
STUDY SCHEME & SYLLABUS FOR B.SC Artificial Intelligence & Machine Learning BATCH-2025

B.SC Artificial Intelligence & Machine Learning

First Semester

Course Code	Course Type	Course Title	Load Allocation				Marks Distribution		
			Cd	L	T	P	Internal	External	Total Marks
25C2CCU-101	Core Theory	Mathematics	4	3	1	0	40	60	100
25C2CCU-102	Core Theory	Fundamentals of Computer and IT	4	3	1	0	40	60	100
25C2PYC-C02	Core Theory	Programming in Python	4	3	1	0	40	60	100
25C2AIU-111	Core Practical/Laboratory	Workshop on Multimedia Tools	2	0	0	4	60	40	100
25C2PYC-C12	Core Practical/Laboratory	Programming in Python Laboratory	2	0	0	4	60	40	100
25C2CCU-112	Core Practical/Laboratory	Fundamentals of Computer and IT Laboratory	2	0	0	4	60	40	100
25C2CCU-103	Ability Enhancement Compulsory Course (AECC)-I	English	1	1	0	0	40	60	100
25C2CCU-113	Ability Enhancement Compulsory Course (AECC)	English Practical/ Laboratory	1	0	0	2	30	20	50
25C2HVC-C01	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules	3	3	0	0	40	60	100
25C2HVC-C11	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)*	1	0	0	1	25	0	25
25C2CCU-111		Mentoring and Professional Development **	1	0	0	1	25	0	25
	TOTAL		25	13	3	16	460	440	900

* The Human Values, De-addiction and Traffic Rules (Lab/ Seminar) and Mentoring and Professional Development course will have internal evaluation only.

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Second Semester

Course Code	Course Type	Course Title	Load Allocation				Marks Distribution		
			C d	L	T	P	Internal	External	Total Marks
25C2AIU-201	Core Theory	Fundamentals of Statistics	4	3	1	0	40	60	100
25C2AIU-205	Core Theory	Operating Systems	4	3	1	0	40	60	100
25C2DSC-C03	Core Theory	Data Structures	4	3	1	0	40	60	100
25C2DSC-C13	Core Practical/Laboratory	Data Structures Laboratory	2	0	0	4	60	40	100
25C2CCU-215	Core Practical/Laboratory	Operating Systems Laboratory	2	0	0	4	60	40	100
25C2AIU-211	Core Practical/Laboratory	Fundamentals of Statistics Laboratory	2	0	0	4	60	40	100
25C2CCU-201	Ability Enhancement Compulsory Course (AECC) -III	Environmental Studies	2	2	0	0	40	60	100
25C2CCU-211		Mentoring and Professional Development	1	0	0	1	25	--	25
	TOTAL		21	11	3	13	365	360	725

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Third Semester

Course Code	Course Type	Course Title	Load Allocation				Marks Distribution		
			Cd	L	T	P	Internal	External	Total Marks
25C2AIU-301	Core Theory	Artificial Intelligence	4	3	1	0	40	60	100
25C2AIU-302	Core Theory	Design and Analysis of Algorithms	4	3	1	0	40	60	100
25C2AIU-303	Core Theory	Database Management Systems	4	3	1	0	40	60	100
25C2AIU-312	Core Practical/Laboratory	Design and Analysis of Algorithms Lab	2	0	0	4	60	40	100
25C2AIU-313	Core Practical/Laboratory	Database Management Systems Lab	2	0	0	4	60	40	100
25C2AIU-311	Core Practical/Laboratory	Artificial Intelligence Lab	2	0	0	4	60	40	100
25C2AIU-304	Skill Enhancement Course-I	Internet Tools and Applications	1	1	0	0	20	30	50
25C2AIU-314	Skill Enhancement Course- Laboratory	Internet Tools and Application Lab	2	0	0	4	60	40	100
25C2AIU-315	Skill Enhancement Course	Career and Placement Planning - 1	1	0	0	2	50	-	50
25C2AIU-316	Value Added Course (NCC)	*MOOC	0	0	0	2	-	-	S/US
	TOTAL		22	10	3	20	430	370	800

Note: * MOOCs List is to be prepared by the department level committee.

S= Satisfactory, US=Un Satisfactory

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Fourth Sem

Course Code	Course Type	Course Title	Load Allocation				Marks Distribution		
			Cd	L	T	P	Internal	External	Total Marks
25C2AIU-401	Core Theory	Data Science & Machine Learning	4	3	1	0	40	60	100
25C2AIU-402	Core Theory	Software Engineering	4	3	1	0	40	60	100
25C2AIU-403	Core Theory	Cloud Computing	4	3	1	0	40	60	100
25C2AIU-411	Core Practical/Laboratory	Data Science & Machine Learning Lab	2	0	0	4	60	40	100
25C2AIU-412	Core Practical/Laboratory	Cloud Computing Lab	2	0	0	4	60	40	100
25C2AIU-404	Skill Enhancement Course-II	Advance Python Programming	1	3	0	0	20	30	50
25C2AIU-413	Skill Enhancement Course- Laboratory	Advance Python Programming Lab	1	0	0	2	30	20	50
25C2AIU-414	Skill Enhancement Course	Career and Placement Planning - 2	1	0	0	2	50	-	50
25C2AIU-415	Value Added Course (NCC)	*MOOC	0	0	0	2	-	-	S/US
Total			19	12	3	18	340	310	650

Note: * MOOCs List is to be prepared by the department level committee.

S= Satisfactory, US=Un Satisfactory

Students will undergo 45 days Industrial Training after 4th semester. Examination will be conducted along with 5th semester practical.

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Fifth Sem

Course Code	Course Type	Course Title	Load Allocation				Marks Distribution		
			Cd	L	T	P	Internal	External	Total Marks
25C2AIU-501	Skill Enhancement Course-III	R Programming	3	3	0	0	40	60	100
25C2AIU-511	Skill Enhancement Course-Laboratory	R Programming Laboratory	1	0	0	2	30	20	50
	Open Elective-I		3	3	0	0	40	60	100
	Elective-I		3	3	0	0	40	60	100
	Elective-II		4	3	1	0	40	60	100
	Elective-I Laboratory		2	0	0	4	60	40	100
	Elective-II Laboratory		2	0	0	4	60	40	100
25C2AIU-512	Project	Project 1	2	0	0	4	60	40	100
25C2AIU-513	Industrial Training	Industrial Training	2	0	0	4	60	40	100
25C2AIU-514	Skill Enhancement Course	Career and Placement Planning - 3	1	0	0	2	50	-	50
25C2AIU-515	Value Added Course (NCC)	*MOOC	0	0	0	2	-	-	S/US
Total			23	12	1	22	480	420	900

Note: * MOOCs List is to be prepared by the department level committee. S= Satisfactory, US=Un Satisfactory

Elective – I	
Course Code	Course Title
25C2AIU-PE1-01	Natural Language Processing
25C2AIU-PE1-02	Image Processing
25C2AIU-PE1-03	Web Mining & Recommender System

Elective-II	
Course Code	Course Title
25C2AIU-PE2-01	Modelling and Simulation
25C2AIU-PE2-02	Neural Network
25C2AIU-PE2-03	IOT & Blockchain Technology

Elective – I Laboratory		Elective-II Laboratory	
Course Code	Course Title	Course Code	Course Title
25C2AIU-PE1-11	Natural Language Processing Lab	25C2AIU-PE2-11	Modelling and Simulation Lab
25C2AIU-PE1-12	Image Processing Lab	25C2AIU-PE2-12	Neural Network Lab
25C2AIU-PE1-13	Web Mining & Recommender System Lab	25C2AIU-PE2-13	IOT & Blockchain Technology Lab

**B.SC Artificial Intelligence & Machine Learning
Sixth Sem**

Course Code	Course Type	Course Title	Load Allocation				Marks Distribution		
			Cd	L	T	P	Internal	External	Total Marks
25C2AIU-601	Skill Enhancement Course-III	Weka- Open Source Software Tool	3	3	0	0	40	60	100
25C2AIU-611	Skill Enhancement Course-Laboratory	Weka- Open Source Software Tool Lab	2	0	0	4	60	40	100
	Open Elective-II		3	3	0	0	40	60	100
	Elective-III		4	3	1	0	40	60	100
	Elective-IV		4	3	1	0	40	60	100
	Elective-III Laboratory		2	0	0	4	60	40	100
	Elective-IV Laboratory		2	0	0	4	60	40	100
25C2AIU-612	Project	Project 2	2	0	0	4	60	40	100
25C2AIU-613	Skill Enhancement Course	Career and Placement Planning - 4	1	0	0	2	50	-	50
25C2AIU-614	Value Added Course (NCC)	*MOOC	0	0	0	2	-	-	S/US
TOTAL			23	12	2	20	450	400	850

Note: * MOOCs List is to be prepared by the department level committee. S= Satisfactory, US=Un Satisfactory

Elective – III	
Course Code	Course Title
25C2AIU-PE3-01	Business Intelligence
25C2AIU-PE3-02	Intelligent Systems
25C2AIU-PE3-03	Geographic Information Systems
25C2AIU-PE3-04	Data Mining & warehousing

Elective – IV	
Course Code	Course Title
25C2AIU-PE4-01	Social Network Analysis
25C2AIU-PE4-02	Big Data Analytics
25C2AIU-PE4-03	Computer Vision
25C2AIU-PE4-04	Deep Learning

Elective – III Laboratory	
Course Code	Course Title
25C2AIU-PE3-11	Business Intelligence Lab
25C2AIU-PE3-12	Intelligent Systems Lab
25C2AIU-PE3-13	Geographic Information Systems Lab
25C2AIU-PE3-14	Data Mining & warehousing Lab

Elective – IV Laboratory	
Course Code	Course Title
25C2AIU-PE4-11	Social Network Analysis Lab
25C2AIU-PE4-12	Big Data Analytics Lab
25C2AIU-PE4-13	Computer Vision Lab
25C2AIU-PE4-14	Deep Learning Lab

25C2CCU-101

Mathematics

Program: B.Sc. (AI & ML)	L: 3 T: 1 P: 0
Branch: Computer Applications	Credits: 4
Semester: 1 st	Contact hours: 44 hours
Internal max. marks: 40	Theory/Practical: Theory
External max. marks: 60	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: core/elective: Core

Prerequisite: Student must have the knowledge of Basic Mathematics.

Co requisite:NA.

Additional material required in ESE:-NA-

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

CO#	Course Outcomes
CO1	define various mathematical set notations.
CO2	explain different logical terms used in basic mathematics.
CO3	illustrate various operations and formulas by matrix algebra.
CO4	summarize the finite number of quantities in AP and GP.

Detailed contents	Contact hours
<u>Unit-I</u> Set Introduction, Objectives, Representation of Sets (Roster Method, Set Builder Method), Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union of Set, Intersection of Set, Difference of Set, Symmetric Difference of Set) Universal Sets, Complement of a Set.	12 hours
<u>Unit-II</u> Logic Statement, Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.	10 hours

<u>Unit -III</u> Matrices Introduction, Types of Matrix (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix, Unit Matrix, NullMatrix, ComparableMatrix, EqualMatrix), Scalar Multiplication, Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix.	12 hours
<u>Unit-IV</u> Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantities in A.P, Arithmetic Means, Geometric Progression, Geometric Mean.	10 hours

Text Books:

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen, McGraw Hill, 6th Edition.
2. College Mathematics, Schaum's Series, TMH.

Reference Books:

1. Elementary Mathematics, Dr. RDSharma
2. Comprehensive Mathematics, ParmanandGupta
3. Elements of Mathematics, MLBhargava

E Books/ Online learning material

1. www.see.leeds.ac.uk/geo-maths/basic_maths.pdf
2. www.britannica.com/science/matrix-mathematics
3. www.pdfdrive.com/schaums-outline-of-discrete-mathematics-third-edition-schaums-e6841453.html

25C2CCU-102
Fundamentals of Computer and IT

Program: B.Sc. (AI & ML)	L: 3 T: 1 P: 0
Branch: Computer Applications	Credits: 4
Semester: 1 st	Contact hours: 44 hours
Internal max. marks: 40	Theory/Practical: Theory
External max. marks: 60	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	explain the concept of input and output devices of computers.
CO2	classify types of computers, their processing and networking with other computing systems and devices.
CO3	analyze operating system and its working to solve problems related to operating systems
CO4	describe word processing, spreadsheet and presentation graphics software skills
CO5	make use of the Internet safely, legally, and responsibly.

Detailed Contents	Contact hours
Unit-I Human Computer Interface Concepts of Hardware and Software; Data and Information. Functional Units of Computer System: CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors. Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. Data Representation: Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.	12

Unit-II Concept of Computing, Types of Languages: Machine, assembly and High level Language; Operating system as user interface, utility programs. Word processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.	10
Unit-III Spreadsheet: Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. Presentation Graphics Software: Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	10
Unit-IV The Impact of Computing and Internet on Society Introduction to Secure Electronic Transaction, Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer (EFT), Unified Payment Interface (UPI), Immediate Payment System (IMPS), Digital Signature and Certification Authority. Concept of Mobile Computing, Cloud Computing, Big Data and Internet of Things (IoT)	12

Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2. Fundamentals of Computers, P. K.Sinha& P. Sinha, 2007, BPB Publishers.
3. IT Tools, R.K. Jain, Khanna Publishing House“ Introduction to Information Technology”, Satish Jain, Ambrish Rai & Shashi Singh, Paperback Edition, BPB Publications,2014.

Reference Books:

1. “Introduction to Computers”, Peter Norton
2. Computers Today, D. H. Sanders, McGrawHill.
3. “Computers”, Larry long & Nancy long, Twelfth edition, Prentice Hall.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning.
5. Computer Fundamentals, A. Goel, 2010, Pearson Education

E Books/ Online learning material

1. www.sakshat.ac.in
2. <https://swayam.gov.in/course/4067-computer-fundamentals>

25C2PYC-C02
Programming in Python

Program: B.Sc. (AI & ML)	L: 3 T: 1 P: 0
Branch: Computer Applications	Credits: 4
Semester: 1 st	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: 40%
Internal max. marks: 40	Duration of end semester exam (ESE): 3hrs
External max. marks: 60	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE:-NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	explain environment, data types, operators used in Python.
CO2	compare Python with other programming languages.
CO3	outline the use of control structures and numerous native data types with their methods.
CO4	design user defined functions, modules files, and packages and exception handling methods.
CO5	show solutions for Object Oriented Programming concepts.

Detailed Contents	Contact hours
Unit-I Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages. Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.	12

Unit-II Control Structures: Decision making statements, Python loops, Python control statements. Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).	10
Unit-III Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.	12
Unit-IV Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python. Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.	10

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, McGraw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, O'REILLY.

25C2AIU-111
Workshop on Multimedia Tools

Program: B.Sc. (AI & ML)	L:0 T:0 P:4
Branch: Computer Applications	Credits: 2
Semester: 1 st	Contact hours: 2 hours per week
Internal max. marks: 60	Theory/Practical: Practical
External max. marks: 40	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: Basic understanding of computer system and images.

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: After completing this course, students will be able to:

CO#	Course outcomes
CO1	define terms related to multimedia technologies.
CO2	demonstrate the types of multimedia products and their evaluation criteria.
CO3	apply GIMP editor for image editing and focusing on paint tools.
CO4	analyze the various image transformation and color manipulation techniques.
CO5	design web pages with variable and fixed-sized layouts, optimizing images.

Detailed contents	Contact hours
Unit-I Introduction: Objectives – History of Multimedia – Its market – Content copyright – Resources for multimedia developers – Types of produces – Evaluation – Hardware Architecture – OS and Software – Multimedia Architecture – Software library – Drivers.	4
Unit-II Downloading and installing free open source multimedia tool like GIMP, understanding its workspace (toolbox, menus, panels). Paint Tools: Common Features, Dynamics, Brush Tools (Pencil, Paintbrush, Airbrush), Bucket Fill, Blend, Pencil, Paintbrush, Eraser, Airbrush, Ink, Clone, Heal, Perspective Clone, Blur/Sharpen, Smudge, Dodge/Burn, applying fills and outlines – creating default fills and outlines – gradient fill – types – custom fill – copy – clone – mesh – gradient mesh	8

Unit-III Transform Tools: Common Features, Align, Move, Crop, Rotate, Scale, Shear, Perspective, Flip, The Cage Tool. Color Tools: Overview, Color Balance, Hue-Saturation, Colorize, Brightness-Contrast, Threshold, Levels, Curves, Posterize, Desaturate.	5
Unit-IV Animation: Text Animation methods, building an animated GIF, Animating a still image, Morphing, re-synthesizer tool. Designing for a webpage: Web Design tools, Variable and fixed sized designs, Optimizing images for web.	5

* **Students can choose multimedia tool of their choice. Recommended tool is GIMP.**

Text Book:

1. A book of GIMP: A guide to nearly everything, Olivier Lecarme, Karine Delvare Published by no starch press, California.
2. Multimedia Technology and Applications – David Hillman- Galgotia Publications pvt. Ltd, 1998.

25C2PYC-C12

Programming in Python Laboratory

Program: B.Sc. (AI & ML)	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 1 st	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: 90%
Internal max. marks: 60	Duration of end semester exam (ESE): 3hrs
External max. marks: 40	Elective Status : Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: - Maintain practical note book as per the instructions given by the instructor.

Course Outcomes: Students will be able to :

CO#	Course outcomes
CO1	classify the various data types and operators used in Python.
CO2	outline the use of control structures with their methods.
CO3	explain the concept of functions in Python.
CO4	analyze different file modes and way to handle files effectively.

List of assignments:

1.	Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2.	Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute volume of following 3D shapes: cube, cylinder, cone and sphere.
4.	Compute and print roots of quadratic equation $ax^2+bx+c=0$, where the values of a, b, and c are input by the user.
5.	Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,....
6.	Write a program to determine whether a triangle is isosceles or not?
7.	Print multiplication table of a number input by the user.
8.	Compute sum of natural numbers from one to n number.
9.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13.....n
10.	Compute factorial of a given number.
11.	Count occurrence of a digit 5 in a given integer number input by the user.

12.	Print Geometric and Harmonic means of a series input by the user.
13.	Evaluate the following expressions: a. $x - x^2/2! + x^3/3! - x^4/4! + \dots x^n/n!$ b. $x - x^3/3! + x^5/5! - x^7/7! + \dots x^n/n!$
14.	Print all possible combinations of 4, 5, and 6.
15.	Determine prime numbers within a specific range.
16.	Count number of persons of age above 60 and below 90.
17.	Compute transpose of a matrix.
18.	Perform following operations on two matrices. 1) Addition 2) Subtraction 3) Multiplication
19.	Count occurrence of vowels.
20.	Count total number of vowels in a word.
21.	Determine whether a string is palindrome or not.
22.	Perform following operations on a list of numbers: 1) Insert an element 2) delete an element 3) sort the list 4) delete entire list
23.	Display word after Sorting in alphabetical order.
24.	Perform sequential search on a list of given numbers.
25.	Perform sequential search on ordered list of given numbers.
26.	Maintain practical note book as per their serial numbers in library using Python dictionary.
27.	Perform following operations on dictionary 1) Insert 2) delete 3) change
28.	Check whether a number is in a given range using functions.
29.	Write a Python function that accepts a string and calculates number of upper case letters and lower case letters available in that string.
30.	To find the Max of three numbers using functions.
31.	Multiply all the numbers in a list using functions.
32.	Solve the Fibonacci sequence using recursion.
33.	Get the factorial of a non-negative integer using recursion.
34.	Write a program to create a module of factorial in Python.
35.	Design a Python class named <i>Rectangle</i> , constructed by a length & width, also design a method which will compute the area of a rectangle.
36.	Design a Python class named <i>Circle</i> constructed by a radius and two methods which will compute the area and the perimeter of a circle.
37.	Design a Python class to reverse a string 'word by word'.
38.	Write a Python program to read an entire <i>text file</i> .
39.	Design a Python program to read first n lines of a <i>text file</i> .
40.	Construct a Python program to write and append text to a file and display the text.

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, McGraw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, O'REILLY.

25C2CCU-112
Fundamentals of Computer and IT Laboratory

Program: B.Sc. (AI & ML)	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 1 st	Contact hours: 4 hours per week
Internal max. marks: 60	Theory/Practical: Practical
External max. marks: 40	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: -NA-

Co requisite:-NA-

Additional material required in ESE: -NA-

CourseOutcomes:

CO#	Course outcomes
CO1	experiment with Open Office applications for word processing, spreadsheets, and presentations.
CO2	utilizing text boxes and paragraphs formatting techniques in newsletter design.
CO3	applying documentation and accounting operations using various software tools.
CO4	creating interactive presentations in PowerPoint using different tools.

Instructions:

Word Orientation: The instructor needs to give an overview of word processor. Details of the four tasks and features that would be covered Using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.	
1.	Using word to create Resume Features to be covered: - Formatting Fonts in word, Drop Cap in word, ApplyingTexteffects,UsingCharacterSpacing,BordersandColors,Inserting Header and Footer, Using Date and Time option in Word.
2.	Creating an Assignment Features to be covered: - Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
3.	Creating a Newsletter Features to be covered :- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs

4.	Creating a Feedback form Features to be covered :- Forms, Text Fields, Inserting objects, Mail Merge in Word.
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Excel Orientation:

The instructor needs to tell the importance of Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered Excel – Accessing, overview of toolbars, saving excel files,

1.	Creating a Scheduler Features to be covered :- Gridlines, Format Cells, Summation, auto fill, Formatting Text
2.	Calculations Features to be covered: - Cell Referencing, Formulae in excel – average, std.deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP
3.	Performance Analysis Features to be covered :- Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting
4.	Game (like Cricket, badminton) Score Card Features to be covered :- Pivot Tables, Interactive Buttons, Importing Data, Data Protection, DataValidation

Presentation Orientation:

1.	Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered includes: - PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows
2.	This session helps students in making their presentations interactive. Topics covered includes : Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts
3.	Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topics covered includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides. Auto content wizard, Slide Transition, Custom Animation, Auto Rehearsing
4.	Power point test would be conducted. Students will be given model power point presentation which needs to be replicated

Internet and its Applications:

The instructor needs to tell the how to configure Web Browser and to use search engines by defining search criteria using Search Engines

1.	To learn to setup an e-mail account and send and receive e-mails
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2.	To learn to subscribe/post on a blog and to use torrents for accelerated downloads
3.	Hands on experience in online banking and Making an online payment for any domestic bill

Reference Books:

1. IT Tools, R.K. Jain, Khanna PublishingHouse
2. Introduction to Information Technology, ITL Education Solutions limited, PearsonEducation
3. Introduction to information technology, Turban, Rainer and Potter, John Wiley and Sons
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, ThomsonLearning

25C2CCU-103

English (Ability Enhancement Compulsory Course (AECC)-I))

Program: B.Sc. (AI & ML)	L: 1 T: 0 P: 0
Branch: Computer Applications	Credits: 1
Semester: 1 st	Contact hours: 11 hours
Internal max. marks: 40	Theory/Practical: Theory
External max. marks: 60	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

Course Code	Course Outcomes
CO1	explain the concept of business communication along with the prerequisites for an effective communication.
CO2	classify business communication with respect to its form (reading, writing, spoken), setting of usage (personal, social, business, interpersonal, intrapersonal or group).
CO3	apply the knowledge and skills of business communication in areas of speaking, reading and writing presentations.
CO4	explain the barriers of effective business communication.
CO5	improve professional communication like reading and writing skills.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Detailed Contents:

Unit1- 1 (Introduction)

- Theory of Communication
- Types and modes of Communication

Unit- 2 (Language of Communication)

- Verbal and Non-verbal
- (Spoken and Written)
- Personal, Social and Business
- Barriers and Strategies

- Intra-personal, Inter-personal and Group communication

Unit-3 (Reading and Understanding)

- Close Reading
- Comprehension
- Summary Paraphrasing
- Analysis and Interpretation
- Translation (from Hindi/Punjabi to English and vice-versa)

OR

Precis writing /Paraphrasing (for International Students)

- Literary/Knowledge Texts

Unit-4 (Writing Skills)

- Documenting
- Report Writing
- Making notes
- Letter writing

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.
4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul, Dr. Brati Biswas
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

25C2CCU-113

English Practical/Laboratory (Ability Enhancement Compulsory Course (AECC))

Program: B.Sc. (AI & ML)	L: 0 T: 0 P: 2
Branch: Computer Applications	Credits: 1
Semester: 1 st	Contact hours: 2 hours per week
Internal max. marks: 30	Theory/Practical: Practical
External max. marks: 20	Duration of end semester exam (ESE): 3hrs
Total marks: 50	Elective status: Core

Prerequisite: -NA-

Co requisite:-NA-

Additional material required in ESE: -NA-

Course Outcomes:

Course Code	Course Outcomes
CO1	build english vocabulary and language proficiency.
CO2	improve their professional communication through reading and writing practices.
CO3	develop vital communication skills which are integral to personal, social and professional interactions.
CO4	identify common errors in spoken and written communication.
CO5	make use of english language as an independent user.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Interactive practice sessions in Language Lab on Oral Communication

- Listening Comprehension
- Self Introduction, Group Discussion and Role Play
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations
- Monologue
- Effective Communication/ Mis-Communication
- Public Speaking

25C2HVC-C01
Human Values, De-addiction and Traffic Rules

Program: B.Sc. (AI & ML)	L: 3 T: 0 P: 0
Branch: Computer Applications	Credits: 3
Semester: 1 st	Contact hours: 33 hours
Internal max. marks: 40	Theory/Practical: Theory
External max. marks: 60	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Ability Enhancement

Prerequisite: -NA-

Co requisite:-NA-

Additional material required in ESE: -NA-

Course Outcomes:

Course Code	Course Outcomes
CO1	explain the concept of value education, with respect to an individual's understanding of self, ambitions, happiness and prosperity.
CO2	interpret the need of self (I) and body to ensure harmony in a human.
CO3	construct a holistic view towards society as a whole and the role of human-to-human interaction in it.
CO4	analyze harmony in the nature and existence.
CO5	elaborate the knowledge on ethical human values and its implication on modern day professional requirement.

Note: This course is intended to provide a much needed orientational input in Value Education to the young enquiring minds.

Detailed Contents	Contact hours
Unit-I Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 1. Understanding the need, basic guidelines, content and process for Value Education 2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic	8

requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels	
Unit-II Understanding Harmony in the Human Being - Harmony in Myself! 1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 2. Understanding the needs of Self ('I') and 'Body' - <i>Sukha</i> and <i>Suvidha</i> 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 4. Understanding the characteristics and activities of 'I' and harmony in 'I' 5. Understanding the harmony of I with the Body: <i>Sanyam</i> and <i>Swasthya</i>; correct appraisal of Physical needs, meaning of Prosperity in detail 6. Programs to ensure <i>Sanyam</i> and <i>Swasthya</i> - Practice Exercises and Case Studies will be taken up in Practice Sessions.	8
Unit-III Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship 1. Understanding harmony in the Family- the basic unit of human interaction 2. Understanding values in human-human relationship; meaning of <i>Nyaya</i> and program for its fulfillment to ensure <i>Ubhay-tripti</i>; Trust (<i>Vishwas</i>) and Respect (<i>Samman</i>) as the foundational values of relationship 3. Understanding the meaning of <i>Vishwas</i>; Difference between intention and competence 4. Understanding the meaning of <i>Samman</i>, Difference between respect and differentiation; the other salient values in relationship 5. Understanding the harmony in the society (society being an extension of family): <i>Samadhan</i>, <i>Samridhi</i>, <i>Abhay</i>, <i>Sah-astitva</i> as comprehensive Human Goals 6. Visualizing a universal harmonious order in society- Undivided	8

Society (<i>AkhandSamaj</i>), Universal Order (<i>SarvabhaumVyawastha</i>)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.	
Unit-IV Understanding Harmony in the Nature and Existence - Whole existence as Co-existence 1. Understanding the harmony in the Nature 2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature 3. Understanding Existence as Co-existence (<i>Sah-astitva</i>) of mutually interacting units in all-pervasive space 4. Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.	4
Unit-V Implications of the above Holistic Understanding of Harmony on Professional Ethics 1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems 6. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers	5

b) At the level of society: as mutually enriching institutions and organizations.	
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Text Book

1. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Reference Books

1. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3. A Nagraj, 1998, *Jeevan Vidyaek Parichay*, Divya Path Sansthan, Amarkantak.
4. Susan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991.
5. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Common wealth Publishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.
7. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome's report*, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers*, Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, *Foundations of Ethics and Management*, Excel Books.
12. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, <http://uhv.ac.in>
2. Story of Stuff, <http://www.storyofstuff.com>
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology – the Untold Story*

25C2HVC-C11
Human Values, De-addiction and Traffic Rules (Lab/ Seminar)

Program: B.Sc. (AI & ML)	L: 0 T: 0 P: 1
Branch: Computer Applications	Credits: 1
Semester: 1 st	Contact hours: 1 hour per week
Internal max. marks: 25	Theory/Practical: Practical
External max. marks: 0	Duration of end semester exam (ESE): 3hrs
Total marks: 25	Elective status: Ability Enhancement

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Code	Course Outcomes
CO1	estimate the development of Holistic perspective among students towards life, profession and happiness.
CO2	identify the essential complementarity between “VALUES” and “SKILLS” to ensure sustained happiness and prosperity..
CO3	examine the value-based living in a natural way.
CO4	formulate plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior.
CO5	outline the responsibilities of a manager for society and organization in the era of globalization at workplace..

One each seminar will be organized on Drug De-addiction and Traffic Rules. Eminent scholar and experts of the subject will be called for the Seminar at least once during the semester. It will be binding for all the students to attend the seminar.

25C2CCU-111

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

Course Outcomes:

Course Code	Course Outcomes
CO1	apply communication skills in today's workplace to facilitate ability to work collaboratively.
CO2	outline the understanding of effective group discussion and interview etiquettes.
CO3	identify the different techniques of communication.
CO4	explain various elements of group dynamics, team building activity and cooperation.
CO5	develop leadership qualities for fostering creativity and collaboration.

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz(General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B (Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club,etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty in charges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

SEMESTER 2ND

25C2AIU-201
Fundamentals of Statistics

Program: B.Sc. (AI & ML)	L: 3 T: 1 P:0
Branch: Computer Applications	Credits: 4
Semester: 2 nd	Contact hours: 44 hours
Internal max. marks: 40	Theory/Practical: Theory
External max. marks: 60	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: Students must have the basic knowledge of mathematic terms.

Co requisite: NA

Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.

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

CO#	Course Outcomes
CO1	analyze different random variables and functions of statistics.
CO2	identify the various visualization tools for representing data.
CO3	describe various statistical formulas.
CO4	calculate the averages of different type of data.

Detailed Contents	Contact hours
Unit I Statistics and Probability: Introduction to Statistics – Origin of Statistics, Features of Statistics, Scope of Statistics, Functions of Statics, Uses and importance of Statistics, Limitation of Statistics, Distrust of Statistics Collection of Data: Introduction to Collection of Data, Primary and Secondary Data, Methods of Collecting Primary Data, Methods of Secondary Data, Statistical Errors, Rounding off Data (Approximation).	8 hours

Unit II Classification of Data Frequency Distribution: Introduction Classification of Data, Objectives of Classification, Methods of Classification, Ways to Classify Numerical Data or Raw Data. Tabular, Diagrammatic and Graphic Presentation of Data: Introduction to Tabular Presentation of Data, Objectives of	12 hours
Tabulation, Components of a Statistical Table, General Rules for the Construction of a Table, Types of Tables, Introduction to Diagrammatic Presentation of Data, Advantage and Disadvantage of Diagrammatic Presentation, Types of Diagrams, Introduction to Graphic Presentation of Data, Advantage and Dis advantage of Graphic Presentation, Types of Graphs.	
Unit III Measures of Central tendency: Introduction to Central Tendency, Purpose and Functions of Average, Characteristics of a Good Average, Types of Averages, Meaning of Arithmetic Mean, Calculation of Arithmetic Mean, Merit and Demerits of Arithmetic Mean, Meaning of Median, Calculation of Median, Merit and Demerits of Median, Meaning of Mode, Calculation of Mode, Merit and Demerits of Mode, Harmonic Mean-Properties- Merit and Demerits.	12 hours
Unit IV Measures of Dispersion: Meaning of Dispersion, Objectives of Dispersion, Properties of a good Measure of Dispersion, Methods of Measuring Dispersion, Range Introduction, Calculation of Range , Merit and Demerits of Range, Mean Deviation, Calculation of Mean Deviation , Merit and Demerits of Mean Deviation, Standard Deviation Meaning, Calculation of Standard Deviation , Merit and Demerits of Standard Deviation, Coefficient of Variation, Calculation of Coefficient Variance, Merit and Demerits of Coefficient of Variation.	12 hours

Text Books:

1. Statistics and Data Analysis, A.Abebe, J. Daniels, J.W.Mckean, December2000.
2. Statistics, Tmt. S. EzhilarasiThiru, 2005, Government ofTamilnadu.
3. Introduction to Statistics, David M.Lane.
4. Weiss, N.A., Introductory Statistics. Addison Wesley,1999.
5. Clarke, G.M. & Cooke, D., A Basic course in Statistics. Arnold,1998.

Reference Books:

1. Banfield J.(1999), Rweb: Web-based Statistical Analysis, Journal of Statistical Software.
2. Bhattacharya,G.K. and Johnson, R.A.(19977), Statistical Concepts and Methods, New York, John Wiley &Sons.

E-Books/ Online learning material

1. http://onlinestatbook.com/Online_Statistics_Education.pdf
2. <https://textbookcorp.tn.gov.in/Books/12/Std12-Stat-EM.pdf>
3. <https://3lihandam69.files.wordpress.com/2015/10/introductorystatistics.pdf>

25C2CCU-205
Operating Systems

Program: B.Sc. (AI & ML)	L: 3 T: 1 P: 0
Branch: Computer Applications	Credits: 4
Semester: 2 nd	Contact hours: 44 hours
Internal max. marks: 40	Theory/Practical: Theory
External max. marks: 60	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: Basic understanding of computer system.

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: After completing this course, students will be able to:

CO#	Course outcomes
CO1	define various types of operating systems.
CO2	explain different resource managements performed by operating system
CO3	define the architecture in terms of functions performed by different types of operating systems.
CO4	analyze the performance of different algorithms used in design of operating system components.
CO5	compare the key properties of different types of operating systems.

Detailed contents	Contact hours
Unit-I Fundamentals of Operating system: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems. Process & Thread Management: Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, synchronization issues. CPU Scheduling: Need of CPU scheduling, CPU I/O Burst Cycle, Pre-emptive vs. Non-pre-emptive scheduling, Different scheduling criteria's, scheduling algorithms (FCFS, SJF, Round-Robin, Multilevel Queue).	12
Unit-II Memory Management: Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, page replacement algorithms.	11

Unit-III I/O Device Management: I/O devices and controllers, device drivers; disk storage. File Management: Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection.	10
Unit-IV Advanced Operating systems: Introduction to Distributed Operating system, Characteristics, architecture, Issues, Communication & Synchronization; Introduction Multiprocessor Operating system, Architecture, Structure, Synchronization & Scheduling; Introduction to Real-Time Operating System, Characteristics, Structure& Scheduling.	11

Text Books:

1. Operating System Principles by Abraham Silberschatz and Peter BaerGalvin, Seventh Edition, Published byWiley-India.
2. Principals of Operating System by NareshChauhan, Published by OXFORD University Press,India.

Reference Books:

1. Operating Systems by SibsankarHaldar and Alex A. Aravind, Published by PearsonEducation.
2. Operating system by Stalling, W., Sixth Edition, Published by PrenticeHall (India)

25C2DSC-C03

Data Structures

Program: B.Sc. (AI & ML)	L: 3 T: 1 P: 0
Branch: Computer Applications	Credits: 4
Semester: 2 nd	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks: 40	Duration of end semester exam (ESE): 3hrs
External max. marks: 60	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	apply appropriate constructs of programming language, coding standards for application development.
CO2	select appropriate data structures for problem solving and programming.
CO3	illustrate the outcome of various operations on data structures.
CO4	identify appropriate searching and/or sorting techniques for wide range of problems and data types.
CO5	distinguish between various types of data structures.

Detailed Contents	Contact hours
Unit-I Introduction to Data Structures: Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion. Arrays, Pointers and Strings: Introduction to Arrays, Definition, One Dimensional Array and Multi-Dimensional Arrays, Pointer, Pointer to Structure, various Programs for Array and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings.	10

Unit-II	
Stacks and Queue	8
Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack Queues, Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and PriorityQueue.	
Unit-III Linked Lists and Trees Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List. Trees Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree B Tree, B+ Tree.	14
Unit-IV Graphs, Searching, Sorting and Hashing Graphs: Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms. Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. Hashing: Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing	12

Text Books

1. BrijeshBakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Kruse R.L. Data Structures and Program Design in C;PHI
3. Aho Alfred V., Hopperoft John E., Uilman Jeffrey D., “Data Structures and Algorithms”,AddisonWesley

Reference books

1. Horowitz &Sawhaney: Fundamentals of Data Structures, GalgotiaPublishers.
2. YashwantKanetkar, Understanding Pointers in C, BPB Publications.
3. Horowitz, S. Sahni, and S. Rajasekaran, Computer Algorithms, Galgotia Pub. Pvt. Ltd., 1998.

25C2DSC-C13
Data Structures Laboratory

Program: B.Sc. (AI & ML)	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 2 nd	Contact hours: 4 hours per week
Theory/Practical: Practical	Percentage of numerical/design problems: --
Internal max. marks: 60	Duration of end semester exam (ESE): 3hrs
External max. marks: 40	Elective status: Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: - NA-

Course Outcomes: Student will be able to

CO#	Course outcomes
CO1	interpret memory management issues associated with data structures.
CO2	experiment with the fundamental data structures such as arrays and queue.
CO3	analyze the relationship between recursion and iterative approaches.
CO4	evaluate the different techniques for optimizing code using data structures.

Instructions: Programs may be developed in C/C++/Python/Java language.

List of assignments:

1	Program for using Dynamic Functions (malloc(), calloc(), realloc() and free()) functions.
2	Program to insert, delete and traverse an element from an array
3	Program to merge one dimensional arrays
4	Program for addition and subtraction of two matrices.
5	Program for implementing multiplication of two matrices
6	Implement linear search using one and two dimensional array.
7	Program for implementing selection sort.
8	Program for implementing insertion sort.
9	Program for implementing quick sort.
10	Program for implementing merge sort.
11	Program to calculate length of the string using user defined function.
12	Program to concatenate and compare two strings using user defined function.
13	Program for using the concept of pointer to string.
14	Program to reverse a sentence by recursion.
15	Program to delete all repeated words in string.

16	Program to find the number of vowels, consonants, digits and white space in a string.
17	Program to find the length of the longest repeating sequence in a string.
18	Program to find highest and lowest frequency character in a string.
19	Program for implementing Stack using array.
20	Program for implementing Stack using pointer.
21	Program for implementing multiple stack.
22	Program for converting infix to postfix form.
23	Program for implementing Queue using array.
24	Program for dynamic implementation of queue.
25	Program for implementing circular queue.
26	Program for implementing dequeue.
27	Program for implementing priority queue.
28	Program for implementing Singly Linked list.
29	Program for implementing Doubly Linked list.
30	Program for implementing Binary Search Tree.
31	Program for Breadth First Search (BFS) for graph traversal.
32	Program for Depth First Search (DFS) for graph traversal.

Reference Books:

1. BrijeshBakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Aho Alfred V., Hopperoft John E., Ullman Jeffrey D., “Data Structures and Algorithms”,AddisonWesley
3. Horowitz &Sawhaney: Fundamentals of Data Structures, GalgotiaPublishers.

25C2CCU-215
Operating Systems Laboratory

Program: B.Sc. (AI & ML)	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 2 nd	Contact hours: 4 hours per week
Internal max. marks: 60	Theory/Practical: Practical
External max. marks: 40	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: After going through the practical, student will be able to:

CO#	Course outcomes
CO1	explain the fundamental operating system concepts including Windows and Linux operating system.
CO2	develop programs to simulate memory allocation strategies and virtual memory management.
CO3	apply various file system-related operations such as file creation, deletion, read, write using file management techniques.
CO4	evaluate the performance of operating system components.

Instructions:

1	Installation of windows OS.
2	Installation of Linux OS.
3	Dual boot installation of Operating systems.
4	Implementation of FCFS Scheduling algorithm
5	Implementation of SJF Scheduling algorithm
6	Implementation of Round-Robin Scheduling algorithm
7	Vi Editor & its commands
8	Shell Commands
9	Shell Scripting- Using variables
10	Shell Scripting- Input & Output
11	Shell Scripting- Data types
12	Shell Scripting- Use of arithmetic operators
13	Shell Scripting- if control statement programs
14	Shell Scripting- while control statement
15	Shell Scripting- for control statement

- Instructor can select programs of their own for implementing different concepts.

Reference Books:

1. Linux: The complete reference by Richard Petersen,
Published by Tata McGraw- HillPublication.
2. Operating System Principles by Abraham Silberschatz and Peter
Baer Galvin, Seventh Edition, Published byWiley-India.

25C2AIU-211
Fundamentals of Statistics Laboratory

Program: B.Sc. (AI & ML)	L: 0 T: 0 P: 4
Branch: Computer Applications	Credits: 2
Semester: 2 nd	Contact hours: 4 hours per week
Internal max. marks: 60	Theory/Practical: Practical
External max. marks: 40	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Core

Prerequisite: Students must have the knowledge of Spreadsheet.

Co requisite: The students will develop analytical behavior & will have better understanding of analyzing data and testing hypotheses.

Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.

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

CO#	Course Outcomes
CO1	utilizing statistical methods to calculate the different data.
CO2	analyzing data using various frequency tables and graphs to visually communicate information.
CO3	creating an array and calculating the range of data points efficiently.
CO4	utilizing the various spreadsheet software to solve statistical problems Accurately.

Instructions: Sample exercises are given below and Instructor can increase or decrease the experiments as per the requirement.

1:	Display the Maximum and Minimum market data.
2:	Display year wise strength of the students of a college in Tabular form & Graphical form.
3:	Calculate the average marks of the students of your College.
4:	Print measure of Central Tendency using grouped and ungrouped data.
5:	Construct & print frequency distribution using data with the following Techniques: a)Histogram b) Frequency Polygon c)FrequencyCurve c) Ogive curves.

6:	Find out & display the Median and Mode from the following series by using suitable method: <table><tr><td>Class</td><td>156-158</td><td>158-160</td><td>160-162</td><td>162-164</td><td>164-166</td></tr><tr><td>Frequency</td><td>4</td><td>8</td><td>28</td><td>51</td><td>89</td></tr></table>	Class	156-158	158-160	160-162	162-164	164-166	Frequency	4	8	28	51	89		
Class	156-158	158-160	160-162	162-164	164-166										
Frequency	4	8	28	51	89										
7:	Calculate an appropriate measure of dispersion using grouped and ungrouped data.														
8:	Make an array and calculate range of the data.														
9:	Represent the placement record of the students of your college.														
10:	Calculate & display Letter Grade using spreadsheet.														
11:	Represent the following data by suitable graphs, determine therefrom the number of children having IQ (i) Below 105 (ii) Above 124. <table><tr><td>IQ</td><td>75-84</td><td>85-94</td><td>95-104</td><td>105-114</td><td>115-124</td><td>125-134</td></tr><tr><td>No.ofChildren</td><td>8</td><td>20</td><td>45</td><td>54</td><td>28</td><td>16</td></tr></table>	IQ	75-84	85-94	95-104	105-114	115-124	125-134	No.ofChildren	8	20	45	54	28	16
IQ	75-84	85-94	95-104	105-114	115-124	125-134									
No.ofChildren	8	20	45	54	28	16									

Reference Books:

1. Statistics for Economics, TR Jain, VKOhri.
2. Statistics and Data Analysis, A.Abebe, J. Daniels, J.W.Mckean, December 2000.

E-Books/ Online learning material

1. https://www.meritnation.com/cbse-class-11-commerce/economics/class_13_tr_jain.
2. http://college.cengage.com/mathematics/brase/understandable_statistics/9780618949922_ch03.pdf
3. http://www.rockcreekschools.org/pages/uploaded_files/Excel%201%20Lab%20Exercises.pdf

25C2CCU-201
Environmental Science

Program: B.Sc. (AI & ML)	L: 2 T: 0 P: 0
Branch: Computer Applications	Credits: 2
Semester: 2 nd	Contact hours: 22 hours
Internal max. marks: 40	Theory/Practical: Theory
External max. marks: 60	Duration of end semester exam (ESE): 3hrs
Total marks: 100	Elective status: Ability Enhancement

Prerequisite: -NA-

Co requisite:-NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	identify the environmental problems at local and national level through literature and general awareness.
CO2	examine the visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental issues.
CO3	choose environmental issues and critically analyze them to explore the possibilities to mitigate these problems.
CO4	demonstrate about their roles as citizens, consumers and environmental actors in a complex, interconnected world.

Detailed Contents	Contact hours
Unit-I Introduction to Environmental Studies Multidisciplinary nature of Environmental Studies: Scope & Importance Need for Public Awareness.	2

Unit-II Ecosystems Concept of an Ecosystem: Structure & functions of an ecosystem (Producers, Consumers & Decomposers) Energy Flow in an ecosystem: Food Chain, Food web and Ecological Pyramids Characteristic features, structure & functions of following Ecosystems: Forest Ecosystem Aquatic Ecosystem (Ponds, Lakes, River & Ocean)	4
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Unit-III Natural Resources Renewable & Non-renewable resources Forest Resources: Their uses, functions & values (Biodiversity conservation, role in climate change, medicines) & threats (Overexploitation, Deforestation, Timber extraction, Agriculture Pressure), Forest Conservation Act Water Resources: Their uses (Agriculture, Domestic & Industrial), functions & values, Overexploitation and Pollution of Ground & Surface water resources (Case study of Punjab), Water Conservation, Rainwater Harvesting, Land Resources: Land as a resource; Land degradation, soil erosion and desertification Energy Resources: Renewable & non-renewable energy resources, use of alternate energy resources (Solar, Wind, Biomass, Thermal), Urban problems related to Energy	4
Unit-IV Biodiversity & its conservation Types of Biodiversity: Species, Genetic & Ecosystem India as a mega biodiversity nation, Biodiversity hot spots and biogeographic regions of India Examples of Endangered & Endemic species of India, Red data book	4
Unit-V Environmental Pollution & Social Issues Types, Causes, Effects & Control of Air, Water, Soil & Noise Pollution Nuclear hazards and accidents & Health risks Global Climate Change: Global warming, Ozone depletion, Acid rain, Melting of Glaciers & Ice caps, Rising sea levels Environmental disasters: Earthquakes, Floods, Cyclones, Landslides	4
Unit-VI Field Work Visit to a National Park, Biosphere Reserve, Wildlife Sanctuary Documentation & preparation of a Biodiversity (flora & fauna) register of campus/river/forest Visit to a local polluted site: Urban/Rural/Industrial/Agricultural Identification & Photography of resident or migratory birds, insects (butterflies) Public hearing on environmental issues in a village	4

Text Books:

1. Bharucha, E. Text Book for Environmental Studies. University Grants Commission, NewDelhi.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd.Bikaner.

3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net(R)
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford(TB)
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,1196p
7. De A.K., Environmental Chemistry, Wiley EasternLtd.
8. Down to Earth, Centre for Science and Environment(R)
9. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
10. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay(R)
11. Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press1140p.
12. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
13. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition.639p.
14. Mhaskar A.K., Matter Hazardous, Techno-Science Publication(TB)
15. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co.(TB)
16. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA,574p
17. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
18. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House,Meerut
19. Survey of the Environment, The Hindu(M)Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
20. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication(TB)
21. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA499p

25C2CCU-111

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

Course Outcomes:

Course Code	Course Outcomes
CO1	apply communication skills in today's workplace to facilitate ability to work collaboratively.
CO2	outline the understanding of effective group discussion and interview etiquettes.
CO3	identify the different techniques of communication.
CO4	explain various elements of group dynamics, team building activity and cooperation.
CO5	develop leadership qualities for fostering creativity and collaboration.

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)

7. Expert and video lectures
8. Aptitude Test
9. Group Discussion
10. Quiz(General/Technical)
11. Presentations by the students
12. Team building Exercises

Part – B (Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club,etc.

Evaluation shall be based on rubrics for Part – A & B

Mentors/Faculty in charges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

Semester III

Course Code	Course Type	Course Name	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-301	Core Theory	Artificial Intelligence	4	3	1	0	40	60	100
Prerequisites of Industrial Psychology: Basic concepts of AI									

Course Outcomes (COs):

At the end of the course, the student will be able to	
CO1	Illustrate the fundamental concepts, scope, approaches of Artificial Intelligence .
CO2	Explore search strategies including forward chaining, backward chaining, blind search (BFS, DFS), heuristic search, A and A* algorithms, AO* algorithm
CO3	Analyze knowledge representation and reasoning techniques including ontologies, predicate logic, situation calculus, and description logics to represent objects, relations, events, actions, time, and space.
CO4	Explain the architecture of expert systems and analyze existing expert systems to identify their key components with their relationships between them
CO5	Simplify intelligent AI solutions by combining machine learning paradigms, neural networks and natural language processing techniques.

Detailed Syllabus

Unit 1

Overview of AI: foundations, scope, problems, and approaches. Intelligent Agents: reactive agents, deliberative agents, goal-driven agents, utility-driven agents, and learning agents — architecture, characteristics, and comparative analysis.

(Hours 11)

Unit 2

Problem-Solving through Search: forward and backward chaining, state-space search, blind search (BFS, DFS), heuristic search, problem reduction, A and A* algorithms, AO* algorithm, minimax search, constraint propagation, neural search, stochastic search, evolutionary search algorithms. Sample applications from real-world domains.

(Hours 10)

Unit 3

Knowledge Representation and Reasoning: ontologies, foundations of KR&R, representing objects/relations/events/actions/time/space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications. Decision-Making: utility theory basics, decision theory, sequential decision problems, elementary game theory, sample applications.

(Hours 10)

Unit 4

Expert Systems: overview of expert system architecture, study of existing expert systems. Languages for AI: PROLOG — syntax, data structures, representing objects and relationships, built-in predicates. LISP — basic and intermediate LISP programming, list processing, recursion, and functional programming constructs.

(Hours 10)

Unit 5

Advanced AI Techniques: introduction to machine learning paradigms (supervised, unsupervised, reinforcement learning), neural networks fundamentals, natural language processing overview. Case Studies and Emerging Trends: AI ethics and fairness, real-world AI deployments, current research directions, and future scope.

(Hours 11)

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Artificial Intelligence	Rich E., Knight K. and Nair B. S.,	Tata McGraw Hills	2009
2	Artificial Intelligence: Structures and Strategies for Complex Problem Solving	Luger F. G.	Pearson Education Asia	2009

Reference Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Artificial Intelligence and Expert Systems	Patterson W. D	Pearson	1st (2015)
2	Artificial Intelligence: A Modern Approach	Russel S., Norvig P.	Prentice Hall	3rd (2014)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Inter nal	External	Total
25C2AIU-302	Design and Analysis of Algorithms	Core Theory	4	3	1	0	40	60	100
Prerequisite: - Problem-Solving Skills									

Course Outcomes (COs):

At the end of the course the student will be able to	
CO1:	Describe algorithm characteristics and interpret time, space, and recursive complexity
CO2:	Apply brute-force and greedy strategies to solve computational problems like Bin Packing and Knapsack
CO3:	Analyze dynamic programming, branch-and-bound, and backtracking techniques for solving optimization problems like TSP.
CO4:	Explain graph algorithms including DFS, BFS, shortest path, minimum spanning tree, topological sorting, and network flow algorithms.
CO5:	Categorise algorithmic complexity classes (P, NP, NP-complete, NP-hard) and apply heuristic and randomized algorithms.

Detailed Syllabus

Unit 1

Characteristics of Algorithm: properties of algorithms.

Analysis of Algorithms: asymptotic analysis of complexity bounds – best case, average case and worst case behavior; performance measurements of algorithms; time and space trade-offs.

Analysis of Recursive Algorithms: solving recurrence relations using substitution method and recursion tree method.

(Hours 11)

Unit 2

Fundamental Algorithmic Strategies: brute-force strategy and greedy method for algorithm design.

Illustrations of these techniques for problem solving, such as Bin Packing and Knapsack problems.

(Hours 10)

Unit 3

Algorithm Design Techniques: dynamic programming, branch-and-bound and backtracking methodologies for the design of algorithms.

Applications of these strategies in solving optimization problems such as the Traveling Salesman Problem (TSP).

(Hours 10)

Unit 4

Graph Algorithms: traversal algorithms including Depth First Search (DFS) and Breadth First Search (BFS); shortest path algorithms; transitive closure; minimum spanning tree; topological sorting; network flow algorithm.

(Hours 10)

Unit 5

Tractable and Intractable Problems: computability of algorithms, computability classes – P, NP, NP-complete and NP-hard.

Advanced Topics: heuristic algorithms and randomized algorithms.

(Hours11)

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Algorithms	Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein	MIT Press/McGraw-Hill	4th (2022)
2	Data Structures and Algorithms in C++	Weiss	Pearson	4th (2014)

Reference Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Algorithm Design	Jon Kleinberg and Éva Tardos	Pearson	1st (2005)
2	Algorithm Design: Foundations, Analysis, and Internet Examples	Michael T Goodrich and Roberto Tamassia	Wiley	2nd (2006)

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal	External	Total
25C2AIU-311	Artificial Intelligence Lab	Core Practical/Laboratory	2	0	0	4	60	40	100
Prerequisite: -C (in case of implementing using C)									

Course Outcomes (COs):

At the end of the course, the student will be able to	
CO1	Explain and apply basic AI search algorithms to solve classical problem-solving tasks.
CO2	Apply depth-first search and best-first search techniques for effective problem solving in AI.
CO3	Implement heuristic search techniques such as A* and hill climbing in intelligent systems.
CO4	Solve AI problems such as 8-queens, 8-puzzle, and Tower of Hanoi using appropriate search strategies.
CO5	Compare the performance of different AI search strategies for problem solving.

Sr. No.	Use any language such as C/C++/LISP/PROLOG
1	Construct a program to solve the 8-Queens problem in Artificial Intelligence.
2	Demonstrate a solution of any problem using the Depth First Search (DFS) algorithm.
3	Develop a program to solve a problem using the Best First Search technique.
4	Experiment with the 8-Puzzle problem using the Best First Search algorithm.
5	Test and generate the output of the A* search algorithm using a suitable program.
6	Make use of a program to demonstrate the Tower of Hanoi problem.

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-312	Design and Analysis of Algorithms Laboratory	Core Practical/Laboratory	2	0	0	4	40	60	100
Prerequisite: -Programming Fundamentals									

Course Outcomes (COs):

At the end of the course, the student will be able to	
CO1	Experiment with greedy and dynamic programming algorithms for optimization problems.
CO2	Apply dynamic programming to solve problems like TSP and matrix chain multiplication.
CO3	Practice with DFS and BFS for graph traversal applications
CO4	Develop shortest path algorithms such as Dijkstra, Bellman-Ford and Floyd's
CO5	Implement minimum spanning tree and heuristic algorithms for real-world problems.

Exp.No.	Experiment Title
1	Code and analyze solutions to following problem with given strategies: i. Knap Sack using greedy approach ii. Knap Sack using dynamic approach
2	Code and analyze to find an optimal solution to matrix chain multiplication using dynamic programming.
3	Code and analyze to find an optimal solution to TSP using dynamic programming.
4	Implementing an application of DFS such as: i. to find the topological sort of a directed acyclic graph ii. to find a path from source to goal in a maze.
5	Implement an application of BFS such as: i. to find connected components of an undirected graph ii. to check whether a given graph is bipartite.
6	Code and analyze to find shortest paths in a graph with positive edge weights using Dijkstra's algorithm.
7	Code and analyze to find shortest paths in a graph with arbitrary edge weights using Bellman-Ford algorithm.
8	Code and analyze to find shortest paths in a graph with arbitrary edge weights using Flyods' algorithm.
9	Code and analyze to find the minimum spanning tree in a weighted, undirected graph using Prims' algorithm
10	Code and analyze to find the minimum spanning tree in a weighted, undirected graph using Kruskals' algorithm.
11	Coding any real world problem or TSP algorithm using any heuristic technique.

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-303	Database Management Systems	Core Theory	4	3	1	0	40	60	100
Prerequisite: -Data Organization Concept									

Course Outcomes (COs):

At the end of the course, the student will be able to	
CO1:	Compare different data models such as hierarchical, network, relational, and the ER model.
CO2:	Apply relational database concepts including relational algebra and relational calculus for performing database queries.
CO3:	Explain database triggers to automate actions and maintain data integrity in database systems.
CO4:	Evaluate normalization techniques to assess and improve database schema design and justify efficient database structures by analyzing redundancy, dependency, and data integrity.
CO5:	Categorize database recovery techniques, concurrency control, security mechanisms, and the effectiveness of distributed databases in managing and protecting data.

Detailed Syllabus

Unit 1

Introduction to DBMS, data modeling for a database, three-level architecture of DBMS, and components of a DBMS.
Introduction to data models: hierarchical model, network model and relational model.
Comparison of hierarchical, network and relational models, Entity Relationship (ER) model.

(Hours 10)

Unit 2

Relational database concepts, relational algebra and relational calculus.
SQL fundamentals including Data Definition Language (DDL), Data Manipulation Language (DML) and Data Control Language (DCL).

(Hours 10)

Unit 3

PL/SQL concepts and structure, advantages of PL/SQL, variables, constants and control structures. Cursors – implicit and explicit cursors and their use in handling query results. Stored procedures and stored functions, creation and execution. Database triggers and their types and uses. Exception handling in PL/SQL. Packages – package specification and package body. Collections – VARRAYs, nested tables and associative arrays.

(Hours 11)

Unit 4

Introduction to normalization: First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), dependency preservation and Boyce–Codd Normal Form (BCNF).
Multi-valued dependencies and Fourth Normal Form (4NF), Join dependencies and Fifth Normal Form (5NF), Domain-Key Normal Form (DKNF).

(Hours 11)

Unit 5

Database recovery, concurrency management, database security, integrity and control.
Structure of a distributed database and design of distributed databases.

(Hours10)

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	An Introduction to Database System	Bipin C. Desai	Galgotia Publications Pvt Ltd-New Delhi	Revised Edition,(2012)
2	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudharshan	Tata McGraw Hill	7th (2021)

Reference Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	SQL,PL/SQL The Programming Language of Oracle	IvanBayross	BPB Publications	4th Revised (2009)
2	Database Management Systems	Raghu Ramakrishnan	McGraw-Hil	3rd (2014)

Course Code	Course Name	Course Type	C d	L	T	P	Marks		
							Internal	External	Total
25C2AIU-313	Database Management Systems Lab	Core Practical/Laboratory	2	0	0	4	60	40	100
Prerequisite: - Basic SQL Awareness									

Course Outcomes (COs):

At the end of the course the student will be able to

CO1:	Demonstrate the different types of database queries and explain their execution process in a relational database system.
CO2:	Apply SQL DDL and DML commands to create database structures and populate, retrieve, and manipulate data in a relational database.
CO3:	Compute and enforce integrity constraints on a database
CO4:	Experiment with PL/SQL including stored procedures, stored functions, cursors, packages
CO5:	Implement the design of new databases and modify existing databases to support new applications.

Exp No.	Experiment Title
1	Used of CREATE, ALTER, RENAME and DROP statement in the database tables (relations)
2	Used of INSERT INTO, DELETE and UPDATE statement in the database tables (relations)
3	Use of simple select statement.
4	Use of select query on two relations
5	Use of nesting of queries.
6	Use of aggregate functions.
7	Use of substring comparison.
8	Use of order by statement.
9	Consider the following schema for a College Database: STUDENT (Student_id, Name, Department, Year) STUDENT_COURSES (Student_id, Course_Name) DEPARTMENT (Dept_Name, Address, Phone) COURSE_SEATS (Course_id, Dept_id, No_of_Seats) COURSE_REGISTRATION (Course_id, Dept_id, Student_id, Reg_Date, Semester) COLLEGE_DEPARTMENT (Dept_id, Dept_Name, Address) Write SQL queries to: Retrieve details of all courses in the college – course_id, course name, department name, students enrolled, number of seats available in each department, etc.

	2. Get the particulars of students who have registered for more than 3 courses between Jan 2018 to Jun 2018. 3. Delete a course in the COURSE table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the COURSE table based on year/semester of offering. Demonstrate its working with a simple query.
10	Consider the following schema for Order Database: SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) Write SQL queries to - Count the customers with grades above Amritsar's average. - Find the name and numbers of all salesmen who had more than one customer. - List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.) - Create a view that finds the salesman who has the customer with the highest order of a day. 5 Demonstrate the DELETE operation by removing sales man with id 1000. All his orders must also be deleted
11	Write a PL/SQL code to add two numbers and display the result. Read the numbers during run time.

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-304	Internet Tools and Applications	Skill Enhancement Course-I	1	1	0	0	20	30	50
Prerequisite: - Basic Networking Concepts									

Course Outcomes (COs):

At the end of the course the student will be able to	
CO1	Describe the basic concepts, features, and services of the Internet and Protocols.
CO2	Explain WWW architecture, web browsers, and the functioning of DNS.
CO3	Analyze the architecture of email along with applications and services of Internet applications.
CO4	Build web pages using various HTML elements like tables, text formatting, and lists.
CO5	Make use of URLs, hyperlinks, and images effectively in web page design.

Detailed Syllabus

Unit-I

Introduction to Internet: Internet concept, advantages and disadvantages, internet facilities through WWW and HTML.
Internet protocols: TCP/IP, FTP, newsgroups, remote logins, chat groups and related services.

(Hours 3)

Unit-II

World Wide Web (WWW): client side and server side concepts, web browsers and web pages.
Locating information on the web and working of Domain Name System (DNS).

(Hours 3)

Unit 3

E-mail: architecture, user agent, message format, message transfer and e-mail privacy.
Applications and services of the Internet.

(Hours 2)

Unit 4

HTML: introduction to HTML, structure of HTML documents. HTML elements including head, body, style, script elements, text formatting and lists. Organizing data using tables: basic table structures, cells, headings and layout presentation.

(Hours 2)

Unit 5

Uniform Resource Locators (URLs): absolute URLs, relative URLs, fragment URLs and URL schemes such as HTTP, mailto, news, FTP, Telnet and file. Hyperlinks and anchors: structure and uses of hyperlinks, linking to specialized contents. Images in web pages: adding images, image links, image maps and image formats such as GIF and JPEG.

(Hours 3)

Text Book

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Internetworking with TCP-IP: Principles, Protocols and Architecture	Douglas E. Comer	PHI/Pearson	6th (2014)
2	HTML 4.0 No Experience Required	Stephan Mack,Janan Platt	BPB Publication /sybex	1st (1997)

Reference Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Internet Users guide to Network Resources Tools	Margaret Levine Young, Margaret Isaacs	Addison wesley	2nd edition (2000)
2	Internet and word wide Web: How to Program	Paul J. Deitel ,Harvey M. Deitel	Pearson	5th edition (2012)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-314	Internet Tools and Applications Laboratory	Core Practical/Laboratory	2	0	0	4	60	40	100
Prerequisite: -Basic Application Software Skills									

Course Outcomes (COs):

At the end of the course the student will be able to

CO1	Apply basic structure and formatting of HTML web pages.
CO2	Demonstrate hyperlinks, URLs and images in web page design.
CO3	Develop tables, lists and frames using HTML elements.
CO4	Construct the use of CSS to enhance the presentation of web pages.
CO5	Experiment with simple web applications such as forms and image maps.

Exp No.	Experiment Title
1	Create a web page to show the structure of HTML
2	Show the use of formatting tags in HTML
3	Write HTML code to show the use of absolute and relative URL with Anchor Tag
4	Create a table in which colspan and rowspan elements are used.
5	Create a webpage to show the use of different lists available in HTML
6	Create a webpage to show the use of frame tag in HTML.
7	Create a webpage to show the use of different types of CSS
8	Create admission form for a college
9	Show the use of image tag and show images as buttons
10	Create a web page to show the use of image maps.

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Internetworking with TCP/IP: Principles, Protocols and Architecture	Douglas E. Comer	Pearson Edition	6th (2014)
2	Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics	Jennifer Niederst Robbins	O'Reilly Media	5th (2018)

Reference Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	The Internet Book: Everything You Need to Know about Computer Networking and How the Internet Works	Douglas E. Comer	Pearson Edition	5th (2018)
2	Learning PHP, MySQL & JavaScript	Robin Nixon	O'Reilly Media	6th (2021)

Course Code	Course Type	Course Name	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-315	Skill Enhancement Course	Career and Placement Planning - 1	1	0	0	2	50	-	50
Prerequisites: Basic understanding of C Language									

Course Outcomes:

At the end of the course, the student will be able to	
CO1	Explain the structure of C++ programs, programming fundamentals, data types, operators, and input/output operations.
CO2	Apply decision-making and looping constructs to develop basic C++ programs.
CO3	Develop modular programs using functions, recursion, and arrays in C++.
CO4	Construct object-oriented programs using classes, objects, constructors, and member functions.
CO5	Analyze the use of pointers, reference variables, and dynamic memory allocation in C++ programs.

Detailed Syllabus
Unit 1: Fundamentals of C++ (5 Hours)

Introduction to programming and object-oriented programming concepts, structure of a C++ program, tokens, keywords, identifiers, data types, variables, constants, operators, type casting, and input/output using `cin` and `cout`.

Unit 2: Control Structures (5 Hours)

Decision-making statements (`if`, `if-else`, `switch`), looping constructs (`for`, `while`, `do-while`), nested loops, break and continue statements, and logical problem-solving exercises.

Unit 3: Functions and Arrays (5 Hours)

Function declaration and definition, call by value and call by reference, inline functions, default arguments, function overloading, recursion basics, one-dimensional and two-dimensional arrays, and passing arrays to functions.

Unit 4: Classes and Objects (6 Hours)

Concept of classes and objects, access specifiers, member functions, array of objects, constructors (default and parameterized), copy constructor, destructor, static data members, `const` keyword, and friend functions.

Unit 5: Pointers and Memory Management (5 Hours)

Pointer fundamentals, pointer arithmetic, pointers with arrays and objects, dynamic memory allocation using `new` and `delete`, reference variables, pointer to functions, and practical problem-solving using pointers.

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Data Structures using C/C++	TPP Dept.	TPP	6th Edition (2025)

2	Object Oriented Programming In C++	Balaguruswami, E.	Tata McGraw-Hill	8 th Edition, (2020)
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Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Pub.Yr.)
1	The C++ Programming Language	Bjarne Stroustrup	Pearson Education	4th Edition (2013)
2	An Introduction to Object-Oriented Application Development	Richard Johnson	Thomson Learning	1 st Edition, (2007)

Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-316	Value Added Course (NCC)	MOOC	0	0	0	2	-	-	S/US

Course Outcomes:

Defined by the online platform for the specific course chosen.

The Departmental committee shall select a MOOC available on any reputed platform. However, the selected MOOC should not be similar to the regular courses offered as a part of the department curriculum.
course

The overall monitoring of the MOOC course will be under the supervision of the teacher In-charge of the department. The Departmental Academic Committee shall assess the student work based on the relevant course completion certificate.

S= Satisfactory

US=Unsatisfactory

Semester IV

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-401	Data Science & Machine Learning	Core Theory	4	3	1	0	40	60	100
Prerequisite: - Artificial Intelligence									

Course Outcomes (COs):

At the end of the course the student will be able to

CO1	Interpret fundamental concepts, methods, and theoretical principles in Machine Learning.
CO2	Apply supervised and instance-based learning algorithms to develop solutions for classification and regression tasks.
CO3	Compare different learning models, algorithms, and implement suitable machine learning techniques.
CO4	Analyze the functionality of Decision Tree and Bayesian Learning methods and assess their effectiveness in real-world problem solving.
CO5	Apply the models of Artificial Neural Networks, Genetic Algorithms, and assess their applications in intelligent systems.

Detailed Syllabus
Unit 1: Fundamentals of Data Science

Introduction, evolution, and key roles in data science (Data Scientist, Analyst, Engineer).

Phases of a data science project: problem definition, data collection, preparation, modeling, evaluation, and deployment. Applications in healthcare, finance, marketing, social media, and e-commerce. Overview of data collection methods and sources (databases, APIs, web scraping, sensors, social media). Concepts of structured/unstructured data, data integration, storage systems, data warehouses, and data lakes.

Ethical, privacy, and security issues in data science

(Hours 11)

Unit 2
Data Preparation, Visualization & Model Evaluation

Data formats (CSV, JSON, XML) and data preprocessing techniques such as parsing, wrangling, feature selection, and transformation. Data cleaning methods: handling missing, noisy, and inconsistent data; normalization and segmentation. Introduction to data visualization, types of charts, and visual encoding techniques. Exploratory Data Analysis (EDA) and tools like Matplotlib, Seaborn, Tableau, and Power BI. Basics of regression models (simple, multiple, polynomial) and model evaluation concepts such as cross-validation, overfitting, and model selection.

(Hours: 10)

Unit 3
Machine Learning Concepts

Introduction to machine learning and system design considerations. Types of learning: supervised, unsupervised, reinforcement, and instance-based learning. Supervised learning techniques including classification, regression trees, SVM, and KNN. Unsupervised learning through clustering and basics of reinforcement learning (Q-learning, value functions, temporal difference learning).

(Hours: 9)

Unit 5
Neural Networks & Genetic Algorithms

Introduction to artificial neural networks and their role in parallel processing.

Concepts such as perceptron, multilayer networks, back propagation, and recurrent networks.

Overview of genetic algorithms including evolution-based search, genetic programming, and parallelization techniques.

(Hours: 12)

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Machine Learning	Mitchell M., T.	McGraw-Hill	1st (1997)
2	Introduction to Machine Learning	Alpaydin Et	MIT Press	4th (2020)

Reference Books:

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Pattern Recognition and Machine Learning	Bishop M., C	Springer-Verlag	1st (2006)
2	Machine Learning, Neural and Statistical Classification	Michie D., Spiegelhalter J. D., Taylor C. C., Campbell	Overseas Press	1st (1994)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-411	Data Science & Machine Learning Lab	Core Practical/Laboratory	2	0	0	4	60	40	100

Prerequisite: - Basics of programming, statistics, and data handling.

Course Outcomes (COs):

At the end of the course, the student will be able to	
CO1	Understand and apply data preprocessing techniques such as cleaning, transformation, and reduction on real-world datasets.
CO2	Analyze and visualize data using appropriate graphical tools to extract meaningful insights.
CO3	Develop and implement machine learning models for regression and classification problems.
CO4	Evaluate and compare different machine learning algorithms using performance metrics.
CO5	Demonstrate the ability to use open-source tools and datasets for solving real-world data science problems.

Experiment 1: Installation & Setup

- Install any open-source ML tool (Python, Anaconda, Jupyter Notebook, Scikit-learn, Pandas).
- Verify installation with a simple program.

Experiment 2: Data Collection

- Search and download datasets from sources like:
 - Kaggle
 - UCI Repository
 - Data.gov
- Load dataset into Python using Pandas.

Experiment 3: Data Preprocessing – Cleaning

- Handle missing values (mean, median, mode)
- Remove duplicates
- Handle noisy/inconsistent data

Experiment 4: Data Transformation

- Apply:
 - Normalization (Min-Max Scaling)
 - Standardization
 - Encoding (Label Encoding / One-Hot Encoding)

Experiment 5: Data Reduction & Summarization

- Perform:
 - Feature selection
 - Dimensionality reduction (PCA - basic)
 - Data summarization using statistical measures

Experiment 6: Data Visualization

- Visualize dataset using:
 - Bar chart
 - Line graph
 - Histogram
 - Scatter plot
- Tools: Matplotlib / Seaborn

Experiment 7: Regression Model Implementation

- Select a regression dataset
- Implement:
 - Linear Regression
- Evaluate using:
 - Mean Squared Error (MSE)
 - R² Score

Experiment 8: Classification Algorithms

- Implement:
 - Logistic Regression
 - Decision Tree
 - K-Nearest Neighbors (KNN)
- Compare accuracy

Experiment 9: Clustering Techniques

- Implement:
 - K-Means Clustering
- Visualize clusters and analyze patterns

Experiment 10: Model Evaluation & Comparison

- Evaluate models using:
 - Accuracy
 - Precision, Recall, F1-score
 - Confusion Matrix
- Compare performance of multiple algorithms

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Machine Learning with Python	Andreas C. Müller, Sarah Guido	O'Reilly Media	1st (2016)
2	Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow	Aurélien Géron	O'Reilly Media	3rd (2022)

Reference Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Python for Data Analysis	Wes McKinney	O'Reilly Media	2nd (2017)
2	Applied Machine Learning with Python	Alex Galea	Packt Publishing	1st (2018)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-402	Software Engineering	Core Theory	4	3	1	0	40	60	100
Prerequisite: -Data Organization Concept									

Course Outcomes (COs):

At the end of the course, the student will be able to	
CO1:	Understand software engineering concepts, process models, and development practices.
CO2:	Apply Agile methodologies and compare them with traditional approaches.
CO3:	Analyze software requirements, risks, and project planning techniques
CO4:	CO4: Design and test software systems using UML diagrams and testing strategies..
CO5:	Evaluate software quality, metrics, and manage maintenance and release processes.

Detailed Syllabus

Unit 1

The evolving role of software, changing nature of software, software myths, layered technology, process framework, umbrella activities. Process models: waterfall model, incremental process model, evolutionary process models (prototyping and spiral model), unified process. Introduction to software engineering practices and challenges in modern software development..

(Hours 10)

Unit 2

Agility principles, Agile manifesto, Agile methods, plan-driven vs Agile development, Extreme Programming (XP), Scrum framework (roles, events, artifacts), Agile process models, advantages and limitations of Agile, Agile tools and practices, introduction to DevOps and continuous integration basics.

(Hours 10)

Unit 3

Functional and non-functional requirements, software requirement specification (SRS), requirements elicitation, analysis, validation, and management, risk management: identification, projection, RMMM plan, project planning: pricing, estimation techniques, scheduling, Agile planning.

(Hours 11)

Unit 5

Software quality concepts, software quality assurance (SQA), reviews, software reliability, product metrics (analysis, design, code, testing, maintenance), release management, product sustenance: maintenance, updates, migration strategies.

(Hours10)

Text Books

S.No .	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Software Engineering: A Practitioner's Approach	Roger S. Pressman, Bruce R. Maxim	McGraw-Hill	9th (2019)
2	Software Engineering	Ian Sommerville	Pearsons	10th (2015)

Reference Books

S.No .	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	The DevOps Handbook	Gene Kim, Jez Humble, Patrick Debois, John Willis	IT Revolution Press	2nd (2021)
2	Fundamentals of Software Engineering	Rajib Mall	PHI Learning	5th (2018)

Course Code	Course Type	Course Name	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-403	Core Theory	Cloud Computing	4	3	1	0	40	60	100
Prerequisites of Industrial Psychology: Basic concepts of AI									

Course Outcomes (COs):

At the end of the course, the student will be able to	
CO1	Define the fundamentals and concepts of Cloud Computing.
CO2	Explain cloud migration and virtualization technologies.
CO3	Apply capacity planning and identify cloud resources
CO4	Analyze SLA management and cloud security.
CO5	Evaluate different cloud platforms and services.

Detailed Syllabus

Unit 1

Overview of Computing Paradigm:

Recent trends in Computing – Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing.

Introduction to Cloud Computing:

Vision of Cloud Computing, Defining a Cloud, Cloud Delivery Model, Deployment Model, Characteristics, Benefits of Cloud Computing, Challenges ahead. Cloud Computing vs. Cluster Computing vs. Grid Computing.

(Hours11)

Unit 2

Migrating into a Cloud:

Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud.

Virtualization:

Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Hypervisor Technology Examples – Xen, VMware, Microsoft Hyper-V.

(Hours 10)

Unit 3

Capacity Planning:

Elasticity vs Scalability, Introduction, Defining Baseline and Metrics – Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance Types, Network Capacity, Scaling.

Resources Required to Build Cloud:

Compute Resources, Storage Resources, Network Resources, Resource Allocation and Optimization.

(Hours 10)

Unit 4

SLA Management in Cloud Computing:

Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud, Automated Policy-Based Management.

Securing Cloud Services:

Cloud Security, Securing Data – Brokered Cloud Storage Access, Storage Location and Tenancy, Encryption, Auditing and Compliance, Steps to Ensure Security over Cloud

(Hours 10)

Unit 5

Cloud Platforms in Industry:

Amazon Web Services – Compute Services, Storage Services, Communication Services, Additional Services.

Google App Engine – Architecture and Core Concepts, Application Life Cycle, Cost Model.

Microsoft Azure – Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.

(Hours 11)

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Cloud Computing: Concepts, Technology, Security and Architecture	Thomas Erl, Eric Barcelo Monroy	Pearson	2nd Edition (2023)
2	Mastering Cloud Computing: Foundations and Applications Programming	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Shivananda Poojara, Satish Narayana Srirama	Elsevier (Morgan Kaufmann)	2nd Edition (2026)

Reference Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Cloud Computing (Revised and Updated Edition)	Nayan B. Ruparelia	MIT Press	Revised Edition (2023)
2	CompTIA Cloud+ Guide to Cloud Computing	Jill West	Cengage	3rd Edition (2026)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-412	Cloud Computing Lab	Core Practical/Laboratory	2	0	0	4	60	40	100
Prerequisite: -C (in case of implementing using C)									

Course Outcomes (COs):

At the end of the course, the student will be able to	
CO1	Define cloud service and deployment models through practical exposure.
CO2	Explain cloud migration and virtualization techniques.
CO3	Apply cloud resource management and deployment methods.
CO4	Analyze cloud security and service management practices.
CO5	Evaluate cloud platforms and select suitable cloud solutions.

Sr.No.	Experiments
1	Study various companies in cloud business and identify their services under SaaS, PaaS and IaaS categories..
2	Create and deploy a simple warehouse/inventory management application using tools provided by any SaaS platform .
3	Implementation of Para-Virtualization using VMware Workstation / Oracle VirtualBox and Guest OS. Perform creation, migration, cloning and management of Virtual Machines.
4	Explore and use public cloud service provider tools for understanding IaaS, PaaS and SaaS services.
5	Set up a Private Cloud using open-source tools such as OpenStack / Eucalyptus .
6	Study and configure different Cloud Deployment Models (Public, Private, Hybrid and Community Cloud).
7	Perform Capacity Planning and Resource Allocation by monitoring CPU, memory, storage and network utilization in a cloud environment.
8	Implement Cloud Storage Services and perform data upload, sharing, backup and recovery with access control.
9	Configure Cloud Security mechanisms including encryption, authentication and auditing for cloud services.
10	Deploy and compare a sample application on different cloud platforms and analyze performance, scalability and cost .

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Mastering Cloud Computing: Foundations and Applications Programming	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Shivananda Poojara, Satish Narayana Srirama	Elsevier (Morgan Kaufmann)	2nd Edition (2026)
2	Cloud Computing: Concepts, Technology, Security and Architecture	Thomas Erl, Eric Barcelo Monroy	Pearson	2nd Edition (2023)

Reference Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Cloud Computing	Nayan B. Ruparelia	MIT Press	Revised Edition (2023)
2	Hands-On Cloud Administration in Azure	Chris Amaris	Packt Publishing	1st Edition (2023)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-404	Advance Python Programming	Skill Enhancement Course-II	1	3	0	0	20	30	50
Prerequisite: -Basic knowledge of Python programming, databases, and data analysis.									

Course Outcomes (COs):

At the end of the course the student will be able to	
CO1	Make use of database connection and execute queries using Python and MySQL.
CO2	Practice with Pandas library for data manipulation, statistical analysis and data visualization.
CO3	Apply NumPy library for numerical computation, array manipulation and mathematical operations.
CO4	Analyze datasets using scientific computing and visualization libraries such as SciPy and Seaborn.
CO5	Develop basic machine learning models using Python libraries such as Scikit-learn.

Detailed Syllabus

Unit 1

Database Connectivity using Python: Introduction to MySQL, Database concepts, Connecting Python with MySQL database, Creating database connections, Executing SQL queries (SELECT, INSERT, UPDATE, DELETE), Transaction handling, Exception handling and error management in database operations.

(Hours: 2)

Unit 2

Pandas Library for Data Analysis: Introduction to Pandas, Environment Setup. Data Structures in Pandas – Series, DataFrame and Panel. Basic Functionality of Pandas, Descriptive Statistics, Function Application, Reindexing, Iteration and Sorting.

Working with Text Data, Options and Customization, Indexing and Selecting Data.

Statistical Functions – Window Functions, Aggregations, Handling Missing Data, GroupBy operations, Merging and Joining, Concatenation.

Date and Time Functionality (Timedelta), Categorical Data, Data Visualization using Pandas.

(Hours: 3)

Unit 3

NumPy Library for Numerical Computing: Introduction to NumPy, Environment Setup, Narray Object, Data Types and Array Attributes.

Array Creation Routines – Arrays from Existing Data and Numerical Ranges. Indexing and Slicing, Iterating over Arrays, Array Manipulation, String Functions. Mathematical and Arithmetic Operations, Statistical Functions, Sorting, Searching and Counting Functions. Matrix Library, Linear Algebra operations. NumPy with Matplotlib – Histograms and Data Visualization. Input/Output operations with NumPy.

(Hours: 3)

Unit 4

Scientific and Visualization Libraries: Introduction to SciPy Library, Scientific computing functions, Optimization and Integration techniques. Introduction to Seaborn Library for statistical data visualization. Introduction to Scikit-learn library and overview of machine learning tools available in Python.

(Hours: 2)

Unit 5

Machine Learning using Python: Introduction to Machine Learning with Python, Data preprocessing techniques, Feature selection and scaling.

Supervised Learning algorithms using Scikit-learn – Linear Regression, Logistic Regression, K-Nearest Neighbors. Model training and testing, Model evaluation techniques, Introduction to classification and prediction.

(Hours: 2)

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Michael Urban and Joel Murach	Python Programming	Shroff/Murach	2nd (2021)
2	Python Training guide	Mercury Learning	BPB Publications	1st (2014)

Reference book

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Fluent Python: Clear, Concise, and Effective Programming	Luciano Ramalho	O'Reilly Media	2nd (2022)
2	Expert Python Programming	Michał Jaworski & Tarek Ziadé	Packt Publishing	4th (2021)

Course Code	Course Type	Course Name	Cd	L	T	P	Marks		
							Internal	External	Total
25C2AIU-414	Skill Enhancement Course	Career and Placement Planning - 2	1	0	0	2	50	-	50
Prerequisite: -Basic knowledge of Python programming and database concepts.									

Course Outcomes (COs):

After studying this course, students will be able to:	
CO1:	Develop Python programs using advanced control structures and functions.
CO2:	Apply object-oriented programming concepts in Python applications.
CO3:	Experiment with file handling techniques, exception handling mechanisms, and regular expressions to manage, validate, and process data effectively in programs.
CO4:	Create the structure and functionality of applications with Python frameworks and development tools.
CO5:	Demonstrate programs that interact with databases to store, retrieve, and manage data efficiently.

Sr. No.	Experiments
1	WAP to connect with MySQL
2	WAP to implement various queries
3	Implement various methods of NumPy Library
4	Implement various methods of Pandas Library
5	Implement various methods of Scipy Library
6	Implement various methods of Seaborn Library
7	Implement various methods of Scikit-learn Libraries

Text Books

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Core Python Programming	Wesley J. Chun	Pearson Education	3rd (2012)
2	Programming in Python	Pooja Sharma	BPB Publications	1st (2017)

Reference book

S.No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Python: The Complete Reference	Martin C. Brown	McGraw-Hill Education	4th (2022)
2	Learning Python	Mark Lutz	O'Reilly Media	5th (2013)

Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-415	Value Added Course (NCC)	MOOC	0	0	0	2	-	-	S/US

Course Outcomes:

Defined by the online platform for the specific course chosen.

The Departmental committee shall select a MOOC available on any reputed platform. However, the selected MOOC should not be similar to the regular courses offered as a part of the department curriculum.
course

The overall monitoring of the MOOC course will be under the supervision of the teacher In-charge of the department. The Departmental Academic Committee shall assess the student work based on the relevant course completion certificate.

S= Satisfactory

US=Unsatisfactory