose

PCB.

5. Measurement of ripple factor of HWR and FWR.

Total: 30 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Chapman, W.A.J. Workshop Technology, Edward Arnold, 2001.

REFERENCES:

1. Raghuwanshi B.S., Workshop Technology Vol. I & II, DhanpathRai & Sons.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2 Edn, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.
4. JeyapoovanT. and Pranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Required Numbers (for batch of 30 students)
Part I: Civil Engineering Practices		
(a)	**Plumbing Work:**	
1)	Pipe Vice	15 Nos.
2)	Die Holder with Die set	15 Nos.
(b)	**Wood Work**	
1)	Tri Square	15 Nos.
2)	Hand Saw	15 Nos.
3)	Carpentry bench wise	15 Nos.
4)	Firmer Chisel	15 Nos.
5)	Motrin Chisel	15 Nos.
6)	Iron Jack	15 Nos.
7)	Mallet	15 Nos.
8)	Bench hold fastens	15 Nos.
9)	Wooden Bench Hook	15 Nos.
10)	Wood Cutting Machine	2 Nos.
Part II: Mechanical Engineering Practices		
(a)	**Welding Work:**	
1)	Arc welding unit	5 Nos.
2)	Gas welding unit	2 Nos.
(b)	**Basic Machining Work:**	
1)	Lathe Machines	5 Nos.
2)	Drilling Machines	5 Nos.
(c)	**Assembly Work:**	
1)	Centrifugal pump	2 Nos.
2)	Air-conditioner unit	2 Nos.
3)	Household mixer	2 Nos.
(d)	**Sheet Metal Work:**	
1)	Steel rule	2 Nos.
2)	Bend snips	5 Nos.
3)	Straight snips	5 Nos.
4)	Scriber	5 Nos.
5)	Divider	5 Nos.
6)	Trammel	5 Nos.
7)	Prick Punches	5 Nos.
8)	Centre punches	5 Nos.
9)	Pliers	5 Nos.
10)	Ball pean hammer	5 Nos.
11)	Raising hammer	5 Nos.
12)	Riverting hammer	5 Nos.
13)	Square free hammer	5 Nos.
14)	Anvil	3 Nos.
15)	Swage block	3 Nos.
16)	Wige gauges	2 Nos.
(e)	**Foundry Work**	
1)	Cope and Drag Box	5 Nos.
2)	Pattern	5 Nos.
3)	Solid pattern	5 Nos.
4)	Split pattern	5 Nos.
5)	Runner	5 Nos.

6)	Riser	5 Nos.
7)	Sprue	5 Nos.
8)	Sand reamer	5 Nos.
9)	Trowel	5 Nos.
PART-III Electrical Practices		
1)	Assorted electrical components for house wiring	15 sets
2)	Electrical measuring instruments	10 sets
3)	Study purpose items: Iron box, fan and regulator, emergency lamp	One each
4)	Megger (250V/500V)	1 No.
5)	Power Tools: (a) Range Finder (b) Digital Live-wire detector	2 Nos 2 Nos
PART-IV Electronics Practices		
1)	Soldering guns	10 No.
2)	Assorted electronic components for making circuits	50 No.
3)	Small PCBs	10 No.
4)	Multi Meters	10 No.
5)	Study purpose items: Telephone, FM radio, low-voltage power supply	2 each

CURRICULUM AND
II SEMESTER SYLLABI

Applicable to the students admitted to

B.TECH -ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

R-2021: CBCS

Academic year 2021-2022
onwards

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R-2021: CBCS CURRICULA

II SEMESTER SYLLABI

LIST OF ABBREVIATIONS

S. No.	Abbreviations	Detailed Description
1	**HSMC**	Humanities & Social Science including Management Courses
2	**BSC**	Basic Science Courses
3	**ESC**	Engineering Science Courses
4	**PCC**	Professional Core Courses
5	**PEC**	Professional Elective Courses
6	**OEC**	Open Elective Courses
7	**PROJ**	Project Work
8	**EEC**	Employability Enhancement Courses
9	**MC**	Mandatory Courses

Category Based Credit Split-Up – Semester Wise

Semester	HSMC	BSC	ESC	PCC	PEC	OEC	Project /EEC	MC	Total Credit
1	3	12	10	-	-	-	-	-	**25**
2	3	7	5	9	-	-	-	-	**24**
3	-	4	-	17	-	-	0	0	**21**
4	-	4	5	12	-	-	1	0	**22**
5	-	-	-	19	-	3	1	-	**23**
6	-	-	-	17	3	-	1	-	**21**
7	-	-	-	8	6	3	2	-	**19**
8	-	-	-	-	6	-	6	-	**12**
Total Credits	**6 (3.5%)**	**27 (16.2%)**	**20 (1.1%)**	**82 (49.1%)**	**15 (9.0%)**	**6 (3.5%)**	**11 (6.6%)**	**0 (0 %)**	**167**

B.Tech. – Artificial Intelligence and Data Science Curriculum (R2021)

		SEMESTER I								
S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	Credits			
							L	T	P	C
THEORY										
1	21EN11T	Communicative English	HSMC	40	60	100	3	0	0	3
2	21MA12T	Matrices and Differential Calculus	BSC	40	60	100	3	1	0	4
3	21PH13T	Engineering Physics I	BSC	40	60	100	3	0	0	3
4	21CY14T	Engineering Chemistry	BSC	40	60	100	3	0	0	3
5	21CS15IT	Problem Solving and Python Programming	ESC	40	60	100	2	0	4	4
6	21ME16T	Engineering Graphics	ESC	40	60	100	4	0	0	4
PRACTICAL										
7	21BS17P	Physics and Chemistry Laboratory	BSC	40	60	100	0	0	4	2
8	21ME18P	Engineering Practices Laboratory	ESC	40	60	100	0	0	4	2
TOTAL										25

		SEMESTER II								
S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	Credits			
							L	T	P	C
THEORY										
1	21EN21T	Technical English	HSMC	40	60	100	3	0	0	3
2	21MA22T	Vector Calculus and Complex Integration	BSC	40	60	100	3	1	0	4
3	21PH23T	Engineering Physics II	BSC	40	60	100	3	0	0	3
4	21EE24T	Basic Electrical, Electronics and Instrumentation Engineering	ESC	40	60	100	3	0	0	3
5	21CS25T	Data Structures	PCC	40	60	100	3	0	0	3
6	21AI26IT	C Programming	PCC	40	60	100	2	0	4	4
PRACTICAL										
7	21CS27P	Data Structures Laboratory	PCC	40	60	100	0	0	4	2
8	21EE28P	Basic Electrical and Electronics Engineering Laboratory	ESC	40	60	100	0	0	4	2
TOTAL										24

SEMESTER III

S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	L	T	P	C
THEORY										
1	21AI31T	Introduction to Artificial Intelligence	PCC	40	60	100	3	0	0	3
2	21AI32T	Programming with Java	PCC	40	60	100	3	0	0	3
3	21MA33T	Linear Algebra for Data science	BSC	40	60	100	3	1	0	4
4	21HC34T	Database Management Systems	PCC	40	60	100	3	0	0	3
5	21AI35IT	Data Science for Engineers	PCC	40	60	100	2	0	4	4
6	21MC01T	Constitution of India	MC	40	60	100	2	0	0	0
PRACTICAL										
7	21AI37P	Java Programming Laboratory	PCC	40	60	100	0	0	4	2
8	21HC39P	Database Management Systems Laboratory	PCC	40	60	100	0	0	4	2
TOTAL										**21**

SEMESTER IV

S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	L	T	P	C
THEORY										
1	21AI41T	Data Engineering	PCC	40	60	100	3	0	0	3
2	21AI42IT	Machine Learning Techniques	PCC	40	60	100	2	0	4	4
3	21MA43T	Statistics for Data Science	BSC	40	60	100	3	1	0	4
4	21HC44T	Operating Systems	PCC	40	60	100	3	0	0	3
5	21HE32T	Digital Logic Circuits	ESC	40	60	100	3	0	0	3
6	21MC02T	Environmental Sciences	MC	40	60	100	2	0	0	0
PRACTICAL										
7	21HC47P	Operating Systems Laboratory	PCC	40	60	100	0	0	4	2
8	21HE38P	Digital Logic Circuits Laboratory	ESC	40	60	100	0	0	4	2
9	21EE04P	Internship	EEC	100	-	100	0	0	0	1
TOTAL										**22**

4

		SEMESTER V								
S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	L	T	P	C
THEORY										
1	21AI51T	Programming Languages for AI	PCC	40	60	100	3	0	0	3
2	21HC52T	Data Analytics	PCC	40	60	100	3	0	0	3
3	21HI53IT	Web Technology	PCC	40	60	100	2	0	4	4
4	21HC54T	Block Chain Technology	PCC	40	60	100	3	0	0	3
5	21AI55T	Knowledge Engineering	PCC	40	60	100	3	0	0	3
6	-	Open Elective - 1	OEC	40	60	100	3	0	0	3
PRACTICAL										
7	21HC57P	Data Analytics Laboratory	PCC	40	60	100	0	0	4	2
8	21EE01P	Mini Project - 1	EEC	40	60	100	0	0	2	1
9	21EE03P	Technical Seminar	EEC	-	100	100	0	0	2	1
		TOTAL								**23**

		SEMESTER VI								
S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	L	T	P	C
THEORY										
1	21AI61T	Cloud Computing	PCC	40	60	100	3	0	0	3
2	21AI62T	Internet of Things	PCC	40	60	100	3	0	0	3
3	21AI63T	Swarm Intelligence	PCC	40	60	100	3	0	0	3
4	21AI65IT	Data Analysis and Visualization	PCC	40	60	100	2	0	4	4
5	-	Professional Elective - I	PEC	40	60	100	3	0	0	3
PRACTICAL										
6	21AI67P	IoT Lab	PCC	40	60	100	0	0	4	2
7	21AI68P	Cloud Computing Lab	PCC	40	60	100	0	0	4	2
8	21AI69P	Mini Project - 2	EEC	40	60	100	0	0	2	1
		TOTAL								**21**

SEMESTER VII

S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	L	T	P	C
THEORY										
1	21AI71T	Deep Learning Techniques	PCC	40	60	100	3	0	0	3
2	21AI72T	Data Warehousing and Mining	PCC	40	60	100	3	0	0	3
3	-	Professional Elective - II	PEC	40	60	100	3	0	0	3
4	-	Professional Elective - III	PEC	40	60	100	3	0	0	3
5	-	Open Elective - II	OEC	40	60	100	3	0	0	3
PRACTICAL										
6	21AI76P	Deep Learning and Data Mining Laboratory	PCC	40	60	100	0	0	4	2
7	21AI77P	Project Phase - 1	PROJ	40	60	100	0	0	4	2
TOTAL										**19**

SEMESTER VIII

S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	L	T	P	C
THEORY										
1	-	Professional Elective V	PEC	40	60	100	3	0	0	3
2	-	Professional Elective VI	PEC	40	60	100	3	0	0	3
PRACTICAL										
3	21AI83P	Project Work – Phase II	PROJ	40	60	100	0	0	12	6
TOTAL										**12**

List of Professional Elective Courses

S. No.	Course Code	Engineering Stream Courses
PROFESSIONAL ELECTIVE I		
1	21AI651PT	Advanced Python Programming
2	21AI652PT	Scalable system for Data science
3	21AI653PT	Research Methodology
4	21AI654PT	Security for Data Science
5	21AI655PT	Advanced Topics on Database
PROFESSIONAL ELECTIVE II		
6	21AI731PT	Information Retrieval Technique
7	21AI732PT	Modeling and Simulation
8	21AI733PT	Cognitive Science
9	21AI734PT	Numerical Optimization
10	21AI735PT	Medical Imaging
PROFESSIONAL ELECTIVE III		
11	21AI741PT	Agile Methodologies
12	21AI742PT	Game Programming
13	21AI743PT	Multidisciplinary Sensors
14	21AI744PT	Virtual Reality and Augmented Reality
15	21AI745PT	Cyber Security & Ethical Hacking
Science and Management Stream Courses		
16	21AI7701	Distributed system Technologies
17	21AI7702	Mining with Massive Database
18	21AI7703	Reinforcement Learning
19	21AI7704	Data Driven Decision Making
20	21AI7705	Business Intelligence
21	21AI7801	Large Scale Visual Data Analytics
22	21AI7802	Autonomous system and Drones
23	21AI7803	Spatio-temporal Data Analysis
24	21AI7804	Geospatial Data Analysis
25	21AI7805	Quantum Artificial Intelligence
26	21AI7901	Video Analytics
27	21AI7902	Principles of Software Engineering
28	21AI7903	Neural Networks
29	21AI7904	Computer Architecture and Organization
30	21AI7905	Computer Networks

LIST OF OPEN ELECTIVES

S. No	COURSE CODE	NAME OF THE COURSE
1	21AI651PT	Advanced Python Programming
2	21AI31T	Introduction to Artificial Intelligence
3	21AI03OT	Machine Learning Techniques for Engineers
4	21AI04OT	Data Science

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Course code	**21EN21T**	Semester			II	
Category	**HUMANITIES & SOCIAL SCIENCE INCLUDING MANAGEMENT COURSES (HSMC)**		**L**	**T**	**P**	**C**
Course Title	**TECHNICAL ENGLISH** **(Common for all Branches)**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:
- To make the students of engineering and technology to enhance their ability on reading and comprehencing the different texts
- To improve their creative and critical thinking so as to use in demanding contexts
- To equip the learners with the skills of writing convincing job Applications and effective reports
- To develop their speaking skills to make technical presentations and participate in group discussions
- To facilitate them to hone their soft skills

PREREQUISITE:
- Technical writing and basic English grammar.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C201. 1	*Read* and understand general and technical texts	K2
C201. 2	*Apply* creative and critical thinking and communicate their ideas efficiently	K2
C201. 3	*Participate* in group discussions and deliver short speeches effectively	K3
C201. 4	*Write* effectively and persuasively in academic and workplace contexts	K3
C201. 5	*Experiment with* the future challenges confidently and successfully	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C201. 1	-	-	-	-	-	-	-	-	1	3	-	2	-	-	-
C201. 2	-	-	-	-	-	-	-	-	1	3	-	2	-	-	-
C201. 3	-	-	-	-	-	-	-	-	1	3	-	2	-	-	-
C201. 4	-	-	-	-	-	-	-	-	1	3	-	2	-	-	-
C201. 5	-	-	-	-	-	-	-	-	1	3	-	2	-	-	-
C201	-	-	-	-	-	-	-	-	1	3	-	2	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT-I   TECHNICALWRITING AND VISUAL CONVERSION   9
PRACTICAL
LISTENING : Listening to pronunciation of longer words.
SPEAKING   : Making out meaning of pictorial and graphical representations.
TUTORIAL
READING   : Understanding logic and sequencing in reading inferring the exact meaning of
                text
WRITING   : Extended Definition- Writing Instructions, Checklists & Recommendations-
                Reading short technical text from Journal.
VOCABULARY: Technical vocabulary- Regular and Irregular verbs.

UNIT- II   TECHNICAL WRITING AND GUIDELINES PREPARATION   9
PRACTICAL
LISTENING : Comprehensive listening - Listening to telephonic conversations – short and
                long conversations from different domains, listening to various pre-recorded
                conversations and speeches.
SPEAKING   : Delivering short speeches in the class.
TUTORIAL
READING   : Technical reading on innovations and innovators.
WRITING   : Conditional clauses, Numerical adjectives, Process Description
VOCABULARY: Collocation, Verbal Analogies.

UNIT-III   TECHNICAL PROCESS WRITING   9
PRACTICAL
LISTENING   : Listening to documentaries and making notes.
SPEAKING   : Basic speaking practice based on BEC, IELTs, and TOFEL.
TUTORIAL
READING   : longer text both general and technical –practice in speed reading
WRITING   : Purpose statements, words are used as nouns and verbs- describing a process –
                use of sequence word - Interpretation of Graphs and Charts.
VOCABULARY: Sequence words –Misspelled words -Embedded sentences.

UNIT- IV   TECHNICAL WRITING AND BUSINESS LETTERS   9
PRACTICAL
LISTENING   : listening to native accents.
SPEAKING   : Group Discussions - Process, Skills, Guidelines, Evaluation, Oral Presentation
                - Planning, Preparing, Organizing and Presenting.
TUTORIAL
READING   : Reading for detailed comprehension.
WRITING : Cause and effect, impersonal passive voice, idioms and phrases, - Letter writing, job
                application, business correspondence (letters) – calling for quotations, placing
                order, complaint letters, preparing a memo, notice and e-mail itinerary.

VOCABULARY: clauses and If conditionals.

UNIT-V   TECHNICAL WRITING AND REPORT WRITING   9

PRACTICAL
LISTENING   : TED /ink talks
SPEAKING   : Starting a Career — vision statement, preparing logo and tagline, making short
                  term and long-term goals, setting plans.
TUTORIAL
READING   : Reading and understanding technical articles.
WRITING   : Degrees of comparison, editing, Email etiquette, Mispronounced words –
                  Report writing survey, feasibility, industrial visit, reporting various incidents
                  and accidents, Minutes of meeting.
VOCABULARY: Reported speech.

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Department of English, Anna University, Chennai. Mindscapes: English for Technologists and Engineers. Orient Black Swan, Chennai.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Black Swan Publications, Chennai, 2011.

REFERENCE BOOKS:

1. Rizvi, M. Ashraf, "Effective Technical Communication", Tata McGraw— Hill,2006.
2. Ibbotson, Mark, "Cambridge English for Engineering", Cambridge University Reference Press, 2008
3. Richard Johnson-Sheehan, "Technical Communication Today"4th EditionBooks Longman Publishing Group, 2011.
4. Richard Johnson-Sheehan, "Technical Communication Today"4th EditionBooks Longman Publishing Group, 2011
5. Porter, Patricia A., and Margaret Grant, "Communicating Effectively in English: Oral Communication for Non-Native Speakers", 2nd Edition, Wadsworth, 1992.
6. Gopalaswamy, Ramesh & Ramesh Mahadevan. ACE of Soft Skills: Attitude, Communication and Etiquette for Success, New Delhi: Pearson, 2010.

Extensive Reading:

Wells, H G. The Time Machine, Peacock, India, 2008.

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Course code	**21MA22T**	Semester		**II**		
Category	**BASIC SCIENCE COURSE (BSC)**		**L**	**T**	**P**	**C**
Course Title	**VECTOR CALCULUS AND COMPLEX INTEGRATION (Common for all Branches)**		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

- To improve their ability in vector calculus
- To expose to the ideas of analytic functions
- To solve differential equation using the concept of Laplace Transform.

PREREQUISITE:

- Mathematics skills at Sem-I level

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C202.1	*Apply* the vector calculus concepts to solve engineering problems.	K3
C202.2	*Apply* the concept of mapping to solve Linear equation.	K3
C202.3	*Apply* the complex integration problem ideas to solve engineering problems.	K3
C202.4	*Understand* the concepts of multiple integrals.	K2
C202.5	*Apply* the concepts of Laplace transformation to solve Differential Equations.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C202.1	3	2	-	-	-	-	-	-	-	-	-	-
C202.2	3	2	-	-	-	-	-	-	-	-	-	-
C202.3	3	2	-	-	-	-	-	-	-	-	-	-
C202.4	2	2	-	-	-	-	-	-	-	-	-	-
C202.5	3	2	-	-	-	-	-	-	-	-	-	-
C202	3	2	-	-	-	-	-	-	-	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   VECTOR CALCULUS   12

Gradient, divergence, curl – Solenoidal and irrotational fields – Vector identities– Directional derivatives – Line, surface and volume integrals –Green's, Gauss divergence and Stoke's theorems (without proof) .

UNIT II   ANALYTIC FUNCTIONS   12

Limit of a complex functions-Derivative of f(z)-Definition of Analytic Function – Cauchy Riemann equations – Properties of analytic functions - Determination of harmonic conjugate – Milne-Thomson's method – Conformal mappings: 1/z, az , az+b and bilinear transformation.

UNIT III   COMPLEX INTEGRATION   12

Line integral – Cauchy's integral theorem (statements only) – Cauchy's integral formulae and its applications – Taylor's and Laurent's expansions (statements only) – Singularities – Poles and Residues – Cauchy's residue theorem (statement only) – Contour integration – Unit circle and semicircular contour.

UNIT IV   MULTIPLE INTEGRALS   12

Double integration in Cartesian and polar coordinates – Change of order of integration – Area as double integral – Triple integration in Cartesian coordinates – Conversion from Cartesian to polar – Volume as a double and Triple Integral.

UNIT V   LAPLACE TRANSFORMS   12

Definition-Conditions for existence- Transforms of elementary functions – Properties of Laplace Transform-Transforms of periodic functions – Transforms of derivatives and integrals– Inverse transforms – Convolution theorem– Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only- Unit step function and Unit impulse function [simple problems only]

                                       Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. B. S. Grewal, Higher **Engineering Mathematics**, Khanna Publishers, New Delhi, 42nd Edition, 2012.

REFERENCES:

1. E. Kreyszig, **Advanced Engineering Mathematics**, John Wiley & Sons. Singapore, 10[th]Edition, 2012.
2. M.K. Venkataraman, Engineering **Mathematics: Vol I and II**, National Publishing., Chennai 2001.
3. T. Veerarajan, **Engineering Mathematics**, Tata McGraw Hill Publishing Co, New Delhi, 2004.

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Course code	**21PH23T**	Semester		**II**		
Category	**BASIC SCIENCE COURSE (BSC)**		**L**	**T**	**P**	**C**
Course Title	**ENGINEERING PHYSICS II** **Common for** **(CSE, IT, ECE, CHEMICAL, CIVIL, AI&DS, CSE(AI&ML)**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To equip the students with the knowledge of carrier concentration and doping in semiconductors.
- To familiarize the basics of Magnetic and Superconducting materials.
- To empower the students in understanding the importance of fluid properties.
- To elucidate the physics and instrumentation of spectrometry

PREREQUISITE:

- High School Maths and Physics

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C203.1	*Understand* basics of electronic states and energy band structure formation	K2
C203.2	*Understand* the importance of carrier concentration and doping in semiconductors	K2
C203.3	*Understand* physics of magnetic and superconducting materials.	K2
C203.4	*Understand the* importance of fluid properties.	K2
C203.5	*Understand* the physics of spectrometry and its instrumentation.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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	PSO-4
C203.1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C203.2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C203.3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C203.4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C203.5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C203	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   SOLID STATE ELECTRONICS   9

Band theory of solids - Classification of solids on the basis of band theory - Classical free electron theory - expression for electrical conductivity - thermal conductivity - Wiedemann-Franz law - electrons in metals - Fermi-Dirac probability function - Position of Fermi level Temperature variation of carrier concentration - density of energy states - electron effective mass - concept of hole.

UNIT II   SEMICONDUCTING MATERIALS AND DEVICES   9

Elemental and compound semiconductors - Intrinsic and extrinsic semiconductors - Properties. Carrier concentration in intrinsic, n-type and p-type semiconductors. Hall effect - experimental determination of Hall coefficient. Application - Hall and Peltier devices - Formation of p-n junctions - position of Fermi level in equilibrium - forward and reverse bias - p-n junction diode: I-V characteristics in forward and reverse bias - Photodiode - LDR, LED, and solar cell.

UNIT III   MAGNETIC AND SUPERCONDUCTING MATERIALS   9

Introduction to magnetic materials - Domain theory of ferromagnetism, Hysteresis. Soft and Hard magnetic materials - Anti-ferromagnetic materials - Ferrites, magneto resistance material Superconducting phenomena - properties of superconductors - Meissner effect and isotope effect. Type-I and Type-II superconductors, High TC superconductors - Magnetic levitation and SQUIDS.

UNIT IV   FLUID MECHANICS   9

Introduction to ideal and real fluids- Basic concepts of density and pressure in a fluid-Newtonian fluids, Non-Newtonian fluids - Capillarity – Surface tension - Experimental determination of surface tension by capillary rise method – Viscosity - Coefficient of viscosity - Role of temperature on surface tension and viscosity - Measurement of pressure by strain-gauge diaphragms.

UNIT V   SPECTROMETRY   9

Theory of Infrared absorption spectrometry – Quantum treatment– Instrumentation – Infrared sources and detectors. Applications – Theory of Raman spectroscopy – excitation mechanism. Instrumentation – Sources and detectors. Nuclear Magnetic Resonance – Relaxation process in NMR – Free induction decay – Chemical Shift – Instrumentation and components of NMR.

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. N.Garcia, A. Damask and S.Schwarz "Physics for Computer Science Students", SpringerVerlag, 2012.
2. Umesh Mishra and Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. C. Kittel , Introduction to solid state physics, Wiley. 2004
4. Yunus a. Çengel, john m. Cimbala Fluid Mechanics: fundamentals and applications Fourth edition Mc Graw Hill 2018
5. Aruldas Molecular Structure and Spectroscopy Prentice Hall 2007.

REFERENCES:

1. Arthur Beiser Concepts of Modern Physics; Tata McGraw – Hill Edition. 2003
2. Steven H. Simon, The Oxford Solid State Basics 1st Edition Oxford 2013
3. S O Pillai, Solid State Physics, New Age International 2006
4. Willard H H, Meritt L L Dean J A and Settle F A, "Instrumental Methods of Analysis", CBS Publishers and Distributions, New Delhi, 2001.
5. C.N.Banwell Fundamentals of Molecular Spectroscopy , Fourth edition Tata Mc.Graw Hill
6. Bruce R. Munson, Alric P. Rothmayer, Theodore H. Okiishi, Wade W. Huebsch Fundamentals of fluid mechanics Wiley, 2012

Course code	**21EE24T**	Semester		**II**		
Category	**ENGINEERING SCIENCE COURSE (ESC)**		**L**	**T**	**P**	**C**
Course Title	**BASIC ELECTRICAL, ELECRONICS AND INSTRUMENTATION ENGINEERING** Common for (CSE, IT, AI&DS, BIOTECH, CIVIL, MECHANICAL, CSE(AI&ML))		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- The course is intended to introduce the students to basic theorems and laws in DC and AC circuits.
- This course aims at giving adequate exposure to students on the principles of electrical machines.
- The course will enable the students to acquire knowledge on fundamentals and applications of various electronic devices and measuring instruments.

PREREQUISITE:

- Engineering Physics, Mathematics

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C204.1	*Impart* knowledge on electrical circuit components, laws and theorems.	K2
C204.2	*Analyze* the behavior of ac circuits components in power system	K3
C204.3	*Illustrate* the working of various ac machines, dc machines and special machines along with its characteristics.	K2
C204.4	*Infer* and *relate* the working and applications of various electronics devices and circuits.	K2
C204.5	*Categorize* the specific instruments for electrical measurements.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
C204.1	3	2	-	-	-	-	-	-	2	-	1	1
C204.2	3	2	-	-	-	-	-	-	2	-	1	1
C204.3	3	2	-	-	-	-	-	-	2	-	1	1
C204.4	3	2	-	-	-	-	-	-	-	-	1	1
C204.5	3	2	-	-	-	-	-	-	2	-	1	1
C204	3	2	-	-	-	-	-	-	2	-	1	1

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   DC CIRCUITS   9

Basic circuit components (R, L & C) - Ohms Law - Kirchoff's Law – voltage and current division -source transformation-steady state solution of DC circuits - Nodal analysis, Mesh analysis-Thevenin's Theorem, Norton's Theorem, Maximum Power transfer -Superposition Theorem.

UNIT II   AC CIRCUITS   9

Introduction to AC circuits – waveforms and RMS value – power and power factor, Analysis of single-phase ac circuits consisting of RL and RLC combinations -Resonance- Balanced and Unbalanced three-phase circuits-Star and Delta connections.

UNIT III   ELECTRICAL MACHINES   9

Principles of operation and characteristics of DC machines, Construction and operation of Single-Phase transformer – Three phase transformer connections – Autotransformer. Construction and types of Single phase and Three phase Induction motor, Construction and working principle of Alternator, Stepper motors – Brushless DC Motors.

UNIT IV   ELECTRONIC DEVICES & CIRCUITS   9

Types of Materials – Silicon & Germanium - PN Junction diodes – Structure, Operation and Characteristics – Display devices-LED, Laser diodes – Zener diode - Bipolar Junction Transistor – Characteristics and applications –Amplifiers - Basics, types and applications, Oscillators-Basics, types and its applications—D/A and A/D converters.

UNIT V   MEASUREMENTS & INSTRUMENTATION   9

Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive Thermoelectric, piezoelectric, photoelectric, Hall effect. Types and principle of indicating Instruments – Multimeters, Wattmeter, instrument transformers (CT and PT), Oscilloscopes.

                                       TOTAL: 45 PERIODS

LEARNING RESOURCES:

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, ―Basic Electrical and Electronics Engineering, McGraw Hill Education (India) Private Limited, Third Reprint ,2016
2. Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press, 2013
3. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2007.

REFERENCES:

1. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
2. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
3. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016
4. David A. Bell, "Electronic devices and circuits", Oxford University higher education,5th edition2008.
5. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2006.

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Course code	21CS25T	Semester		II		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**DATA STRUCTURES** **(Common for AI&DS, CSE, CSE(AI&ML))**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:
- To understand the concept of ADTs
- To understand the structure of Linear data structures.
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures in real time applications.

PREREQUISITE:
- Programming knowledge in C

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C205.1	*Understand* the concepts of Abstract Data Types and Operations on it.	K2
C205.2	*Apply* the concepts of linear data structures in real time applications.	K3
C205.3	*Understand* the structure of Non-Linear Data Structure-Trees.	K2
C205.4	*Understand* the concepts of Graph and analyze its various applications.	K2
C205.5	*Apply* sorting algorithms in real time applications and understand the concept of hashing technique**.**	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C205.1	3	2	1	-	-	-	-	-	-	-	-	1	3	2	3
C205.2	3	2	1	-	-	-	-	-	-	-	-	1	3	2	3
C205.3	3	2	1	-	-	-	-	-	-	-	-	1	3	2	3
C205.4	3	2	1	-	-	-	-	-	-	-	-	1	3	2	3
C205.5	3	2	1	-	-	-	-	-	-	-	-	1	3	2	3
C205	3	2	1	-	-	-	-	-	-	-	-	1	3	2	3

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT-I   LINEAR DATA STRUCTURES – LIST   9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation —singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT-II   LINEAR DATA STRUCTURES – STACKS, QUEUES   9

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

UNIT- III   NON-LINEAR DATA STRUCTURES – TREES   9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees– binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree -Minimum Spanning Tree - Dijkstra's Algorithm - Heap – Applications of heap.

UNIT-IV   NON-LINEAR DATA STRUCTURES - GRAPHS   9

Definition – Representation of Graph – Types of graphs - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT-V   SEARCHING, SORTING AND HASHING TECHNIQUES   9

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort - Quick sort - Merge sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2013.

2. Reema Thareja, "Data Structures Using C", Second Edition , Oxford University Press, 2014.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction To Algorithms", Third Edition, Mcgraw Hill, 2009.

2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,2002.

3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education 2004.

4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008, Biochemistry, 4th Edition, WH Freeman & Co., 2000.

VEL TECH HIGH TECH

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Course code	**21AI26IT**	Semester		**II**		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**C PROGRAMMING**		**2**	**0**	**4**	**4**

COURSE OBJECTIVES:

- The course is intended to introduce the students to computational thinking and make the students develop C Programs using basic programming constructs.
- The course will enable the students to apply the fundamentals of C programming to solve engineering problems.
- The course will acquire the knowledge of databases with C Programming.

PREREQUISITE:

- Basic Mathematics Skills

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C206. 1	*Acquire* basic knowledge on C tokens and arrays	K2
C206. 2	*Organize* the data using functions and pointers	K3
C206. 3	*Experiment* with structure and File Handling	K4

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C206. 1	2	1	-	-	-	-	-	-	-	-	-	-	1	1
C206. 2	3	2	1	-	-	-	-	-	-	-	-	-	2	1
C206. 3	3	3	2	1	-	-	-	-	-	-	-	-	2	1
C206	3	2	2	1	-	-	-	-	-	-	-	-	2	1

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   BASICS OF C PROGRAMMING   8

Introduction to programming paradigms - Structure of C program - C Tokens - Storage classes - Expressions - Input/output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Arrays –Sorting - Strings - Macro expansions

UNIT II   FUNCTIONS   8

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions

UNIT III   POINTERS   5

Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

UNIT IV   STRUCTURES   6

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Self-referential structures – Dynamic memory allocation – Union

UNIT V   FILE PROCESSING   5

Files – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments

Total: 28 Periods

List of Experiments

1. Write a simple c program using data types and Operators
2. Write a Program to calculate electricity bill. Read starting and ending meter reading. The charges are as follows.
   No. of Units Consumed Rate in (Rs)
   1-100 1.50 per unit
   101-300 2.00 per unit for excess of 100 units
   301-500 2.50 per unit for excess of 300 units
   501-above 3.25 per unit for excess of 500 units
3. Write a Program to calculate roots of quadratic equations (using if-else).
4. Write a program to perform matrix manipulations (addition, subtraction, multiplication and manipulation)
5. Write a program to perform various string manipulations using built-in functions.
6. Write a program to create structure for an account holder in a bank with following Fields: name, account number, address, balance and display the details of five account holders.
7. Write a program which copies the contents of one file to another file using command line arguments.
8. Write a simple C program for database connectivity.

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Reema Thareja, ―Programming in C‖, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, ―The C Programming language‖, Second Edition, Pearson Education, 2006

REFERENCES:

1. Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, ―Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, ―Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.

Sl. No.	Description of Equipment	Required numbers (For batch of 30 students)
1	Systems with Linux Operating System with GNU Compiler [Open Source]	30 Nos

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Course code	**21CS27P**	Semester		**II**		
Category	**PROFESSIONAL CORE COURSE (PCC)**	**L**	**T**	**P**	**C**	
Course Title	**DATA STRUCTURES LABORATORY (COMMON FOR CSE, AI&DS, CSE(AI&ML)**	**0**	**0**	**4**	**2**	

COURSE OBJECTIVES:
- To understand various data representation techniques in the real world.
- To implement linear and non-linear data structures.
- To analyze various algorithms based on their time and space complexity.
- To develop real-time applications using suitable data structure.
- To identify suitable data structure to solve various computing problems

PREREQUISITE:
- Basic C Programming Skills

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C207.1	*Understand* various data representation techniques in the real world.	K3
C207.2	*Implement* linear and non-linear data structures.	K3
C207.3	*Analyze* various algorithms based on their time and space complexity.	K3
C207.4	*Develop* real-time applications using suitable data structure.	K3
C207.5	*Identify* suitable data structure to solve various computing problems.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO. No	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
C207.1	3	2	1	-	3	-	-	2	2	2	-	1	3	2	3
C207.2	3	2	1	-	3	-	-	2	2	2	-	1	3	2	3
C207.3	3	2	1	-	3	-	-	2	2	2	-	1	3	2	3
C207.4	3	2	1	-	3	-	-	2	2	2	-	1	3	2	3
C207.5	3	2	1	-	3	-	-	2	2	2	-	1	3	2	3
C207	3	2	1	-	3	-	-	2	2	2	-	1	3	2	3

Note: 1: Slight, 2: Moderate, 3: Substantial

List of Experiment	**No. of Credits: 2**

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues.
9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

LEARNING RESOURCES:

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, PearsonEducation, 2013.
2. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2014.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Mcgraw Hill, 2009.

2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,2002.

3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education 2004.

4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

Sl. No.	Description of Equipment	Required numbers (For batch of 30 students)
1	Systems with Linux Operating System with GNU Compiler [Open Source]	30 Nos

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Course code	**21EE28P**	Semester		**II**		
Category	**ENGINEERING SCIENCE COURSE (ESC)**		**L**	**T**	**P**	**C**
Course Title	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY Common for (AI&DS, MECH)**		**0**	**0**	**4**	**2**

COURSE OBJECTIVES:
- Provide hands on experience with generators and motors.
- Understand the working of dc/ac motors and generators
- Learn the uses of transformer
- Understand the working of transducers and amplifiers

PREREQUISITES:
- Engineering Physics and Engineering Mathematics

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C208.1	*Perform* experiments to know the working of DC motors / Generators / Transformers.	K2
C208.2	*Illustrate* the load characteristics of DC motors / Generators / Transformers.	K3
C208.3	*Draw* the characteristics of diodes and transistors for different configuration.	K2
C208.4	*Design* bridge network circuit to measure the values of passive component.	K3
C208.5	*Illustrate* the characteristics of amplifier and ADC converters.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
C208.1	2	1	-	-	-	-	-	-	2	-	-	-
C208.2	2	1	-	-	-	-	-	-	2	-	-	-
C208.3	2	1	-	-	-	-	-	-	2	-	-	-
C208.4	2	1	-	-	-	-	-	-	2	-	-	-
C208.5	2	1	-	-	-	-	-	-	2	-	-	-
C208	2	1	-	-	-	-	-	-	2	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS	No. of Credits: 2

LIST OF EXPERIMENT

1. Open circuit and load test on shunt generators
2. Load test on DC Shunt & DC Series motor
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. Load test on single phase Induction Motor
6. Load test on three phase squirrel cage Induction motor
7. Study of DC & AC motor starters
8. VI Characteristics of Semiconductor diode and Zener diode.
9. Characteristics of a NPN Bipolar Junction Transistor under common emitter, common collector and common base configurations.
10. Measurement of passive (R, L, C) elements using Bridge Networks
11. Design and plot the characteristics of instrumentation amplifier.
12. Design and test the analog to digital converter.

TOTAL: 60 PERIODS

LEARNING RESOURCES:

TEXT BOOKS:
1. D P Kothari and I.J Nagarath, ―Basic Electrical and Electronics Engineering‖, McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2007.

REFERENCES:
1. N K De, Dipu Sarkar, "Basic Electrical Engineering", Universities Press (India)Private Limited 2016
2. David A. Bell ,"Electronic devices and circuits", Oxford University higher education,5th edition2008.
3. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2006.

21EE28P Basic Electrical and Electronics Engineering

Laboratory Requirements for a batch of 30 students

Sl. No.	Description of Equipment	Quantity required
1.	**Open circuit and load test on shunt generators** 1. D.C motor – Shunt Generator set 2. Ammeter (0-30 A), (0-2A) 3. Voltmeter (0-30V) 4. Rheostat 175Ω, 250 Ω 5. Tachometer 6. Connecting Wires	 1 1 1 1 1 As required
2.	**Load test on DC Shunt & DC Series motor** 1. Ammeter MC (0-20A) 2. Voltmeter MC (0-300)V 3. Rheostat 7.5 Ω, 10 A 4. Tachometer 5. Field Rheostat 175 Ω, 1.5 A 6. Connecting wires	1 each 1 1 1 1 1 As required
3.	**Speed control of DC shunt motor (Armature, Field control)** 1. DC shunt motor 2. Ammeter MC (0-20A) 3. Voltmeter MC (0-300)V 4. Rheostat 7.5 Ω, 10 A 5. Tachometer 6. Field Rheostat 175 Ω, 1.5 A 7. Field Rheostat 100 Ω, 2A 8. Connecting wires	 1 1 1 1 1 1 1 As required
4.	**Load test on single phase transformer** 1. 1KVA transformer 2. Ammeter MI (0-10A) 3. Ammeter MI (0- 5A) 4. Voltmeter MC (0-300)V 5. Voltmeter MC (0-150)V 6. Wattmeter (300V, 10A, UPF) 7. Connecting wires	1 1 1 1 1 1 2 As required
5.	**Load test on single phase Induction Motor** 1. Single phase Induction motor 2. Ammeter MI (0-20A) 3. Voltmeter MI (0-300)V 4. Wattmeter – 300V, 30 A 5. Tachometer – Digital 6. Connecting Wires	 1 1 1 1 1 As required
6.	**Load test on three phase squirrel cage Induction motor** 1. Three phase Squirrel Cage Induction motor	 1

	2. Ammeter MI (0-20A)	1
	3. Voltmeter MI (0-300)V	1
	4. Wattmeter – 300V, 30 A	1
	5. Tachometer – Digital	1
	6. Connecting Wires	As required
7.	**Study of DC & AC motor starters** 1. Two-point , three point and four-point DC starters 2. DOL starter, Autotransformer starter	2 each 2 each
8.	**VI Characteristics of Semiconductor diode and Zener diode.** 1. PN Diode (BY127, OA79), Zener diode (6.8V, 1A) 2. Resistor 1 KΩ, 100Ω 3. Bread Board 4. DC Regulated Power supply (0 - 30 V variable) 5. Multimeter 6. Connecting wires	1 1 1 1 1 As required
9.	**Characteristics of a NPN Bipolar Junction Transistor under common emitter, common collector and common base configurations.** 1. Transistor (No-BC548) 2. Resistors- 1kΩ, 470KΩ, 1MΩ 3. Bread Board 4. DC Regulated Power supply (0 - 30 V variable) 5. Multimeter 6. Connecting wires	2 1 each 1 1 1 1 As required
10.	**Measurement of passive (R, L, C) elements using Bridge Networks** 1. Wheat stone Bridge kit 2. Maxwell's inductance Capacitance Bridge kit 3. Patch chords 4. Multimeter	1 1 1 1
11.	**Design and plot the characteristics of instrumentation amplifier.** 1. Instrumentation Amplifier Kit 2. Patch chords 3. Multimeter	1 1 1
12.	**Design and test the analog to digital converter.** 1. Analog – Digital and Digital – Analog Converters(ADC and DACs) 2. Patch chords 3. Multimeter	1 1 1

3rd SEMESTER
CURRICULUM & SYLLABI

Applicable to the students admitted to

B.TECH-ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

R-2021: CBCS

Academic year 2021-2022

Onwards

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Avadi, Tamil Nadu 600062

B.Tech. – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

R-2021: CBCS CURRICULUM

S. No.	Course Code	Course Title	Category	CIE Marks	SEE Marks	Total marks	Credits			
							L	T	P	C
SEMESTER III										
THEORY										
1	21AI31T	Introduction to Artificial Intelligence	PCC	40	60	100	3	0	0	3
2	21AI32T	Programming with Java	PCC	40	60	100	3	0	0	3
3	21MA33T	Linear Algebra for Data science	BSC	40	60	100	3	1	0	4
4	21HC34T	Database Management Systems	PCC	40	60	100	3	0	0	3
5	21AI35IT	Data Science for Engineers	PCC	40	60	100	2	0	4	4
6	21MC01T	Constitution of India	MC	40	60	100	2	0	0	0
PRACTICAL										
7	21AI37P	Java Programming Laboratory	PCC	40	60	100	0	0	4	2
8	21HC39P	Database Management Systems Laboratory	PCC	40	60	100	0	0	4	2
									TOTAL	21

Dean Academics   **Principal**

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Course code	**21AI31T**	**Semester**		**III**		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To impart concepts of the Artificial Intelligence.

- To learn the issues and rules of knowledge representation.

- To study about the knowledge representation for Reasonings.

- To provide wide knowledge about various learning algorithms.

- To know about various applications of AI.

PREREQUISITE:

- Basic Mathematics Skills
- Basic knowledge of python

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C301.1	*Understand* the fundamental concept of Artificial Intelligence.	K2
C301.2	*Illustrate* the Knowledge representation and Rules based system.	K2
C301.3	*Infer* the knowledge of Bayes and Heuristics methods on Reasoning.	K2
C301.4	*Understand* the Learning algorithms by analogies.	K2
C301.5	*Summarize* the applications of Artificial Intelligence.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C301.1	2	1	-	-	-	-	-	-	-	-	-	-	1	1
C301.2	2	1	1	-	-	-	-	-	-	-	-	-	1	1
C301.3	2	1	-	-	-	-	-	-	-	-	-	-	1	1
C301.4	2	1	1	-	-	-	-	-	-	-	-	-	1	1
C301.5	2	1	-	-	-	-	-	-	-	-	-	-	1	1

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS: **No. of Credits: 3**

UNIT I   INTRODUCTION   9
Introduction - Foundation and history of AI - AI Problems and techniques - AI programming languages – Introduction to LISP and PROLOG – Problem spaces and searches - Blind search strategies; Breadth first - Depth first – Heuristic search techniques Hill climbing - Best first – A* algorithm AO* algorithm – game trees - Minimax algorithm – Game playing – Alpha beta pruning.

UNIT II   KNOWLEDGE REPRESENTATION   9
Knowledge representation issues – Predicate logic – logic programming – Semantic nets - Frames and inheritance - constraint propagation –Representing Knowledge using rules – Rules based deduction system.

UNIT III   REASONING WITH UNCERTAIN KNOWLEDGE   9
Introduction to uncertain knowledge review of probability – Baye's Probabilistic inferences and Dempster Shafer theory –Heuristic methods – Symbolic reasoning under uncertainty- Statistical reasoning – Fuzzy reasoning – Temporal reasoning- Non monotonic reasoning.

UNIT IV   PLANNING AND LEARNING   9
Planning - Introduction, Planning in situational calculus - Representation for planning – Partial order planning algorithm- Learning from examples- Discovery as learning – Learning by analogy – Explanation based learning –Introduction to Neural nets – Genetic Algorithms.

UNIT V   APPLICATIONS OF AI   9
perception, communication, interaction, and action; multiagent systems-Principles of Natural Language Processing -Rule Based Systems Architecture - AI application to robotics - Current trends in Intelligent Systems.

<div style="text-align:right">

Total: 45 Periods
</div>

LEARNING RESOURCES:

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach (3rd Edition)**,** 2020.

2. Chandra, V: Artificial Intelligence and Machine Learning Paperback – 2014.

REFERENCES:

1. Daugherty, Paul R., and H. James Wilson. Human+ machine: reimagining work in the age of AI. Harvard Business Press, 2018.

2. Prateek, J.: Artificial Intelligence with Python, pp. 14–16. Packet Publishing, Birmingham (2017).

3. Husain, Amir. The sentient machine: The coming age of artificial intelligence. Simon and Schuster, 2017.

4. Kaplan, Jerry. Artificial intelligence: What everyone needs to know. Oxford University Press, 2016.

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Course code	**21AI32T**	Semester		**III**		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**PROGRAMMING WITH JAVA**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance, interfaces and Vector
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces and Applet.

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PREREQUISITE:

- Programming skill in C

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C302. 1	*Understand* Object oriented concepts of Java Programming.	K2
C302. 2	*Understand* the concept of Inheritance and its types.	K2
C302. 3	*Apply* I/O streaming mechanisms on a file.	K3
C302. 4	*Understand* Multithreading concepts to write a simple generic program.	K2
C302. 5	*Understand* the Programming on graphical representations.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C302.1	2	1	-	-	-	-	-	-	-	-	-	1	2	1
C302.2	2	1	-	-	-	-	-	-	-	-	-	1	2	1
C302.3	3	2	-	-	-	-	-	-	-	-	-	1	2	1
C302.4	2	1	-	-	-	-	-	-	-	-	-	1	2	1
C302.5	2	1	-	-	-	-	-	-	-	-	-	1	2	1

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS   **No. of Credits: 3**

UNIT I   INTRODUCTION TO OOP AND JAVA FUNDAMENTALS   10

Fundamentals of Programming - Difference between C, C++ and Java - Object Oriented Programming – Abstraction – objects and classes – Encapsulation- Inheritance – Polymorphism- OOP in Java – Characteristics of Java – The Java Environment – Java Source File Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers – static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages – JavaDoc comments.

UNIT II   INHERITANCE AND INTERFACES   9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning -inner classes, ArrayLists – Strings-Vector

UNIT III   EXCEPTION HANDLING AND I/O   9

Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNIT IV   MULTITHREADING AND GENERIC PROGRAMMING   8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations-Applets.

UNIT V   EVENT DRIVEN PROGRAMMING   9

Graphics programming – Frame – Components – working with 2D shapes – Using colour, fonts, and images – Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields, Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

                                                     Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education, 2017.
2. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals‖, 9th Edition, Prentice Hall, 2017.
3. E.Balagurusamy, Programming with Java, Tata McGill. , Fifth Edition, 2017.

REFERENCES:

1. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers‖, 7th Edition, Pearson, 2019.
2. Steven Holzner, ―Java 2 Black book‖, Dreamtech press, 2014.
3. Timothy Budd, ―Understanding Object-oriented programming with Java‖, Updated Edition, Pearson Education, 2000.

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Course code	**21MA33T**	Semester		III		
Category	**BASIC SCIENCE COURSE (BSC)**		**L**	**T**	**P**	**C**
Course Title	**LINEAR ALGEBRA FOR DATA SCIENCE** **(For AI&DS Branch)**		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

- To familiarize the concept of Linear algebra.
- To understand the properties of matrices.
- To Know determinant of a matrix and the solution of simultaneous linear equations.
- To learn linear dependence and linear independence in vector space.
- To learn concepts and matrix decomposition.

PREREQUISITE:

- Vector Calculus and Complex Integration

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C303. 1	*Apply* basic concepts of Matrix properties to solve linear equations.	K3
C303. 2	*Understand* the concepts of vector space and its properties to solve Data Searching problems.	K2
C303. 3	*Analyse* the characteristics of a linear system with Eigen values and vectors.	K3
C303. 4	*Analyse* the systems by vector space techniques.	K3
C303. 5	*Find* eigen values of a matrix using numerical techniques.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C303. 1	3	2	-	-	-	-	-	-	-	-	-	2
C303. 2	2	1	-	-	-	-	-	-	-	-	-	2
C303. 3	3	3	2	-	-	-	-	-	-	-	-	2
C303. 4	3	3	2	-	-	-	-	-	-	-	-	2
C303. 5	2	1	-	-	-	-	-	-	-	-	-	2

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS	**No. of Credits: 4**

UNIT I   MATRICES AND ITS APPLICATIONS   12
Introduction to Matrices and Determinants – Properties(without proof), Rank of Matrix- system of linear equations-Consistency- Gauss elimination method-Gauss Jordon method- matrix inversion method- Cramer's rule.

UNIT II   VECTOR SPACES   12
Introduction to vectors- Vector spaces and sub spaces- Linear independence and Linear dependence- Vector spaces over Real and Complex fields- Basis and dimension, Orthogonality.

UNIT III   LINEAR TRANSFORMATION   12
Linear transformation-Matrix representation of linear transformation-Rank space and null space- Dimension Theorem-Eigenvalues and Eigenvectors of Linear transformation.

UNIT IV   INNER PRODUCT SPACES   12
Inner product- Properties-Orthogonal, Orthonormal vectors-Gram Schmidt orthogonalization - Least square approximation.

UNIT V   EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION   12
Eigen value Problems : Power method, QR decomposition-LU decomposition- Singular value decomposition.

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Friedberg A.H, Insel A.J. and Spence L, Linear Algebra, Prentice Hall of India, New Delhi, 2004.
2. Faires J.D. and Burden R., Numerical Methods, Brooks/Cole (Thomson Publications), New Delhi, 2002.
3. Fundamentals of Matrix Algebra, Gregory Hartman, Virginia Military Institute, Copyright Year: 2011, Publisher: APEX Calculus.

REFERENCES:

1. Kumaresan S, Linear Algebra - A geometric approach, Prentice Hall of India, New Delhi, Reprint, 2010.
2. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Cengage Learning,7th Edition 2011.
3. Introduction to linear algebra, (Fifth Edition), Gilbert Strang, Wellesley-Cambridge Press,2016.
4. Sundarapandian V, Numerical Linear Algebra, Prentice Hall of India, New Delhi, 2008.
5. Bernard Kolman, David R. Hill, Introductory Linear Algebra, Pearson Educations, New Delhi, First Reprint, 2009.

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Course code	**21HC34T**	Semester		III		
Category	**PROFESSIONAL CORE COURSE (PCC)**	**L**	**T**	**P**	**C**
Course Title	**DATABASE MANAGEMENT SYSTEMS** **(Common to CSE, AI&DS)**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

The objective of this course is to prepare the students

- To understand the fundamentals of data models and to represent a database system using ER diagrams and relational database design.
- To learn the SQL basics and to use the normalization process in the databases.
- To understand the fundamental concepts of transaction and recovery procedures and to have an introductory knowledge about Indexing, Query Processing and Cost estimation.

PREREQUISITE:
- Basic knowledge of Database fundamentals

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C304. 1	*Understand* the applications of database models on various parameters.	K2
C304. 2	*Analyze* ER model to Relational model and to perform database design effectively.	K2
C304. 3	*Understand* queries for normalization and optimization criterions.	K2
C304. 4	*Understand* various concurrency and recovery procedures.	K2
C304. 5	*Analyze* various indexing strategies in different database systems	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C304. 1	3	2	2	1	-	-	-	-	-	-	-	-	3	3
C304. 2	3	2	3	2	1	-	-	-	-	-	-	-	3	3
C304. 3	3	2	2	1	-	-	-	-	-	-	-	-	3	3
C304. 4	3	2	2	1	-	-	-	-	-	-	-	-	3	3
C304. 5	2	2	3	2	1	-	-	-	-	-	-	-	3	3

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS	**No. of Credits: 3**

UNIT I   INTRODUCTION TO RELATIONAL DATABASES   9

Introduction, History and Purpose of Database System – Introduction to Big data– Database Schema and Instances- Views of data – Data Models – Database System Architecture – Introduction to relational databases Relational Model – Keys – Relational Algebra.

UNIT II   BASICS OF SQL AND DATABASE DESIGN   9

SQL fundamentals – Advanced SQL features, Triggers- Nested Queries and Embedded SQL, Dynamic SQL. Entity-Relationship model – ER Diagrams – Enhanced-ER Model – ER-to-Relational Mapping.

UNIT III   NORMALIZATION TECHNIQUES   9

Introduction and problem of data redundancy-Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form- Dependencies Preservation-Case Studies of database system.

UNIT IV   TRANSACTIONS AND CONCURRENCY   9

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction states-Concurrent Execution – Need for Concurrency – Types of Locks – Two Phase Locking – Deadlock detection– Transaction Recovery– Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT V   IMPLEMENTATION TECHNIQUES   9

Overview of Physical storage media, RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation- Introduction to Distributed databases and client/server databases.

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts, Seventh Edition, Tata McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe,- Fundamentals of Database Systems, Sixth Edition, Pearson, 2016.

REFERENCES:

1. Raghu Ramakrishnan, Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
2. G.K.Gupta, "Database Management Systems, Tata McGraw Hill, 2011.
3. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006.

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Course code	**21AI35IT**	Semester			**III**		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**	
Course Title	**DATA SCIENCE FOR ENGINEERS**		**2**	**0**	**4**	**4**	

COURSE OBJECTIVES:

- To describe the life cycle of Data Science and computational environments for data scientists using Python.
- To describe the fundamentals for exploring and managing data with Python.
- To examine the various data analytics techniques for labelled/columnar data using Python.
- To demonstrate a flexible range of data visualizations techniques in Python.
- To describe the various Machine learning algorithms for data modelling with Python.

PREREQUISITE:

- Basic Mathematics Skills
- Basic knowledge of Python

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C305. 1	*Understand* the basic concept of Data Science.	K2
C305. 2	*Make use of* knowledge on NumPy to write program on array operations.	K2
C305. 3	*Understand* the concepts of Pandas.	K2
C305. 4	*Write* program retrieve data from an index labeled Library using Pandas.	K3
C305. 5	*Construct* code to combine two Datasets.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C305. 1	2	1	-	-	-	-	-	-	-	-	-	-	1	1
C305. 2	2	1	-	-	-	-	-	-	-	-	-	-	2	1
C305. 3	2	1	-	-	-	-	-	-	-	-	-	-	2	1
C305. 4	3	2	1	-	-	-	-	-	-	-	-	-	2	1
C305. 5	3	2	1	-	-	-	-	-	-	-	-	-	2	1

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   INTRODUCTION TO DATA SCIENCE 6

Introduction to Data Science and its importance - Data Science and Big data-, The life cycle of Data Science- The Art of Data Science - Work with data – data Cleaning, data Munging, data manipulation. Establishing computational environments for data scientists using Python with IPython and Jupyter.

UNIT II   TOWARDS DATA SCIENCE USING NUMPY 6

Understanding Data Types in Python - The Basics of NumPy Arrays - Computation on NumPy Arrays: Universal Functions - Aggregations: Min, Max, and Everything in Between Computation on Arrays: Broadcasting-Comparisons, Masks, and Boolean Logic Fancy Indexing-Sorting Arrays.

UNIT III   INTRODUCTION TO PANDAS 6

Installing and Using Pandas, Introducing Pandas Objects, Data Indexing and Selection. Operating on Data in Pandas, Handling Missing Data.

UNIT IV   DATA MANIPULATION 6

Hierarchical Indexing Combining Datasets: Concat and Append, Combining Datasets: Merge and Join. Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series- General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots.

UNIT V   DATA VISUALIZATION 6

Visualizing Errors Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends Customizing Colorbars, Multiple Subplots, Text and Annotation, Customizing Ticks Customizing Matplotlib: Configurations and Stylesheets, Geographic Data with Basemap.

Total: 30 Periods

List of Experiments:

1. Write a Python Program for Multiply matrices.
2. Write a NumPy program to find the number of elements of an array, length of one array element in bytes and total bytes consumed by the elements.
3. Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels.
4. Write a Python program for Basic plots using Matplotlib
   1. draw line charts
   2. to plot two or more lines
   3. to plot several lines
5. Implementing a Stack class using Python lists.
6. Write a Python Program to find frequency of each word in a string in Python Frequency Distributions.
7. Write a Python program to arrange the elements in sorted order using Bubble, Selection, Insertion and Merge sorting techniques.
8. Write a Python program for Variability of Data set.
9. Write a Python program to implement to combine any two datasets.
10. Implement a Python program to index a dataset with atleast four attributes.
11. Write a Python program to extract the visual character of an image data.
12. Write a program to calculate precision and decision of searching on a dataset.

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Python Data Science Handbook-Essential Tools for Working with Data, Jake Vander Plas, O'Reilly Media, 2020.
2. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 2018.

REFERENCES:

1. Python for Data Analysis, Wes Mckinney, O'Reilly Media, 2013.
2. Field Cady, "Data Science Hand Book", John Wiley & Sons, 2017.
3. Fundamentals of Data Science, Samuel Burns, Amazon KDP printing and Publishing, 2019.
4. Doing Data Science, Straight Talk from The Frontline, Cathy O'Neil and Rachel Schutt. O'Reilly. 2014.
5. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.
6. Nathan Yau, "Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics", Wiley, 2011.
7. Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014.

LAB REQUIREMENTS

Sl. No.	Description of Equipment	Required numbers (For a batch of 30 students)
1.	**Hardware:** Standalone System **Software:** Open-Source Python	30 Nos

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Course code	**21MC01T**	Semester	**III**			
Category	**MANDATORY COURSE (MC)**		**L**	**T**	**P**	**C**
Course Title	**CONSTITUTION OF INDIA**		**2**	**0**	**0**	**0**

COURSE OBJECTIVES:

- To understand the importance of constitution.
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court, controller and auditor general of India and election commission of India.

PREREQUISITE:

- Civic Knowledge.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C001.1	*Understand* historical background of the constitutional making and its importance for building a democratic India, the structure of Indian government, the structure of state government, the local Administration	K2
C001.2	*Understand* the directive principle of state policy, and strengthening of the constitutional institutions.	K2
C001.3	*Analyze* the role of Governor and Chief Minister, role of state election commission, the decentralization of powers.	K2
C001.4	*Understand* the Public Election Process.	K2
C001.5	*Know* the Special Provisions for Various category of People.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C001.1	-	-	-	-	-	3	-	2	-	-	-	1	-	-	-
C001.2	-	-	-	-	-	2	-	2	-	-	-	1	-	-	-
C001.3	-	-	-	-	-	2	-	2	-	-	-	1	-	-	-
C001.4	-	-	-	-	-	1	-	2	-	-	-	1	-	-	-
C001.5	-	-	-	-	-	1	-	2	-	-	-	1	-	-	-

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS   **No. of Credits: 0**

UNIT I   INTRODUCTION TO INDIAN CONSTITUTION   6
The Necessity of the Constitution, The Societies before and after the Constitution adoption.
Introduction to the Indian constitution, The Making of the Constitution, The Role of the
Constituent Assembly - Preamble and Salient features of the Constitution of India.

UNIT II   FUNDAMENTAL RIGHTS AND DIRECTIVE PRINCIPLES   6
Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive
Principles of State Policy (DPSP) and its present relevance in our society with examples.
Fundamental Duties and its Scope and significance in Nation building. Directive Principles of
State Policy (Art. 36-51).

UNIT III   UNION EXECUTIVE AND STATE EXECUTIVE   6
Parliamentary System, Federal System, Centre-State Relations. Union Executive – President,
Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees,
Parliamentary Terminologies**.** Supreme Court of India, State Executives – Governor, Chief
Minister, State Cabinet, State Legislature, High Court and Subordinate Courts.

UNIT IV   ELECTIONS, AMENDMENTS AND EMERGENCY PROVISIONS   6
Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments
Important Constitutional Amendments. Emergency Provisions, types of Emergencies and its
consequences.

UNIT V   DIRECTIVE PRINCIPLES & FUNDAMENTAL DUTIES   6
Fundamental Duties (Art. 51A), Basic Features of Constitution & Constitutional **special
provisions:** Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

Total: 30 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. N. Shukla, Constitution of India, Eastern Book Agency, 2014.

2. P. Jain, Indian Constitutional Law, Lexis Nexis, 2013.

3. M. Seervai, Constitutional Law of India, Universal Law Publishing Co., Reprint 2013.

REFERENCES:

1. Glanville Austin, Indian Constitution – cornerstone of the Nations, Oxford University
    Press, 1999.

2. M. Bakshi, The Constitution of India, Universal Law Publishing Co., 2014.

3. D. Basu, Shorter Constitution of India (14th Ed. 2008, reprint 2010).

Course code	**21AI37P**	Semester		III		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**JAVA PROGRAMMING LABORATORY**		**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list, exception handling and file processing.
- To develop applications using generic programming and event handling.

PREREQUISITE:

- C Programming

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C307.1	*Write* Java programs to implement OOPS Concepts.	K2
C307.2	*Construct* Java programs to derive the concepts of inheritance and interfaces	K3
C307.3	*Build* Java applications using exceptions and I/O streams	K3
C307.4	*Construct* Java application code with threads and generics classes	K3
C307.5	*Write* interactive Java programs using swings and Event Handling	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C307.1	2	1	-	-	-	-	-	-	-	-	-	1	2	1
C307.2	3	2	-	-	-	-	-	-	-	-	-	1	2	1
C307.3	3	2	-	-	-	-	-	-	-	-	-	1	2	1
C307.4	3	2	1	-	-	-	-	-	-	-	-	1	2	1
C307.5	3	2	1	-	-	-	-	-	-	-	-	1	2	1

Note: 1: Slight, 2: Moderate, 3: Substantial

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.
   If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - Greater than 501 units - Rs. 6 per unit
   If the type of the EB connection is commercial, calculate the amount to be paid as follows:
   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - Greater than 501 units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.

3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

5. Write a program to perform string operations using Array List. Write functions for the following
   a. Append - add at end   b. Insert – add at particular index   c. Search
   d. List all string starts with given letter

6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

7. Write a Java program to implement user defined exception handling.

8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.

9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

10. Write a java program to find the maximum value from the given type of elements using a generic function.

11. Design a calculator using event-driven programming paradigm of Java with the following options.
    a) Decimal manipulations
    b) Scientific manipulations

12. Develop a mini project for any application using Java concepts.

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education, 2017.

2. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals‖, 9th Edition, Prentice Hall, 2017.

3. E.Balagurusamy, Programming with Java, Tata McGill. , Fifth Edition, 2017

REFERENCES:

1. Paul Deitel, Harvey Deitel, ―Java SE 8 for programmers‖, 7th Edition, Pearson, 2019.

2. Steven Holzner, ―Java 2 Black book‖, Dreamtech press, 2014.

3. Timothy Budd, ―Understanding Object-oriented programming with Java‖, Updated Edition, Pearson Education, 2000.

LIST OF EQUIPMENT REQUIRED

Sl. No.	Description of Equipment	Required numbers (For batch of 30 students)
1.	Systems with either NetBeans or Eclipse	30 Nos

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Course code	**21HC39P**	Semester		III		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**DATABASE MANAGEMENT SYSTEMS LABORATORY (Common to CSE, AI&DS)**		**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

- To understand data definitions and data manipulation commands and to learn the use of nested and join queries

- To understand functions, procedures and procedural extensions of data bases

- To be familiar with the use of a front-end tool.

PREREQUISITE:

- Basic Programming Skill

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C309.1	*Write* data definitions and manipulation commands.	K2
C309.2	*Design* applications to test Nested and Join Queries	K3
C309.3	*Apply* PL/SQL for processing database	K3
C309.4	*Implement* applications that required as Front-end Tool	K3
C309.5	*Analyze* the use of Tables, Views, Functions and Procedures	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C309.1	2	2	-	-	2	-	-	-	-	-	-	-	1	-
C309.2	3	2	1	-	1	-	-	-	-	-	-	-	2	-
C309.3	3	2	1	1	1	-	-	-	-	-	-	-	2	-
C309.4	3	2	1	-	-	-	-	-	2	1	-	-	2	1
C309.5	3	2	1	-	-	-	-	-	2	1	-	-	3	1

Note: 1: Slight, 2: Moderate, 3: Substantial

LIST OF EXPERIMENTS

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins.
3. Creating an employee database to set various constraints and Creation of Views Indexes, Save point.
4. Database Programming: Implicit and Explicit Cursors
5. Write a PL/SQL block that handles all types of exceptions.
6. To create PL/SQL functions and to implement the stored procedures in SQL (Procedures and Functions).
7. To study the basics of front-end tools.
8. Creation of Database Triggers
9. Database Design using ER modeling, normalization and Implementation for any application
10. Creation of Database in MS Access.
11. Database connectivity using Front End Tools (Application Development using Oracle/ Mysql)
12. Case study of Big Data and NoSQL.

           Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts, Seventh Edition, Tata McGraw Hill, 2020.

2. Ramez Elmasri, Shamkant B. Navathe,- Fundamentals of Database Systems, Sixth Edition,Pearson,2016.

REFERENCES:

1. Raghu Ramakrishnan, Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.

2. G.K.Gupta," Database Management Systems, Tata McGraw Hill, 2011.

3. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.

LIST OF EQUIPMENT REQUIRED

Sl. No.	Description of Equipment	Required numbers (For batch of 30 students)
1.	Systems with MySQL	30 Nos
2.	Visual Studio	30 Nos
3.	Server	1 No

IV & V SEMESTER

CURRICULUM AND SYLLABI

Applicable to the students semester admitted to

B.TECH-ARTIFICIAL INTELLIGENCE AND

DATA SCIENCE

R-2021: CBCS

Academic year 2021-2022
onwards

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B.Tech. – Artificial Intelligence and Data Science (R2021)

S.No	Course code	Course title	Category	CIE Marks	SEE marks	Total marks	L	T	P	C
SEMESTER IV										
THEORY										
1	21AI41T	Data Engineering	PCC	40	60	100	3	0	0	3
2	21AI42IT	Machine Learning Techniques	PCC	40	60	100	2	0	4	4
3	21MA43T	Statistics for Data Science	BSC	40	60	100	3	1	0	4
4	21HC44T	Operating Systems	PCC	40	60	100	3	0	0	3
5	21HE32T	Digital Logic Circuits	ESC	40	60	100	3	0	0	3
6	21MC02T	Environmental Sciences	MC	40	60	100	2	0	0	0
PRACTICAL										
7	21HC47P	Operating Systems Laboratory	PCC	40	60	100	0	0	4	2
8	21HE38P	Digital Logic Circuits Laboratory	ESC	40	60	100	0	0	4	2
9	21EE04P	Internship	EEC	40	60	100	0	0	2	1
									TOTAL	22

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Course code	**21AI41T**	**Semester**		**IV**		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**DATA ENGINEERING**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:
- To create user-friendly relational and No SQL data models.
- To create scalable and efficient data warehouses.
- To build and interact with a cloud-based data lake.
- To automate and monitor data pipelines.

PREREQUISITE:
- Python programming skills
- Intermediate skill in SQL

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C401.1	*Understand the* fundamental concept of Data Engineering.	K2
C401.2	*Identify* the strengths and weaknesses of different types of databases and data storage techniques.	K2
C401.3	*Understand* Data Warehousing architecture.	K2
C401.4	*Manipulate* data with Spark SQL and Spark Data frames.	K3
C401.5	*Setup* data pipeline schedules.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C401.1	2	2	1	-	2	-	-	-	-	-	-	-	3	3
C401.2	2	2	-	-	2	-	-	-	-	-	-	-	3	3
C401.3	2	2	-	-	2	-	-	-	-	-	-	-	3	3
C401.4	3	2	-	-	2	-	-	-	-	-	-	-	3	3
C401.5	3	2	-	-	2	-	-	-	-	-	-	-	3	3

 Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS   **No. of Credits: 3**

UNIT I   INTRODUCTION TO DATA ENGINERING   **9**
Introduction - Data engineering tools-Programming languages databases-Building Our Data Engineering Infrastructure- Reading and Writing Files- Handling files using NiFi- Working withDatabases- Cleaning, Transforming, and Enriching Data-Handling common data issues using pandas.

UNIT II   DATA MODELING   **9**
Overview of data models- Conventional Models, Engineering Data Models- Information System Design Phases- Types of Data Models- No SQL/RM-Tables, Keys , DDL- Engineering and RDBMS- Object-oriented Data Models- Enhanced Semantic Modeling- XML Structure and Data Model- Standard for the Exchange of Product model data- STEP Parts relevant for Data Modeling.

UNIT III   CLOUD DATA WAREHOUSES   **9**
Introduction-Importance -Cloud data warehouses vs. cloud data lakes-Data ware house optimization -data quality-data silos-cloud data warehouse's connectivity capabilities-Trends in cloud data warehousing -cloud data lake work-Case studies.

UNIT IV   SPARK AND DATA LAKES   **9**
Introduction to Spark - Architecture, Application, Spark's Toolset- Production Applications, Datasets- Machine Learning and Advanced Analytics, Spark's Ecosystem and Packages- Types ofData- Working with JSON-Delta Lake quick start- Data Lake Foundation on AWS- Architecture.

UNIT V   AUTOMATE DATA PIPELINES   **9**
Features of a Production Pipeline- Monitoring Data Pipelines- Deploying Data Pipelines- Buildinga Production Data Pipeline- Building Real Time Data Pipelines.

                                                          Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:
1. Paul Crickard , Data engineering with Python(1st Edition), October 2020.
2. Gareth Eagar, Data engineering with AWS.(1st Edition),December 2021.

REFERENCES:
1. Steven L. Brunton J.Nathan Kutz, Data-Driven Science and Engineering. (Publisher: Cambridge University Press).
2. Data Lake Foundation on the AWS Cloud Quick Start Reference Deployment, August, 2020Dave May, AWS Quick Start team.
3. Fast and Scalable Cloud Data Management by Felix Gessert Wolfarm Wingerath NorbertRitter. (Publisher: Springer Nature Switzerland AG)
4. Definitive Guide to Cloud Data Warehouses and Cloud Data Lakes, Talend
5. Modeling with Data: Tools and techniques for scientific computing. (Kindle Edition) by BenKlemens.
6. https://www.databricks.com/wp-content/uploads/2021/06/data-engineers-guide-apache-spark-delta-lake-v3.pdf

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Course code	**21AI42IT**	Semester	**IV**			
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**MACHINE LEARNING TECHNIQUES**		**2**	**0**	**4**	**4**

COURSE OBJECTIVES:
- To understand the need for machine learning for various problem solving.
- To acquire the knowledge of various supervised, semi- supervised and unsupervisedlearning algorithms in machine learning.
- To design appropriate machine learning algorithms for problem solving.

PREREQUISITE:
- Introduction to Artificial Intelligence

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C402.1	*Understand* fundamentals of machine learning.	K1
C402.2	*Build* Linear and Logistic Regression models for a given dataset	K2
C402.3	*Apply* classification techniques for machine Learning	K3
C402.4	*Apply* machine learning algorithms for clustering and feature extraction.	K3
C402.5	*Analyze* appropriate machine learning approaches for various types of problems	K4

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C402.1	2	2	1	-	3	-	-	-	-	2	-	-	3	3
C402.2	3	2	1	-	3	-	-	-	-	2	-	-	3	3
C402.3	3	2	1	-	3	-	-	-	-	2	-	-	3	3
C402.4	3	2	1	-	3	-	-	-	-	2	-	-	3	3
C402.5	3	3	2	-	3	-	-	-	-	2	-	-	3	3

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   MACHINE LEARNING BASICS   6

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends inMachinelearning–DataUnderstandingRepresentationandvisualization.

UNIT II   LINEAR METHODS AND NEURAL NETWORKS   6

Regression – Classification- Linear Regression – Least-Squares method - Bias-Variance Decomposition –Logistic Regression - Neural Network Representation – Problems – Perceptron – Multilayer Networks and Back Propagation Algorithms

UNIT III   MACHINE LEARNING METHODS AND TOOLS   6

Decision trees–Support vector machines– Random Forest – Probabilistic models – Naïve Bayes – K-means Clustering – KNN – CNN – Principal Component analysis – Ranking – Recommendation –Featurization –Azure Machine Learning – Open-source Machine Learning libraries – Amazon's Machine Learning Tool Kit: Sage maker

UNIT IV   ADVANCED LEARNING   6

Reinforcement Learning – Q-Learning – Markov Decision process – Representation Learning – Active Learning – Ensemble Learning – Bootstrap Aggregation – Boosting – Gradient Boosting Machines – Deep Learning

UNIT V   APPLICATIONS AND CASE STUDY   6

Image Recognition–Speech Recognition– Email spam and Malware Filtering Online Fraud Detection–Medical Diagnosis – Dimensionality Reduction – Sequential covering Algorithm – Explanation Based Learning.

Total: 30 Periods

List of Experiments

1. A python program to implement decision tree.
2. A python program to implement dimensionality reduction – PCA
3. Detecting Spam mails using Support vector machine.
4. Implement character recognition using Multilayer Perceptron.
5. Choose best machine learning algorithm to implement online fraud detection.
6. A python program to implement KNN and K-means algorithms.
7. Create customer clusters using different market strategies on a dataset
8. Make a movie recommendation system.
9. A python program to implement boosting .
10. Develop a prediction mechanism to predict which employee can go on leave in a companyin near future
11. Use python to predict employee attrition in a firm and help plan their manpower (Datasetfrom Kaggle)
12. Mini project – develop a simple application using tensor flow / keras.

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Ethem Alpaydin, ―Introduction to Machine Learning‖, Third Edition, Prentice Hall of India, 2015.
2. Aurélien Géron - Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow, 2nd Edition. September 2019, Reilly Media, Inc., ISBN: 9781492032649.

REFERENCES:

1. Mukho padhyay, Sayan. Advanced Data Analytics Using Python: With Machine Learning, Deep Learning and NLP Examples. 1st ed. edition. Apress, 2018
2. Fabio Nelli, ―Python Data Analytics with Pandas, Numpy, and Matplotlib‖, Second Edition, Apress, 2018.
3. Tom Mitchell, ―Machine Learning‖, McGraw-Hill, 2017.
4. Stephen Marsland, ―Machine Learning –An Algorithmic Perspective‖, Second Edition, CRC Press, 2014.
5. Kevin P. Murphy, ―Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012.
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, ―The Elements of Statistical Learning, Second Edition, Springer, 2008.

Course code	**21MA43T**	**Semester**		**IV**		
Category	**BASIC SCIENCE COURSE (BSC)**		**L**	**T**	**P**	**C**
Course Title	**STATISTICS FOR DATA SCIENCE**		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

- This course aims at providing the required skill to apply the statistical tools in engineering Problems.
- To introduce the basic concepts of probability and two-dimensional random variables.
- To acquaint the knowledge of testing of hypothesis and for small and large samples .

PREREQUISITE:

- Basic concepts in probability and statistics.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C403.1	*Solve* problems using the concepts of Probability, random variables and standard discrete and continuous distributions	K3
C403.2	*Compute* the probabilities of two-dimensional random variables and use the central limits theorem to find the probability of the sum of independent and identically distributed random variables.	K3
C403.3	*Apply* the concept of testing of hypothesis for small and large samples in real life problems.	K3
C403.4	*Apply* the basic concepts of classification of designs of experiments in the field of agriculture and statistical quality control.	K3
C403.5	*Imparted* the notion of sampling distributions and statistical technique used in engineering and management problems.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C403.1	2	1	1	-	-	-	-	-	-	-	-	-	3	3
C403.2	2	1	1	-	-	-	-	-	-	-	-	-	2	2
C403.3	2	1	1	-	-	-	-	-	-	-	-	-	2	2
C403.4	2	1	1	-	-	-	-	-	-	-	-	-	2	2
C403.5	2	1	1	-	-	-	-	-	-	-	-	-	2	2

Note:1: Slight,2: Moderate,3:Substantial

SYLLABUS	No. of Credits: 4

UNIT I   PROBABILITY AND RANDOM VARIABLES   9+3

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables –Moments- Moment generating functions -Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II   TWO - DIMENSIONAL RANDOM VARIABLES   9+3

Joint distributions – Marginal and conditional distributions – Covariance-Multinominal Distribution-Bivariate normal distribution-Central limit theorem (for independent and identically distributed random variables) Correlation and linear regression.

UNIT III   TESTING OF HYPOTHESIS   9+3

Sampling distributions – Estimation of Parameters – Statistical hypothesis – Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, Chi-square and F distributions for mean, variance and proportion – Contingency table (test for independence)- Goodness of fit.

UNIT IV   DESIGN OF EXPERIMENTS   9+3

One way and Two-way classification – Completely randomized design- Randomized block design – Latin square design – 2^2 factorial designs.

UNIT V   STATISTICAL QUALITY CONTROL   9+3

Control charts for measurements (X and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits – Acceptance sampling.

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 2018.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

REFERENCES:
1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. James D. Miller., "Statistics for Data Science", Published by Packt Publishing Ltd., First published, November 2017.

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Course code	21HC44T	Semester	IV			
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**OPERATING SYSTEMS** **(Common to CSE , IT, ECE & AI&DS)**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the basics and functions of operating systems.
- To analyze scheduling algorithms and process synchronization.
- To understand the concept of deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android**.**

PREREQUISITE:

- Basic knowledge in Computer.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C404.1	*Analyze* various scheduling algorithms and process synchronization.	K3
C404.2	*Explain* deadlock prevention and avoidance algorithms.	K2
C404.3	*Compare* and contrast various memory management schemes.	K3
C404.4	*Explain* the functionality of file systems, I/O systems, and Virtualization	K2
C404.5	*Compare* iOS and Android Operating Systems.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C404.1	3	2	1	-	-	-	-	-	-	-	-	1	3	2
C404.2	3	2	1	-	-	-	-	-	-	-	-	1	3	2
C404.3	3	2	1	-	-	-	-	-	-	-	-	1	3	2
C404.4	3	2	1	-	-	-	-	-	-	-	-	1	3	2
C404.5	3	2	1	-	-	-	-	-	-	-	-	1	3	2

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   INTRODUCTION   9
Computer System - Elements and organization; Operating System Overview - Objectives and Functions Evolution of Operating System; Operating System Structures – Operating System Services – User Operating System Interface - System Calls — System Programs - Design and Implementation - Structuring methods.

UNIT II   PROCESS MANAGEMENT   9
Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware — Semaphores — Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III   MEMORY MANAGEMENT   9
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table -Segmentation, Segmentation with paging; Virtual Memory - Demand Paging– Copy on Write – Page Replacement - Allocation of Frames –Thrashing.

UNIT IV   STORAGE MANAGEMENT   9
Mass Storage system — Disk Structure - Disk Scheduling and Management; File-System Interface- File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V   VIRTUALIZATION AND MOBILE OPERATING-SYSTEM   9
Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Ninth Edition, 2012, Wiley.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", TataMcGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, PrenticeHall, 2018.
3. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

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Course code	**21HE32T**	Semester		IV		
Category	**ENGINEERING SCIENCE COURSE (ESC)**		**L**	**T**	**P**	**C**
Course Title	**DIGITAL LOGIC CIRCUITS** **(Common to CSE, IT, AI&DS, CSE(AI&ML))**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:
- To Simplify logic digital Circuits using Boolean Functions.
- To Design Combinational and Sequential logic Circuits.
- To Learn Memory and logic devices.
- To understand VHDL model for digital circuits.

PREREQUISITE:
- Higher Secondary level Boolean Algebra

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C302.1	*Simplify* logic functions using Boolean Algebra and K-map.	K3
C302.2	*Design* minimal combinational and sequential logic circuits.	K3
C302.3	*Understand* VHDL for digital circuits	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
C302.1	3	3	3	-		-	-	-	-	-	-	1
C302.2	3	3	3	-	1	-	-	-	-	-	-	1
C302.3	3	3	3	-	1	-	-	-	-	-	-	1

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   BOOLEAN ALGEBRA AND LOGIC GATES   9

Number Systems – Arithmetic Operations – Binary Codes- Tabulation method – Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Simplification of Boolean Functions using Karnaugh Map – Logic Gates – Universal gates Implementations.

UNIT II   COMBINATIONAL LOGIC CIRCUITS   9

Combinational Circuits – Analysis and Design Procedures – Adder-Subtractor -Multiplier – Decoders – Encoders – Multiplexers –Demultiplexers-Implementation of combinational circuits using mux, demux, encoder, decoder- Introduction to VHDL – VHDL Models of Combinational Circuits-Case study (Calender subsystem).

UNIT III   SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS   9

Sequential Circuits – Storage Elements: Latches –SR-JK-D-T –Design Procedure – Analysis of Clocked Sequential Circuits – State Reduction and Assignment –Registers –synchronous up/down counter-BCD counters-Ring counters – VHDL Models of Sequential Circuits.

UNIT IV   ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS   9

Design of Asynchronous Sequential Circuits – Moore and Mealy Model-Asynchronous up/down ripple counter-Ripple BCD counters–ASM-Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

UNIT V   MEMORY AND LOGIC DEVICES   9

Classifications of RAM – Memory Decoding – Classifications of ROM – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices-Case study (SSD-HDD-Flash memory device-Optical storage device).

                                                                    Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, ―Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog‖, 6th Edition, Pearson Education, 2018.

REFERENCES:

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2012.
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013.
4. Donald D. Givone, Digital Principles and Design‖, Tata McGraw Hill, 2003.

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Course code	**21MC02T**	Semester	IV			
Category	**MANDATORY COURSE (MC)**		**L**	**T**	**P**	**C**
Course Title	**ENVIRONMENTAL SCIENCES** **(Common for All Branches except Chemical)**		**2**	**0**	**0**	**0**

COURSE OBJECTIVES:
- To study the nature, interrelationship between living organism and environment, biodiversity, natural resources, pollution control and waste management.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To appreciate the importance of environment by assessing its impact on the human world.

PREREQUISITE:
- Basic awareness on environment.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C002.1	*Illustrate* the interrelationship between living organism and environment.	K2
C002.2	*Relate* Public awareness, environmental pollution and its problem.	K2
C002.3	*Classify* the dynamic processes and the features of natural resources.	K2
C002.4	*Measure* the development and improvement in standard of living.	K2
C002.5	*Summarize* the knowledge about human health and welfare.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C002.1	1	-	-	-	-	-	1	-	-	-	-	-
C002.2	2	-	-	-	-	-	1	-	-	-	-	-
C002.3	1	-	-	-	-	-	1	-	-	-	-	-
C002.4	1	-	-	-	-	-	2	1	-	-	-	1
C002.5	1	-	-	-	-	-	1	1	-	-	-	1

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY   12

Definition, scope and importance of environment – need for public awareness – 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 (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) –Introduction to biodiversity definition: genetic, species and ecosystem diversity –biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity –threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts –endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds, etc., Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II   NATURAL RESOURCES   10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests 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: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources. Field study of local area to document environmental assets – river / forest / grassland /
hill / mountain.

UNIT III   ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT   8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution(c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards, accidents and holocaust – solid waste management: causes, effects and control measures of municipal solid wastes- E waste and Scrap tyres – Recycling of Plastic, Glass and Paper wastes- role of an individual in prevention of pollution – pollution case studies –disaster management: floods, earthquake, cyclone and landslides- case studies. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT IV   SOCIAL ISSUES AND THE ENVIRONMENT   8

From unsustainable to sustainable development- Equitable use of resources for sustainable lifestyles – urban problems related to energy –water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of nongovernmental organization- environmental ethics: Issues and possible

solutions –principles of green chemistry–climate change, global warming, acid rain, ozone layer depletion, 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 – environmental impact assessment- enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V   HUMAN POPULATION AND THE ENVIRONMENT   7
Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – women and child welfare – HIV/AIDS –SARS- Covid-19- role of information technology in environment and human health – Case studies.

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Benny Joseph, Environmental Science and Engineering, Tata McGraw-Hill, New Delhi, 2014.
2. Anubha Kaushik, and Kaushik, C. P., Environmental Science and Engineering, New Age International Publishers, 6thEdition, 2019.

REFERENCES:

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, 2nd Edition, University Grants Commission, Universities Press, 2013.
2. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Pearson Education, 2004.
3. Tyler Miller, G., and Scott E. Spoolman, Environmental Science, Cengage Learning India Pvt, Ltd, Delhi, 2014.

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Course code	**21HC47P**	Semester		IV		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**OPERATING SYSTEMS LABORATORY** **(Common to CSE & IT)**		**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

- To understand the basics of Unix command and shell programming.
- To implement various CPU scheduling algorithms.
- To implement Deadlock Avoidance and Deadlock Detection Algorithms
- To implement Page Replacement Algorithms
- To implement various memory allocation methods.
- To be familiar with File Organization and File Allocation Strategies.

PREREQUISITE:

- Basics on Programming for problem solving.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C407.1	*Define* and implement UNIX Commands	K3
C407.2	*Compare* the performance of various CPU Scheduling Algorithms.	K3
C407.3	*Compare* and contrast various Memory Allocation Methods.	K3
C407.4	*Define* File Organization and File Allocation Strategies.	K3
C407.5	*Implement* various Disk Scheduling Algorithms.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C407.1	3	2	1	-	3	-	-	2	2	2	-	1	3	2
C407.2	3	2	1	-	3	-	-	2	2	2	-	1	3	2
C407.3	3	2	1	-	3	-	-	2	2	2	-	1	3	2
C407.4	3	2	1	-	3	-	-	2	2	2	-	1	3	2
C407.5	3	2	1	-	3	-	-	2	2	2	-	1	3	2

Note: 1: Slight, 2: Moderate, 3: Substantial

LIST OF EXPERIMENTS

1. Illustrate UNIX commands and Shell Programming

2. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close

3. Write C programs to implement the various CPU Scheduling Algorithms

4. Illustrate the inter process communication strategy

5. Implement mutual exclusion by Semaphore

6. Write C programs to avoid Deadlock using Banker's Algorithm and Deadlock Detection Algorithm

7. Write C program to implement Threading

8. Implement the paging Technique using C program

9. Write C programs to implement the following Memory Allocation Methods

      a. First Fit   b. Worst Fit   c. Best Fit

10. Write C programs to implement the various Page Replacement Algorithms

11. a) Write C programs to Implement the various File Organization Techniques

    b) Implement the following File Allocation Strategies using C programs

       a. Sequential   b. Indexed   c. Linked

12. Write C programs for the implementation of various disk scheduling algorithms

13. Case study on iOS mobile operating system.

TOTAL: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:
1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Ninth Edition, 2012, Wiley.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:
1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", TataMcGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, PrenticeHall, 2018.
3. Achyut S.Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

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Course code	**21HE38P**	Semester		IV		
Category	**ENGINEERING SCIENCE COURSE (ESC)**		**L**	**T**	**P**	**C**
Course Title	**DIGITAL LOGIC CIRCUITS LABORATORY** (Common to CSE, IT, AI&DS, CSE(AI&ML))		**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

- Understand the various basic logic gates.
- Design and implement the various combinational circuits.
- Design and implement sequential circuits
- Understand and code with HDL programming

PREREQUISITE:

- Engineering Physics

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C308.1	***Implement*** simplified combinational circuits using basic logic gates.	K2
C308.2	***Implement*** sequential circuits like registers and counters.	K2
C308.3	***Simulate*** combinational and sequential circuits using HDL.	K2
C308.4	***Implement*** simplified combinational circuits using basic logic gates.	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C308.1	3	3	3	-	1	-	-	1	2	2	-	1	3	3	3
C308.2	3	3	3	-	1	-	-	1	2	2	-	1	3	3	3
C308.3	3	2	2	-	1	-	-	1	2	2	-	1	3	3	3
C308.4	3	2	2	-	1	-	-	1	2	2	-	1	3	3	3

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS   **No. of Credits: 2**

LIST OF EXPERIMENTS

1. Verification of Boolean Theorems using basic gates.

2. Design and implementation of combinational circuits using basic gates for given functions.

3. Design and implementation of combinational circuits using basic gates for Binary to gray, Excess 3 to BCD code converters and vice versa.

4. Design and implementation of half adder /full adder/ half subtractor/ full subtractor.

5. Design and implementation of 2-bit magnitude comparator and parity checker/generator.

6. Design and implementation of Boolean expression using multiplexer and De-multiplexer.

7. Design and implementation of Boolean expression using Encoder/Decoder.

8. Design and implementation of RS,JK,T and D flip-flops.

9. Design and implementation of ripple and synchronous counters using flip-flops .

10. Design and implementation of Mod-n counters and Johnson counters using flip-flops.

11. Implementation of SISO ,PISO,SIPO,PIPO shift register using flip-flops.

12. Design Code converters, Multiplexer, Demultiplexer, Counters and Flip-flops using VHDL.

                                                                    Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, ―Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson Education, 2017.

REFERENCES:

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010

2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.

3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013

4. Donald D. Givone, Digital Principles and Design‖, Tata McGraw Hill, 2003.

LIST OF EQUIPMENT REQUIRED

Sl. No.	Description of Equipment	Required numbers (For batch of 30 students)
1.	IC Trainer Kit	15
2.	Bread Boards	15
3.	PC with HDL Software	15
4.	Seven Segment Display	15
5.	ICs 7400/7402/7404/7486/7408/7432/7483/74150/74151/ 74147/7445/7476/7491/7494/7447/74180/7485/7473/ 7411/7474	Each 50

B.Tech. – Artificial Intelligence and Data Science (R2021)

S. No.	Course code	Course title	Category	CIE Marks	SEE marks	Total marks	L	T	P	C
SEMESTER V										
THEORY										
1	21AI51T	Programming Language for AI	PCC	40	60	100	3	0	0	3
2	21HC52T	Data Analytics	PCC	40	60	100	3	0	0	3
3	21HI53IT	Web Technology	PCC	40	60	100	2	0	4	4
4	21HC54T	Block Chain Technology	PCC	40	60	100	3	0	0	3
5	21AI55T	Knowledge Engineering	PCC	40	60	100	3	0	0	3
6	-	Open Elective - I	OEC	40	60	100	3	0	0	3
PRACTICAL										
7	21HC57P	Data Analytics Laboratory	PCC	40	60	100	0	0	4	2
8	21EE01P	Mini Project - I	EEC	40	60	100	0	0	2	1
9	21EE03P	Technical Seminar	EEC	-	100	100	0	0	2	1
TOTAL										23

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Course code	21AI51T	Semester		V		
Category	PROFESSIONAL CORE COURSE (PCC)		L	T	P	C
Course Title	PROGRAMMING LANGUAGE FOR AI		3	0	0	3

COURSE OBJECTIVES:

- To introduce the List of Languages that supports AI.
- To understand the data types of R Programming.
- To perform string manipulation in R
- To program using frames and packages of R

PREREQUISITE:

- Basic Programming knowledge

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C501.1	***Understand*** basic AI languages.	K2
C501.2	***Understand*** the installation and built-in functions.	K2
C501.3	***Apply*** basic data types and functions to solve problems.	K3
C501.4	***Apply*** manipulation concepts on R-Programming.	K3
C501.5	***Evaluate*** performance of R- packages.	K4

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C501.1	2	2	1	-	2	-	-	-	-	-	-	-	3	3
C501.2	2	2	1	-	2	-	-	-	-	-	-	-	3	3
C501.3	3	2	2	-	2	-	-	-	-	-	-	-	3	3
C501.4	3	2	2	-	2	-	-	-	-	-	-	-	3	3
C501.5	3	3	2	2	2	-	-	-	-	-	-	-	3	3

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   ML AND ITS SUPPORTING LANGUAGE   8
Introduction to ML-foundation and history of ML- problems and techniques-ML programming language: Introduction to R, LISP and PROLOG, Uses of PYTHON and JAVA in AI-Basic concepts of C++, R, JULIA, HASKELL-origin and challenge of Natural Language Processing-Tensor flow: Introduction-applications-basics-components –pipeline-tensor flow examples.

UNIT II   R PROGRAMMING   9
Fundamentals of R: Installation of R & R Studio-Features of R-Variables in R-Constants in R-Operators in R-Data types and R Objects-Accepting Input from keyboard-Important Built-in functions.

UNIT III   R DATA STRUCTURES   9
R Data structures: Vectors: Creating Vectors-Accessing elements of a Vector-Operations on Vectors-Vector Arithmetic-control statements-**Function in R**-Formal and Actual Arguments-Named Arguments-Global and local variables-Argument and lazy evaluation of functions-Recursive functions.

UNIT IV   MATRIX AND STRING MANIPULATION   10
Matrices-Creating Matrices-Accessing elements of a Matrix-Operations on Matrices-Matrix transpose. **Strings**-Creating strings-paste( ) and paste0( ) -Formatting numbers and string using format()-String manipulation. **List-**Creating lists-Manipulating list elements-Merging lists-Converting lists to vectors. **Arrays in R-**Creating arrays-Accessing array elements-Calculations across array elements **R Factors**-Understanding factors-Modifying factors-Factors in Data frames.

UNIT V   DATA FRAMES AND PACKAGES   9
Data frames-Creating data frame- Operations on data frames- Accessing data frames-Creating data frames from various sources . **Data visualization -** Need for data visualization - Bar plot-Plotting categorical data-Stacked bar plot-Histogram-plot() function and line plot-pie chart/ Dpie Chart - Scatter plot - Box plot **Strings package –** Important functions in strings - regular expressions. **DYPLYR package**-Load data into data frame-Viewing the data-Selecting columns-Selecting rows-Reordering the rows-Pipe Operator-Group operations

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. "R for Data Science" Hadley Wickham 1st edition O'Reilly publisher ,2016.
2. "The Book of R" Tilman M.Davies 1st edition No Starch Pres publisher,2016.
3. "R for Dummies" Andrie de Vries 2nd edition John Wiley & Sons publisher,2015.
4. Brett Lantz , "Machine Learning with R", Packt Publishing,2019.
5. Beginning R: The Statistical Programming Language‖ , Mark Gardener, Wrox WileyPublication, First Edition, 2012.

REFERENCES:

1. "The Art of R Programming " Norman Matloff 1st edition No Starch Pres Publisher,2011.
2. "Discovering Statistics Using R " Andy Field 1st edition SAGE Publisher,2022.
3. "Handson   Programming with   R"   Garrett Grolemund   2nd   edition O'ReillyPublisher,2014.
4. Nina Zumel, John Mount, ―Practical Data Science with R‖, Manning Publications, 2014.
5. W. N. Venables, D. M. Smith and the R Core Team, ―An Introduction to R, 2013.
6. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, ―Practical Data Science Cookbook‖, Packt Publishing Ltd., 2014.

Web link: http://www.johndcook.com/R_language_for_programmers.html

Course code	**21HC52T**	**Semester**			**V**	
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**DATA ANALYTICS**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To study the basic inferential statistics and sampling distribution.
- To understand the concept of estimation of parameters using fundamental tests and testing of hypotheses.
- To understand the techniques of analysis of variance.
- To gain knowledge in predictive analytics techniques.
- To perform a case study with any available sample data sets.

PREREQUISITE:

- Basic knowledge of data science

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C502.1	*Understand* the concept of sampling	K2
C502.2	*Apply* the knowledge to derive hypotheses for given data	K3
C502.3	*Demonstrate* the skills to perform various tests in the given data	K3
C502.4	*Ability* to derive inference using Predictive Analytics	K3
C502.5	*Perform* statistical analytics on a data set	K4

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C502.1	3	2	1	1	-	-	-	-	-	-	-	-	3	3
C502.2	3	2	1	1	-	-	-	-	-	-	-	-	1	2
C502.3	3	2	1	1	-	-	-	-	-	-	-	-	2	1
C502.4	2	2	1	1	-	-	-	-	-	-	-	-	1	2
C502.5	2	2	1	1	-	-	-	-	-	-	-	-	1	2

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   INFERENTIAL STATISTICS-I   9

Populations – samples – random sampling – probability and statistics Sampling distribution – creating a sampling distribution – mean of all sample means – standard error of the mean – other sampling distributions Hypothesis testing – z-test – z-test procedure – statement of the problem – null hypothesis – alternate hypotheses – decision rule – calculations – decisions - interpretations

UNIT II   INFERENTIAL STATISTICS II   9

Why hypothesis tests? – Strong or weak decisions – one-tailed and two-tailed tests – case studies Influence of sample size – power and sample size Estimation – point estimate – confidence interval – level of confidence – effect of sample size.

UNIT III   T-TEST   9

T-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating the standard error – case studies t-test for two independent samples – statistical hypotheses – sampling distribution – test procedure – p-value – statistical significance – estimating effect size – meta analysis t-test for two related samples

UNIT IV   ANALYSIS OF VARIANCE   9

F-test – ANOVA – estimating effect size – multiple comparisons – case studies Analysis of variance with repeated measures Two-factor experiments – three f-tests – two-factor ANOVA – other types of ANOVA Introduction to chi-square tests.

UNIT V   PREDICTIVE ANALYTICS   9

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling Regression using Stats Models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy Time series analysis – moving averages – missing values – serial correlation – autocorrelation Introduction to survival analysis- Case Studies - Real Time Sentiment Analysis, Stock Market Predictions-Weka Tool

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.

2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014. [Unit V]

REFERENCES:

1. David Spiegelhalter, "The Art of Statistics: Learning from Data", Pelican Books, 2020.

2. Peter Bruce, Andrew Bruce, and Peter Gedek, "Practical Statistics for Data Scientists", Second Edition, O'Reilly Publishers, 2020.

3. Charles R. Severance, "Python for Everybody: Exploring Data in Python 3", Shroff Publishers, 2017.

4. Bradley Efron and Trevor Hastie, "Computer Age Statistical Inference", Cambridge University Press, 2016.

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Course code	**21HI53IT**	Semester		**V**		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**WEB TECHNOLOGY**		**2**	**0**	**4**	**4**

COURSE OBJECTIVES:

- To understand about client-server communication and protocols used during communication.
- To design interactive web pages using Scripting languages.
- To learn server-side programming using servlets and JSP.
- To develop web pages using XML/XSLT.

PREREQUISITE:

- Database management System

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C503.1	*Design* simple web pages using mark-up languages like HTML and XHTML.	K3
C503.2	*Design* dynamic web pages using CSS and java script that is easy to navigate and use.	K3
C503.3	*Design* dynamic web pages with server–side and other technologies.	K3
C503.4	*Develop* web pages using JSP.	K3
C503.5	*Explain* various web services and Create customized Services.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C503.1	3	2	1	-	-	-	-	-	-	-	-	1	3	2
C503.2	3	2	1	-	-	-	-	-	-	-	-	1	3	2
C503.3	3	2	1	-	-	-	-	-	-	-	-	1	3	2
C503.4	3	2	1	-	-	-	-	-	-	-	-	1	3	2
C503.5	3	2	1	-	-	-	-	-	-	-	-	1	3	2

Note:1: Slight,2: Moderate,3:Substantial

UNIT I   WEB SITE BASICS AND HTML   5
Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols – The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics Some Fundamental HTML Elements - Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

UNIT II   CSS AND CLIENT SIDE SCRIPTING   5
Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- -Text Properties-Box Model Normal Flow Box Layout Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-StatementsOperators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

UNIT III   SERVER SIDE SCRIPTING   6
Host Objects: Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-Server-Side Programming: Java Servlets- Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle- Parameter Data Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency- Databases and Java Servlets.

UNIT IV   JSP AND XML   6
Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm- Databases and JSP. Representing Web Data: XML- -Namespaces- DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

UNIT V   AJAX, WEB SERVICES AND ANGULAR   8
AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods. Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service Client-Describing Web Services: WSDL- Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files. Understanding Angular - Adding Angular to Your Environment-Using the Angular CLI - Creating a Basic Angular Application.

Total: 30 Periods

LIST OF EXPERIMENTS

1. Create a web page with the following using HTML.
   i) To embed an image map in a web page.
   ii) To fix the hot spots.
   iii) Show all the related information when the hot spots are clicked
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets:
   - To invoke servlets from HTML forms.
   - Session Tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases
   - For conducting on-line examination.
   - For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Programs using DOM and SAX parsers.
9. Programs using AJAX.
10. Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Database.
11. Show and hide elements and display lists of data using built-in Angular directives.
12. Create a Basic Angular Application

Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Jason Gilmore, "Beginning PHP and MySQL from Novice to Professional", Fourth Edition, Apress Publications, 2010.
3. Brad Dayley, Brendan Dayley ,Caleb "Node.js, MongoDB and Angular Web Development" Second Edition,Addison-Wesley,2018

REFERENCES:

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown,‖ Core Web Programming‖ Second Edition, Volume I and II, Pearson Education, 2001.
4. Bates, ―Developing Web Applications‖, Wiley, 2006
5. Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, "ng-book, The Complete Book on Angular 4" September 2016.

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Course code	**21HC54T**	Semester		**V**		
Category	**PROFESSIONAL CORE COURSE (PEC)**		**L**	**T**	**P**	**C**
Course Title	**BLOCK CHAIN TECHNOLOGY**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the fundamentals of Blockchain.
- To obtain knowledge about technologies of Blockchain.
- To incorporate the models of Blockchain- Ethereum.
- To learn the models of Hyperledger Fabric.

PREREQUISITE:

- Basic knowledge of cryptographic techniques

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C504.1	*Define* and *explain* the fundamentals of Blockchain	K2
C504.2	*Illustrate* the technologies of Blockchain	K3
C504.3	*Describe* the models of Blockchain	K2
C504.4	*Analyze* and demonstrate the Ethereum	K3
C504.5	*Analyze* and demonstrate Hyperledger fabric	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C504.1	3	2	1	1	-	-	-	-	-	-	-	-	3	3
C504.2	3	2	1	1	-	-	-	-	-	-	-	-	1	2
C504.3	3	2	1	1	-	-	-	-	-	-	-	-	2	1
C504.4	2	2	1	1	-	-	-	-	-	-	-	-	1	2
C504.5	2	2	1	1	-	-	-	-	-	-	-	-	1	2

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS   **No. of Credits: 3**

UNIT I   INTRODUCTION   9

Basic Cryptographic primitives used in Blockchain –Secure- Collision- Resistant hash functions - Digital signature - Public key cryptosystems – Zero knowledge proof systems - Need for Distributed Record Keeping – Modelling faults and adversaries- Byzantine Generals problem - Consensus algorithms and their scalability problems - Why Nakamoto Came up with Blockchain based cryptocurrency.
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UNIT II   TECHNOLOGIES BORROWED IN BLOCKCHAIN   9

Technologies Borrowed in Blockchain –hash pointers- Consensus- Byzantine Models of fault tolerance- Digital cash etc.- Bitcoin blockchain - Wallet – Blocks - Merkley Tree - hardness of mining - Transaction verifiability - Anonymity - forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions.

UNIT III   MODELS FOR BLOCKCHAIN   9

Models f-GARAY model -RLA Model -Proof of Work (PoW) as random oracle - Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS) - Bitcoin scripting language and their use

UNIT IV   ETHEREUM   9

Ethereum -Ethereum Virtual Machine (EVM) -Wallets for Ethereum -Solidity - Smart Contracts - The Turing Completeness of Smart Contract Languages and verification challenges- Using smart contracts to enforce legal contracts- Comparing Bitcoin scripting vs. Ethereum Smart Contracts-Some attacks on smart contracts

UNIT V   MEMORY & I/O SYSTEMS   9

Hyperledger fabric- the plug and play platform and mechanisms in permissioned block chain - Beyond Cryptocurrency – applications of block chain in cyber security- integrity of information- E-Governance and other contract enforcement mechanisms - Limitations of block chain as a technology and myths vs reality of blockchain technology

                                                                          Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. S.Shukla, M.Dhawan, S.Sharma,S. Venkatesan "Blockchain Technology:Cryptocurrency and Applications" ,Oxford University Press 2019 .

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and cryptocurrency technologies: a comprehensive introduction", Princeton University Press,2016.

REFERENCES:

1. Joseph Bonneau et al, SoK: "Research perspectives and challenges for Bitcoin and cryptocurrency", IEEE Symposium on security and Privacy, 2015.
2. J.A.Garay et al, "The bitcoin backbone protocol - analysis and applications", EUROCRYPT 2015,Volume 2.
3. R.Pass et al, "Analysis of Blockchain protocol in Asynchronous networks", EUROCRYPT 2017.Pass et al," Fruitchain- a fair blockchain", PODC 2017

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Course code	**21AI55T**	Semester		**V**		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**KNOWLEDGE ENGINEERING**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

The objective of this course is to prepare the student

- To get introduced to the basic knowledge representation, problem solving, and learning methodsof Artificial Intelligence.
- To solve problems in Artificial Intelligence using Python.
- To familiarize with Fuzzy Logic and knowledge processing in expert systems.

PREREQUISITE:

- Introduction to Artificial Intelligence.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms Level
On successful completion of this Course, students will be able to		
C505.1	*Understand* the fundamental knowledge management process	K2
C505.2	*Compare* various information retrieval techniques.	K2
C505.3	*Understand* the machine learning concepts	K2
C505.4	*Apply* ontology engineering on language processing.	K3
C505.5	*Apply* knowledge sharing on web application	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C505.1	2	2	-	-	-	-	-	-	-	-	-	-	3	3
C505.2	2	2	1	-	-	-	-	-	-	-	-	-	3	3
C505.3	2	2	-	-	-	-	-	-	-	-	-	-	3	3
C505.4	3	2	2	-	-	-	-	-	-	-	-	-	3	3
C505.5	3	2	2	-	-	-	-	-	-	-	-	-	3	3

Note: 1: Slight, 2: Moderate, 3: Substantial

UNIT I   INTRODUCTION   9

Data, Information and knowledge-knowledge management- process and principles ofKnowledge management -Artificial intelligence-Knowledge based systems.

UNIT II   KNOWLEDGE ACQUISITION   9

Information gathering-Information Retrieval-Natural language processing Morphology, Lexicon , syntax , and semantics , parsing, POS tagging and named entity Tagging – Information Extraction and filtering.

UNIT III   PREDICATE LOGIC   9

The propositional and predicate calculii- theorem proving, logic programming and knowledge representation -logic for knowledge-based systems-summary of three formalisms-a word of warning.

UNIT IV   KNOWLEDGE REPRESENTATION AND REASONING   9

Knowledge representation - Using Predicate logic - representing facts in logic, functions and predicates Knowledge representation languages – non - monotonic reasoning - Probabilistic-Reasoning- Knowledge representation -Using Predicate logic-representing facts in logic, functions and predicates-Resolution in propositional logic - Resolution in predicate logic-Unification.

UNIT V   KNOWLEDGE SHARING ON THE WEB   9

Ontology Engineering**:** Overview to Ontology-Classifications of Ontology-Methodology use in Ontology - Ontology VS Language - Information Distribution and Integration - Semantic web and its applications-RDF and linked data- Description logic-Web Ontology Language-Social web and semantics.

Total:45 Periods

LEARNING RESOURCES:

TEXTBOOKS:

1. Kendal, Simon Creen Malcolm An Introduction to Knowledge engineering, Springer first edition, 2007

2. R.J. Brachman and H.J. Levesque. Knowledge representation and reasoning (Elsevier 2004)

REFERENCES:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A modem approach (Prentice Hall editionsecond edition, 2002)

2. P. Jackson, Introduction to expert systems, Addison Wesley, 1999.

3. John Debenham, Knowledge Engineering: Unifying Knowledge Base and Database Design,Springer,1998.

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Course code	**21AI01OT**	Semester			V	
Category	**OPEN ELECTIVE COURSE (OEC)**		**L**	**T**	**P**	**C**
Course Title	**ADVANCED PYTHON PROGRAMMING**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the Object-oriented concepts of Python.
- To define Python functions and use function calls to solve problems.
- To process file handling in Python.
- To understand Python libraries for implementing Machine Learning models.

PREREQUISITE:

- Basic Knowledge in Python.

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C001.1	*Understand* the basic principles of Python programming language.	K2
C001.2	*Apply* the Object- Oriented Programming concepts in Python.	K3
C001.3	*Construct* database and GUI applications using Python	K2
C001.4	*Apply* commonly used operations involving file systems and regular expressions.	K3
C001.5	*Write* Machine Learning algorithms.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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
C001.1	2	2	1	-	2	-	-	-	-	-	-	-	3	3
C001.2	3	2	1	-	2	-	-	-	-	-	-	-	3	3
C001.3	2	2	1	-	2	-	-	-	-	-	-	-	3	3
C001.4	3	2	1	-	2	-	-	-	-	-	-	-	3	3
C001.5	3	2	1	-	2	-	-	-	-	-	-	-	3	3

Note: 1: Slight, 2: Moderate, 3: Substantial

SYLLABUS   No. of Credits: 3

UNIT I   INTRODUCTION TO PYTHON   9

Use IDLE to develop programs- Basic coding skills - working with data types and variables - working with numeric data - working with string data - Python functions - **Boolean expressions**- selection structure - iteration structure - working with lists - work with a list of lists - work with tuples - work with dates and times - get started with dictionaries.

UNIT II   OOPS CONCEPTS INPYTHON   9

Classes and objects– Classes in Python – Constructor – Data hiding – Creating Classes- Instance Methods - Special Methods – **Class Variables**– Inheritance – Polymorphism - Type Identification - Custom Exception Classes – Iterators - generators and decorators.

UNIT III   RELATIONAL DATABASE AND PYTHON   9

SQL statements for data manipulation Using SQLite Manager-Working of database Using Python - Calling C/C++ from Python c-types, Extension Modules in C/C++-Creating a GUI that handles an event, working with components.

UNIT IV   FILE I/OAND ERROR HANDLING   9

Introduction-Data Streams, Creating Your Own Data Streams - Access Modes - Writing Data to a File - Reading Data from a File - Additional File Methods - Handling IO Exceptions-Errors - Run Time Errors - **The Exception Model**- Exception Hierarchy - Handling Multiple Exceptions - Working with Directories.

UNIT V   MACHINE LEARNING ALGORITHMS   9
Numpy for numerical Data-Pandas for Data Analysis, Matplotlib for Python plotting, Seaborn for Statical plots – interactive Dynamic visualizations - SciKit for Machine learning, **Threads**-Creating and Joining Threads - Object threads.

Total: 45 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Brett Slatkin , "Effective Python: 90 Specific Ways to Write Better Python , 2020.

2. Addison-Wesley Professional, "Effective Python: 90 Specific Ways to Write Better Python, 2ndEdition, 2019.

3. Michael Urbanand Joel Murach, Python Programming, Shroff/Murach,2016.

REFERENCES:

1. John V Guttag, "Introduction to Computation and Programming Using Python: With Applicationsto Computational Modeling and Understanding Data", Third Edition, MIT Press , 2021.

2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.

3. https://www.python.org/.

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Course code	**21HC57P**	Semester		V		
Category	**PROFESSIONAL CORE COURSE (PCC)**		**L**	**T**	**P**	**C**
Course Title	**DATA ANALYTICS LABORATORY**		**0**	**0**	**4**	**2**

COURSE OBJECTIVES:

- To study and write simple programs using the basic packages for handling data
- To do various sampling and T,Z, Anova test in various samples
- To perform case study and design a system
- To demonstrate Time Series Analysis in any real time application

PREREQUISITE:

- Basic Programming Skill

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C507.1	***Understand*** the various packages in Python	K2
C507.2	***Demonstrate*** the understanding of data distribution with various	K3
C507.3	***Ability*** to Implement T-Test ,Anova and Z-Test on sample data sets	K3
C507.4	***Understanding*** of Mathematical models in real world problems.	K2
C507.5	***Conduct*** time series analysis and draw conclusion	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C507.1	3	2	2	1	-	-	-	-	-	-	-	-	1	1
C507.2	3	2	2	1	-	-	-	-	-	-	-	-	2	1
C507.3	3	2	2	1	-	-	-	-	-	-	-	-	2	1
C507.4	3	2	2	1	-	-	-	-	-	-	-	-	2	1
C507.5	3	2	2	1	-	-	-	-	-	-	-	-	3	1

Note: 1: Slight, 2: Moderate, 3: Substantial

1. To find the Random Sampling of population using python

2. To write the case studies of Z-test

       a) One-Sample Z Test

       b) Two Sample Z Test

3. To write the case studies of T-test

       a) One-Sample T- Test

       b) Two Sample T- Test

4. To Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data

5. To Apply linear regression Model techniques to predict the data on iris dataset

6. To apply multiple regressions, if data have a continuous independent variable. Apply on any dataset.

7. To Apply Logistic Regression Model the students grading system

8. To find financial Time series data Analysis

9. To find Stock Market Prediction using Weka.

10. Construct Decision Tree for Weather data and classify it.

11. Develop a procedure for Visualization for Weather Table.

12. Plot the histogram, bar chart and pie chart on sample data.

13. Find the data distributions using box and scatter plot.

       Total: 60 Periods

LEARNING RESOURCES:

TEXT BOOKS:

1. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014. [Unit V]

REFERENCES:

1. David Spiegelhalter, "The Art of Statistics: Learning from Data", Pelican Books, 2020.
2. Peter Bruce, Andrew Bruce, and Peter Gedek, "Practical Statistics for Data Scientists", Second Edition, O'Reilly Publishers, 2020.
3. Charles R. Severance, "Python for Everybody: Exploring Data in Python 3", Shroff Publishers, 2017.
4. Bradley Efron and Trevor Hastie, "Computer Age Statistical Inference", Cambridge University Press, 2016.

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Course code	**21EE01P**	Semester			**V**	
Category	**EMPLOYABILITY ENHANCEMENT COURSE (EEC)**	**L**	**T**	**P**	**C**	
Course Title	**MINI PROJECT-I**	**0**	**0**	**2**	**1**	

COURSE OBJECTIVES:

- To introduce project based experiential learning

- To design and create am AI model and Prototype to solve real world problems.

PREREQUISITE:

- Project management and Programming Language Courses

COURSE OUTCOMES:

CO. No.	Course outcomes	Blooms level
On successful completion of this Course, students will be able to		
C001.1	*Understand* the strategy and levels of developing a Mini Project/Product	K2
C001.2	*Analyze* the real-world problems and existing solutions	K4
C001.3	*Apply* the knowledge of AI engineering to create a new design ofproduct	K3
C001.4	*Synthesize* the results and arrive at scientific conclusions / products /solution	K5
C001.5	*Document* the results in the form of technical report / presentation	K2

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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	PSO-4
C001.1	3	3	2	2	2	1	1	1	3	2	2	2	2	2	2	2
C001.2	3	3	2	2	2	1	1	1	3	2	2	2	2	2	2	2
C001.3	3	3	2	2	2	1	1	1	3	2	2	2	2	2	2	2
C001.4	3	3	2	2	2	1	1	1	3	2	2	2	2	2	2	2
C001.5	3	3	2	2	2	1	1	1	3	2	2	2	2	2	2	2

Note: 1: Slight, 2: Moderate, 3: Substantial

Students are advised to carry out the projects in the following domains with latest IT
trends, butnot limited

- Machine learning
- AI
- Block Chain
- Cloud Computing
- IoT
- Android Applications
- Data Mining

Total: 30 Periods

ONLINE RESOURCES:

https://www.nature.com/articles/s41467-020-17112-9
https://data-flair.training/blogs/artificial-intelligence-project-ideas/ https://builtin.com/blockchain
https://www.ibm.com/in-en/cloud/free
https://www.evosysglobal.com/blog/iot-and-its-applications-in-todays-world
https://developer.android.com/topic/architecture/domain-layer
https://www.simplilearn.com/what-is-data-mining-article

Course code	**21EE03P**	Semester		**V**		
Category	**EMPLOYABILITY ENHANCEMENT COURSE (EEC)**		**L**	**T**	**P**	**C**
Course Title	**TECHNICAL SEMINAR**		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

- To inculcate the habit of critical thinking
- To emphasise the importance of reading and effective writing
- To expose meta-disciplinary research works
- To cultivate a scholarly habit

PREREQUITES:

- Good Communication Skill for Presentation Techniques.
- Good management of time

COURSE OUTCOMES:

CO. No.	Course Outcomes	Blooms level
On successful completion of this Course, students will be able to		
C003.1	*Define* a compelling and viable problem, question, or project byexploring the purpose and philosophy on topics in technology	K2
C003.2	*Learn to* infuse material from primary and secondary sources withtheir own ideas in research papers	K2
C003.3	*Understand* the stages of writing process which strengthens thetechnical and workplace writing tasks	K2
C003.4	*Demonstrate* an ability to synthesize and assess arguments in scholarly articles and monographs professionally	K3
C003.5	*Develop* Presentation and Communication skills.	K3

COURSE OUTCOMES MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

CO No.	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	PSO-4
C003.1	2	2	-	-	-	-	-	-	3	2	-	2	2	2	2	-
C003.2	2	2	-	-	-	-	-	-	3	2	-	2	2	2	2	-
C003.3	2	2	-	-	-	-	-	-	3	2	-	2	2	2	2	-
C003.4	2	2	-	-	-	-	-	-	3	2	-	2	2	2	2	-
C003.5	2	2	-	-	-	-	-	-	3	2	-	2	2	2	2	-

Note: 1: Slight, 2: Moderate, 3: Substantial

DOMAINS:

Students are advised to choose seminar topics in the following domains with latest IT trends, but not limited

- An approach to AI methodology
- AI- Jobs and Future work
- Negative by AI
- Man Vs Computer
- AI meets Chemistry
- Neural Machine Translation
- Barriers to the growth of AI

Total : 30 Periods

ONLINE RESOURCES:

1. https://www.cse.iitb.ac.in/~cs621-2011/cs621-2007/old/seminar/AIPlanning.pdf
2. https://www.cse.iitb.ac.in/~cs621-2011/cs621-2007/old/seminar_topics.html
3. https://www.topicsforseminar.com/p/ieee-seminar-topics-for-ai.html?m=1#gsc.tab=0

List of Professional Elective Courses

S. No.	Course Code	Engineering Stream Courses
PROFESSIONAL ELECTIVE I		
1	21AI651PT	Advanced Python Programming
2	21AI652PT	Scalable system for Data science
3	21AI653PT	Research Methodology
4	21AI654PT	Security for Data Science
5	21AI655PT	Advanced Topics on Database
PROFESSIONAL ELECTIVE II		
6	21AI731PT	Information Retrieval Technique
7	21AI732PT	Modeling and Simulation
8	21AI733PT	Cognitive Science
9	21AI734PT	Numerical Optimization
10	21AI735PT	Medical Imaging
PROFESSIONAL ELECTIVE III		
11	21AI741PT	Agile Methodologies
12	21AI742PT	Game Programming
13	21AI743PT	Multidisciplinary Sensors
14	21AI744PT	Virtual Reality and Augmented Reality
15	21AI745PT	Cyber Security & Ethical Hacking
Science and Management Stream Courses		
16	21AI7701	Distributed system Technologies
17	21AI7702	Mining with Massive Database
18	21AI7703	Reinforcement Learning
19	21AI7704	Data Driven Decision Making
20	21AI7705	Business Intelligence
21	21AI7801	Large Scale Visual Data Analytics
22	21AI7802	Autonomous system and Drones
23	21AI7803	Spatio-temporal Data Analysis
24	21AI7804	Geospatial Data Analysis
25	21AI7805	Quantum Artificial Intelligence
26	21AI7901	Video Analytics
27	21AI7902	Principles of Software Engineering
28	21AI7903	Neural Networks

29	21AI7904	Computer Architecture and Organization
30	21AI7905	Computer Networks

LIST OF OPEN ELECTIVES

S. No	COURSE CODE	NAME OF THE COURSE
1	21AI651PT	Advanced Python Programming
2	21AI31T	Introduction to Artificial Intelligence
3	21AI03OT	Machine Learning Techniques for Engineers
4	21AI04OT	Data Science