AC NO. 22-02-2025
Item No. 4.1

SIES (Nerul) College of Arts, Science and Commerce (Autonomous)
Syllabus for Approval

B.SC (Artificial Intelligence)
(WITH EFFECT FROM THE ACADEMIC YEAR 2025-2026)

Sr. No.	Heading	Particulars
1	Title of the Programme	B.Sc. (Artificial Intelligence)
2	Eligibility for admission	HSC SCIENCE or Equivalent with Mathematics and Statistics as one of the subjects or its equivalent
3	Minimum Percentage for admission	50%
4	Passing Marks	40%
5	Semesters	I
6	Level	UG
7	Pattern	3-4 years & 6-8 semesters Choice Based Grading System
8	Status	New
9	To be implemented from	From Academic year 2025-26 in a progressive manner

Date: 22nd February, 2025.

Signature:

Dr. Koel Roychoudhury
AC Chairperson

Dr. Sheeja Ravi
Head of the Department

Sri Chandrasekarendra Saraswati Vidyapuram,, Plot I-C, Sector V,
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SIES (Nerul) College of Arts, Science & Commerce (Autonomous)
RISE WITH EDUCATION

SIES (Nerul) College of Arts, Science and Commerce (Autonomous)

(Affiliated to University of Mumbai)
RE-ACCREDITED GRADE "A" BY NAAC (3rd CYCLE)

BOARD OF STUDIES
SYLLABUS FOR
B.SC (ARTIFICIAL INTELLIGENCE)

(WITH EFFECT FROM THE ACADEMIC YEAR 2025-2026)

OBJECTIVES OF THE PROGRAMME:

- To develop students to design robust and maintainable solutions for both simple and complex problems using Artificial Intelligence and machine learning.
- To equip students with a solid understanding of mathematics and science, essential for solving real-world problems with Artificial Intelligence technologies.
- To prepare students to analyze requirements and design engineering solutions by applying Artificial Intelligence and machine learning theory.
- To foster competency in Artificial Intelligence/Machine Learning tools and promote collaborative learning through multi-disciplinary projects.
- To ensure adherence to high ethical standards and industry codes of conduct in AI development.
- To equip students to contribute to societal progress through continuous learning and ethical application of emerging Artificial Intelligence technologies.

PROGRAMME OUTCOMES:

- At the end of the program, students will have a strong understanding of Artificial Intelligence and machine learning algorithms, techniques, and tools, enabling them to develop effective and efficient AI-driven solutions.
- Students will possess practical experience in implementing Artificial Intelligence and machine learning models through hands-on projects and real-world applications.
- Students will be equipped with the skills to conduct research, innovate, and stay updated with the latest advancements in Artificial Intelligence technologies and methodologies.
- Students will demonstrate an understanding of the ethical implications of Artificial Intelligence technologies and apply responsible practices in developing Artificial Intelligence systems.
- Students will effectively communicate complex Artificial Intelligence concepts and solutions and collaborate in multi-disciplinary teams to achieve project goals.

SIES(Nerul) College of Arts, Science and Commercc(Autonomous)

NEP Credit Structure for B.SC (ARTIFICIAL INTELLIGENCE)

Semester	Major	Minor	OE (Basket)	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT,FP, CEP,CC, RP	Cum. Cr./ Sem.
I	Introduction to Artificial Intelligence (2+1P credit Fundamental of Programming using Python (2+1P) credit	-	Eco-Shatra (4-credit)	VSC-Descriptive Statistics (2- credit) SEC - Critical Thinking Techniques(2-credit)	AEC-Effective Communication – I (2- credit) VEC-Environmental studies for computer Science (2- credit) IKS- Indian Astronomy (2- credit)	CC- Life Skill I (2- credit)	22
Total of I	6		4	4	6	2	22

SCHEME OF MODULES

SEMESTER I			
Serial No	Course code	Credits	Course Name
I	Major Department Specific Course (DSC)		
1	U25AI1MJ01	02	Introduction to Artificial Intelligence
2	U25AI1MJP01	01	Practical of Introduction to Artificial Intelligence
1	U25AI1MJ02	02	Fundamentals of Programming using Python
2	U25AI1MJP02	01	Practical of Fundamentals of Programming using Python
II	Open Electives(OE)/ Generic Electives		
1	U25BE1E01	04	Eco Shastra
III	VOCATIONAL COURSE (VC) & SKILL ENHANCEMENT COURSE (SEC)		
1	U25AI1VSC01	02	Descriptive Statistics
2	U25AI1SEC01	02	Critical Thinking Techniques
IV	ABILITY ENHANCEMENT COURSE(AEC)/VALUE EDUCATION COURSE (VEC) / INDIAN KNOWLEDGE SYSTEM (IKS)		
1	U25AI1AEC01	02	Effective Communication - I
2	U25CS1VEC01	02	Environmental Studies for Computer Science
3	U25CS1IKS01	02	Indian Astronomy
V	Co-Curricular(CC) (Any one)		
1	U25CC1LS01	02	Co – curricular in Life Skills I
2	U25CC1DLLE01	02	Co – curricular in DLLE
3	U25CC1NSS01	02	Co – curricular in NSS
TOTAL CREDITS		22	

MAJOR- Introduction to Artificial Intelligence

COURSE CODE: U25AI1MJ01 **COURSE CREDIT: 02**

1 credit – 15 lectures

1 lecture is 60 minutes

Course Objectives:
- Understand the foundations, history, and state of the art of AI.
- Learn about intelligent agents, their environments, and the structure of agents.
- Explore different problem-solving strategies, including uninformed and informed search techniques.

Learning Outcomes:
After successful completion of this course, students would be able to
- Demonstrate knowledge of the foundations and key concepts in the field of AI.
- Analyze and design intelligent agents for specific environments.
- Apply problem-solving techniques and algorithms to find solutions to different types of problems.

Unit	Topics	No. of Lectures
I	**Introduction to AI and Intelligent Agents** **What Is AI:** Foundations, History and State of the Art of AI **Intelligent Agents:** Agents and Environments, Nature of Environments, Structure of Agents.	15
II	**Problem Solving by Searching:** Problem Solving agents, searching for solutions, **Informed Search:** A* search, AO* search, **Uninformed search:** Depth First Search, Breadth First Search, Brand and Bound, Heuristic functions.	15

Textbook(s):
1. Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison-Wesley Publishing Company, 2004.
2. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson, 2010.
3. Nils J. Nilsson, Principles of Artificial Intelligence,
4. Artificial Intelligence by Dr. Rajeshri Shinkar, Dr. Rajendra Patil, Ms. Mitali Shewale, University of Mumbai

Additional Reference(s):
1. Artificial Intelligence: Foundations of Computational Agents, David L Poole,Alan K. Mackworth, 2nd Edition, Cambridge University Press ,2017.
2. Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017 3) The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer, 2013

MAJOR- Practical of Introduction to Artificial Intelligence

COURSE CODE: U25AI1MJP01 **COURSE CREDIT: 01**

1 credit – 2 lectures **1 lecture is 60 minutes**

Sr. No	List of Practical
1	Breadth First Search · Implement the Breadth First Search algorithm to solve a given problem.
2	Depth First Search · Implement the Breadth First Search algorithm to solve a given problem.
3	Iterative Depth First Search · Implement the Iterative Depth First Search algorithm to solve the same problem
4	A* Search · Implement the A* Search algorithm for solving a pathfinding problem.
5	Recursive Best-First Search · Implement the Recursive Best-First Search algorithm for the same problem.
6	Decision Tree Learning · Implement the Decision Tree Learning algorithm to build a decision tree for a given dataset.
7	Visualization and interpretation of decision tree · Evaluate the accuracy and effectiveness of the decision tree on test data. · Visualize and interpret the generated decision tree.
8	Support Vector Machines (SVM) · Implement the SVM algorithm for binary classification.
9	Support Vector Machines (SVM) · Train an SVM model using a given dataset and optimize its parameters.
10	Support Vector Machines (SVM) · Evaluate the performance of the SVM model on test data and analyze the results.
11	Naive Bayes' Classifier · Implement the Naive Bayes' algorithm for classification.
12	Naive Bayes' Classifier · Train a Naive Bayes' model using a given dataset and calculate class probabilities.
13	K-Nearest Neighbors (K-NN) · Implement the K-NN algorithm for classification or regression.

MAJOR- Fundamentals of Programming using Python

COURSE CODE : U25AI1MJ02 **COURSE CREDIT: 02**

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objectives:

- To learn how to write algorithms and flowchart.
- To explore Python programming and understand components of Python Program to design and write program applications.
- To learn loops and decision statement, functions and strings, list, tuple and dictionaries in Python.

Course Outcomes:

After successful completion of this course, students would be able to:

- Ability to write algorithms and flowchart
- Ability to store, manipulate and access data in Python and decision statement in Python also how to write functions and pass arguments in Python.

Unit	Syllabus	No. of lectures
01	**Introduction to Algorithms and Flowchart:** Expressing Algorithms, Benefits of Using Algorithms, General Approaches in Algorithm Design. Advantages of Using Flowcharts ,Limitations of Using Flowcharts , When to Use Flowcharts, Flowchart Symbols & Guidelines, Types of Flowcharts **Introduction:** The Python Programming Language, History, features, Installing Python, Running Python program, Debugging : Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages, The Difference Between Brackets, Braces, and Parentheses, **Variables and Expressions:** Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations. **Conditional Statements:** if, if-else, nested if –else **Looping:** for, while, nested loops **Control statements:** Terminating loops, skipping specific conditions	15
02	**Functions:** Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters Are Local, Stack Diagrams, Fruitful Functions and Void Functions, Why Functions? Importing with from, Return Values, Incremental Development, Composition, Boolean Functions, More Recursion, Leap of Faith, Checking Types **Strings:** A String Is a Sequence, Traversal with a for Loop, String Slices, Strings Are Immutable, Searching, Looping and Counting, String Methods, The in Operator, String Comparison, String Operations. **Lists:** Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods **Tuples and Dictionaries:** Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods	15

References:

Textbook:

1. Introduction to Python Programming by Dr. Trupti S Wani, Mrs, Sonali Sambre, Ms. Beena Kapadiaya , Sheth Publication.

Python Programming by Kiran Gurbani and Ashwin Mehta, Himalaya Publications.

Additional References:

1. Introduction to Computing and Problem Solving Using Python by E Balagurusamy, Mc Graw Hill.
2. Programming and Problem solving with Python by Ashok Namdev Kamthane and Amit Ashok Kamthane, Mc Graw Hill.

MAJOR- Practical of Fundamentals of Programming using Python

COURSE CODE : U25AI1MJP02 **COURSE CREDIT: 01**

1 credit - 2 lectures
1 lecture is 60 minutes

Sr. No.	List of Practicals
1	Write the program for the following: a. Write a program to find the average of five numbers. b. Write a program to swap the values of variables.
2	Write the program for the following: a. Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old. b. Enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user.
3	Write the program for the following: a. Write a program to check the number is prime number or not. b. Write a program to print all prime numbers in an interval.
4	Write the program for the following: a. Write a program to find the factorial of a number. b. Write a program to print sum of first ten natural numbers.
5	Write the program for the following: a. Write a program to find LCM and HCF. b. Write a function to check the input value is Armstrong.
6	Write the program for the following: a. Write the function to check for Palindrome. b. Write a program to generate the Fibonacci series.
7	Write the program for the following: a. Write a recursive function to print the factorial for a given number. b. Write a function that takes a character (i.e. a string of length 1) and returns True if it is a vowel, False otherwise.
8	Write the program for the following: a. Define a function that computes the length of a given list or string. b. Define a procedure histogram() that takes a list of integers and prints a histogram to the screen. For example, histogram([4, 9, 7]) should print the following: **** ********* *******

9	Write the program for the following: a. A pangram is a sentence that contains all the letters of the English alphabet at least once, for example: The quick brown fox jumps over the lazy dog. Your task here is to write a function to check a sentence to see if it is a pangram or not. b. Take a list, say for example this one: a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89] and write a program that prints out all the elements of the list that are less than 5.
10	Write the program for the following: a. Write a program that takes two lists and returns True if they have at least one common member. b. Write a Python program to print a specified list after removing the 0th, 2nd, 4th and 5th elements.
11	Write the program for the following: a. Write a Python program to clone or copy a list b. Write a Python script to sort (ascending and descending) a dictionary by value.
12	Write the program for the following: a. Write a Python script to concatenate following dictionaries to create a new one. Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60} Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60} b. Write a Python program to sum all the items in a dictionary.
13	Write a python program to make a simple calculator.

VSC- Descriptive Statistics

COURSE CODE : U25AI1VSC01 **COURSE CREDIT: 02**
1 Credit – 15 Lectures **1 Lecture is 60 minutes**

Course Objectives:

- To develop the learner's ability to deal with different types of data and to enable the use of different measures of central tendency and dispersion wherever relevant.
- To make learner enable to find the correlation between different variables and further apply the regression analysis to find the exact relation between them and develop ability to analyze statistical data through R software.

Course Outcomes:

- Ability to organize, manage and present data.
- Ability to analyse Statistical data using measures of central tendency and dispersion.
- Study the relationship between variables using techniques of correlation and regression.

Unit	Syllabus	No. of Lectures
1	**Data Types and Data Presentation**: Data types: Attribute, Variable, Discrete and Continuous variable, Univariate and Bivariate distribution. Types of Characteristics, Different types of scales: nominal, ordinal, interval and ratio. **Data presentation**: Frequency distribution, Frequency curve and polygon, Histogram, Ogive curves Stem-leaf representation. **Measures of Central tendency**: Concept of average/central tendency, characteristics of good measure of central tendency. Arithmetic Mean (A.M.), Median, Mode, Combined mean. Partition Values: Quartiles, Deciles and Percentiles. Representing mode, median and quartiles using graphs. **Measures dispersion:** Range, Semi-interquartile range, Quartile deviation, Standard deviation, Variance. Coefficient of range, Coefficient of quartile deviation and Coefficient of variation (C.V.)	15

II	Relation between raw and central moments. **Measures of Skewness and Kurtosis**: Concept of Skewness and Kurtosis, measures based on moments, quartiles (Karl Pearson's and Bowleys measure of skewness) **Correlation**: Measure of Correlation: Scatter diagram and interpretation; Karl Pearson's coefficient of correlation (r), Spearman's rank correlation coefficient: Definition, examples of with and without repetition. **Regression:** Concept of dependent (response) and independent (predictor) variables, concept of regression, Types and prediction, difference between correlation and regression, Relation between correlation and regression	15

References:

1. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd, Calcutta.
2. Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi

Additional References:

1. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
2. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
3. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.
4. Schaum's Outline Of Theory And Problems Of Beginning Statistics, Larry J. Stephens, Schaum's Outline Series McGraw-Hill. 2009

SEC- Critical Thinking Techniques

COURSE CODE : U25AISEC01 **COURSE CREDIT: 02**

1 Credit – 15 Lectures **1 Lecture is 60 minutes**

Course Objectives:

- To Develop Computational Thinking Skills.
- To Apply Logical and Algorithmic Reasoning.

Course Outcomes:

After successful completion of this course, students would be able to

- Apply critical thinking techniques to solve computing problems.
- Evaluate algorithmic efficiency and data-driven arguments

Unit	Syllabus	No. of Lectures
1	Foundations of Critical Thinking: Introduction to Critical Thinking in Computing, Logical Reasoning & Deductive vs. Inductive Thinking, Common Logical Fallacies in Technology and Programming, Bias in Algorithms and Decision-Making Problem-Solving Strategies: Computational Thinking: Decomposition, Pattern Recognition, Abstraction, and Algorithms, Debugging as a Critical Thinking Exercise, Heuristics vs. Formal Methods in Problem-Solving, Case Studies in Complex Problem-Solving (e.g., AI bias, software failures)	15
2	Algorithms and Logic: Algorithmic Thinking and Pseudocode, Computational Complexity & Trade-offs, Evaluating Algorithm Efficiency: Big-O Notation, Logical Proofs and Boolean Algebra Data-Driven Decision Making: Understanding Data Bias and Misinterpretation, Ethical Implications of AI and Machine Learning, Data Science and Critical Thinking: Making Sense of Information, Case Study: How Misinformation Spreads in Digital Systems.	15

1. "How to Solve It" – George Pólya
2. "The Art of Problem Solving, Vol. 1: The Basics" – Richard Rusczyk

Additional References:
1. "Introduction to the Design and Analysis of Algorithms" – Anany Levitin

AEC- EFFECTIVE COMMUNICATION -1

COURSE CODE : U25AIAEC01 COURSE CREDIT: 02

1 credit - 15 lectures
1 lecture is 60 minutes

Course Objectives:

1. To develop an awareness among learners about the complexity of communication process.
2. To develop effective letter writing skills among students with reference to prescribed layouts and formats.
3. To demonstrate the effective use of communication skills applicable for the employability in present situation.

Module-1 .Theory of Communication		**(Total 10 Lectures)**
1.	Introduction and Process of Communication	01
2.	Channels of Communication: Formal /Informal, Vertical, Downward, Upward, Horizontal, Grapevine	03
3.	Methods of Communication: Verbal/Nonverbal	02
4.	Barriers in Communication: Physical, Linguistic, Psychological, Sociocultural, Mechanical	03
5.	Modern Modes of Communication	01
Module-2.Business Correspondence -1		**(Total 10 Lectures)**
1.	Theory of Business Letter Writing,7 Cs of Writing	01
2	Format of Letter Writing, Full Block Format, Modified Block Format, Parts of Letter : Major Parts/Minor Parts	02
3.	Personnel Correspondence: Job Application Letter, Resume, Job Acceptance Letter, Resignation Letter, Recommendation Letter.	05
4.	Professional E mail Writing: Format, Principles	02
Module-3.Language and Writing Skills		**(Total 10 Lectures)**
1.	Paragraph Writing: Developing an idea, Use of appropriate linking devices, Interpretation of Data, Composition on given situation	05
2	Listening Comprehension, Public Speaking Skills, ICT Enabled Communication, Appropriate use of Non-Verbal Communication, Multilingual Competency.	05

Reference Books:

1. A Handbook of Commercial Correspondence by Ashley, A, Oxford University Press, 1992.
2. Basic Business Communication: Skills for Empowering the Internet Generation by Raymond Lesikar and Marie Flatley,9th Edition, Tata McGraw Hill, New Delhi,2002.
3. Business Communication by D Chaturvedi and Mukesh Chaturvedi, Third Edition, Pearson Publications Ltd,2013.
4. Business Communication by Meenakshi Raman and Prakash Singh ,Oxford University Press,2007.
5. Business Communication Strategies by Monippally, Matthukutty, M,Tata McGraw Hill New Delhi,2001.
6. Effective Business Communication by Herta Murphy, Herbert Hildebrandt,,Jane Thomas,Mc Graw Hill Education,2009.
7. Effective Communication by Balan K.R. and Rayadu C.S., Beacon Publication, New Delhi, 1996.
8. Effective Technical Communication by M.Ashraf, Rizvi,Mc Graw Hill Publications,

IKS- Indian Astronomy

COURSE CODE : U25CSIKS01 COURSE CREDIT: 02

1 credit - 15 Hours
1 lecture is 60 minutes
Course Objectives:
To develop an awareness among learners about the Indian Astronomy.
To make learners proficient in the concept, technicalities and computational procedures developed by Indian mathematician and astronomers.
Course Outcomes:
To understands basics of Indian Astronomy.
To Understand Coordinate Systems, Rasi & Nakshatra systems.

Unit	SYLLABUS	No of Lectures
I	Indian Knowledge System : Importance of Ancient Knowledge, Defining Indian Knowledge System, Need of IKS, The IKS Corpus, Caturdasa-Vidyasthana, Historicity of IKS, Unique aspects of IKS, Nuances of Oral Tradition, Sutras, Encryptions	15
II	Astronomy: Unique Aspects, Historical Development of Astronomy in India, The celestial coordinate system, Elements of the Indian Calendar, Notion of years and months, Aryabhatta and Siddhantic tradition, Panchanga- The Indian Calendar System, Astronomical Instruments, Jantar Mantar of Raja Jai Singh Sawai	15

Reference Books:

1. Indian 1.Astronomy: An Introduction by S Balachandra Rao, University Press
2. Mathematics in Ancient and Medieval India by A K Bag, Orientilia Delhi.

VEC-Environmental Studies for Computer Science

COURSE CODE : U25CSVEC01 **COURSE CREDIT: 02**

1 credit - 15 lectures

1 lecture is 60 minutes

Course Objectives:

1. Understand key concepts of environmental studies, ecosystems and natural resources
2. Understand environmental policies and practices
3. Understand the role of communities in environmental management, Use computing effectively by applying concepts of green computing

Course Outcome

1. To understand environmental policies and practices.
2. To develop ethical values towards the environment conservation

Unit	Syllabus	No. of lectures
01	**Introduction** The Multidisciplinary Nature of Environmental Studies, Components of the Environment, Scope and Importance of Environmental Studies, Concept of Sustainability and Sustainable Development. **Ecosystems and Natural Resources** Overview of Ecosystems, Structure and Function of Ecosystems, Energy Flow in Ecosystem, Food Chain, Food Web and Ecological Succession, Case Studies of Ecosystems, Degradation of Ecosystems, Renewable and Non-Renewable Resources, Deforestation, Role of an Individual in the Conservation of Natural Resources.	15
02	**Human Communities and the Environment** Human Population and Growth, Carbon Footprint, Resettlement and Rehabilitation of Project-Affected Persons, Disaster Management, Environmental Movements, Environmental Ethics, Environmental Communication and Public Awareness, Visit to Local Area to Document Environmental Assets. **Green Computing** Overview of Green Computing, Green Computing Efforts, Going Paperless, Power Measurement and Power Reduction, Electronic Waste, Recycling of Electronic Waste, Green Supply Chain, Certifications for Green Computing	15

References:

1. BharuchaErach, "Textbook of Environmental Studies for Undergraduate Courses", Universities Press
2. "Green Computing", Website:https://mu.ac.in/wp-content/uploads/2021/03/GreenComputing.pdf
3. Hawkins R.E., "Encyclopedia of Indian Natural History", Bombay Natural History Society, Bombay
4. Kaushik A., "Environmental Studies", New Age International Publication, New Delhi
5. Jadhav, H &Bhosale, "Environmental Protection and Laws", Himalaya Pub. House, Delhi

Co-Curricular Course in Life Skills I

COURSE CODE: U25CC1LS01 **COURSE CREDIT: 02**

1 credit - 15 lectures **1 lecture is 60 minutes.**

Course Objectives:

1. To enhance one's ability to be fully self- aware by helping oneself to overcome all fears and insecurities and to grow fully from inside out and outside in.
2. To increase one's knowledge and awareness of emotional competency and emotional intelligence at place of study/work
3. To develop interpersonal skills and adopt good leadership behavior foe empowerment of self and others
4. Provide the opportunity for realizing self-potential through practical experience.

Course outcomes:

After completion of the course, learners would be able to:

1. Demonstrate a set of practical skills such as self-management.
2. Practice active listening and persuasion.
3. Adopt good leadership practice.
4. Realize their potential as human beings and conduct themselves properly in the ways of the world.

Module No	Syllabus	No. of Hours	
1	A) Self -Awareness- Self -Concept, Self Esteem, Techniques of Self- awareness- SWOT analysis, Johari Window	4	10
	B) Self -Management- Mindfulness, Innovation, Adaptability, Agility, trustworthiness, Self - Motivation, Emotional Quotient	6	
2	A) Listening as an Active Skill- Types of listeners, Techniques of Effective Listening Listening and Comprehension Probing Questions Barriers to Listening	6	10
	B) Art of Persuasion- Importance, Techniques	4	
3	A) Creative Problem Solving- Six Thinking hats, Mind Mapping, Forced Connections	6	10
	B) Leadership Spiritual leadership, Servant leadership, Value driven authentic leadership	4	
	Total Hours		30

References:

- Goleman, D, Working with Emotional Intelligence. Bloosbury Publication, 1998
- Ghosh, S., Universal Values: As reflected in literature. Ramakrishna Mission Institute of Culture, 2004
- Wadkar, A. J, Life Skills for success.SAGE, 2016

Pedagogy- Practical session / experiential learning / Demonstration /Biographies /Reflection Journal

SCHEME OF PRACTICAL EXAMINATION

I. FOR MAJOR PAPERS

The scheme of examination shall be

- Practical assessment carries 50 marks: 40 marks + 05 marks (journal) + 05 marlks (viva)
- Minimum 75 % practical are required to be completed and written in the journal

(Certified Journal is compulsory for appearing at the time of Practical Exam)

(A) Practical Assessment 50 marks

Description	Marks
Q.1 Two questions of practical's (20 marks each)	40
Journal	5
Viva	5

Passing criteria: Minimum 40% i.e. 20 out of 50 Marks

SCHEME OF THEORY and PRACTICALS EXAMINATION(VSC/AEC/VEC/SEC/IKS)

The scheme of examination shall be divided into two parts:
Internal assessment 40% i.e. 20 marks
Semester end examination 60% i.e. 30 marks

(A) Internal Assessment 20 marks

Description	Marks
Internal tests of 10 marks each Q.1 Multiple choice Questions/True or False - 10 Marks	10
One Project and Viva voce/Presentation/Case studies/Posters	5
Attendance and Class behavior	5
Total	20

(B) Semester end examination 30 marks PAPER PATTERN

Total Marks: 30 Duration: 1 hours

Description	Based on	Marks
Q.1 A) Descriptive Question OR B) Short Notes 2 out of 3 (5 Marks each)	Unit 1	10
Q.2 A) Descriptive Question OR B) Short Notes 2 out of 3 (5 Marks each)	Unit 2	10
Q.3 A) Descriptive Question OR B) Short Notes 2 out of 3 (5 Marks each)	Unit 3	10
Note: Q.1, 2, 3 may be divided into sub questions if required. Q.3 May include theory (short notes) /Case Study in one of the options.		

- **Semester end examination 30 marks PAPER PATTERN**
- **Passing criteria: Minimum 40% in Internal (08 out of 20) and 40% (12 out of 30) in semester end examination.**

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SCHEME OF EXAMINATION OF CO-CURRICULAR

Total Marks: 50

Continuous Evaluation pattern.

Evaluation Criteria	Marks
Prepare a report/presentation/movie/video	10
Roleplay /Discussions /Tests /Projects /Assignments	10
Class Participation	10
Reflective journal evaluation	20
Total	50

SCHEME OF THEORY and PRACTICALS EXAMINATION OF MAJOR

SCHEME OF EXAMINATION

I. FOR MAJOR PAPERS WITH 3 CREDITS

The scheme of examination shall be divided into two parts:

- Internal assessment 40% i.e. 20 marks
- Semester end examination 60% i.e. 30 marks

(A) Internal Assessment 20 marks

Description	Marks
Internal test of 10 marks Multiple choice questions- 10 marks	10
Presentation/ case studies/ Poster making/ Quiz/ Role Play/ Subject Specific Activities	5
Attendance and class Behaviour	5
Total	20

(B) Semester end examination 30 marks

PAPER PATTERN

Duration : 1 hours			
Total Marks: 30			
All questions are compulsory			
Question	Based on	Options	Marks
1	Unit 1	A & B or P & Q	10
2	Unit 2	A & B or P & Q	10
3	Unit 1,2	A & B or P & Q	10
Total			30
Note: 1. Q.1,2 & 3 – 10 marks questions may be divided into sub questions if required.			

Passing criteria: Minimum 40% Internal (8 out of 40) and 40% (12 out of 30) in semester end examination.

SIES (Nerul) College of Arts, Science & Commerce
RISE WITH EDUCATION

CELEBRATING 25 YEARS 1998-2023

SIES (Nerul) College of Arts, Science and Commerce (Autonomous)

Department of Lifelong Learning and Extension

Sr. No.	Heading	Particulars
1	Title of the course	Introduction to DLLE
2	Semesters	I
3	Level	UG
4	Pattern	03 years & 06 semesters CBGS
5	To be implemented from	From Academic year 2024-25 in a progressive manner

SIES (NERUL) COLLEGE OF ARTS, SCIENCE AND COMMERCE (AUTONOMOUS)
NERUL
NAVI
MUMBAI
400 706.

DLLE - Introduction to DLLE

COURSE CODE:U24CC1DLLE01 COURSE CREDIT: 02

1 credit - 15 lectures

1 lecture is 60 minutes.

Course Outcome

1. Students will acquire knowledge on the structure of DLLE.
2. It will enable students to connect and understand the social realities and work for social welfare. It would help students to enhance leadership skills and apply them in their careers.
3. Students will be more aware of the practicality of real life and can face challenges in a better way and will be able to connect to the unreached section of society and help them

Learning outcome:

1. Learners will understand the structure and working of DLLE.
2. Students will connect to the people in society and work for social welfare.
3. Students will gain experience to work in society on various social aspects.

Unit No	Topic	No of Lectures
Unit - 1	• Introduction to DLLE • Aim & Objectives of DLLE • The Extension Dimension (Reach to Unreached) • Importance of Extension and Community work services in NGOs and the society • Role of Extension Teacher, Student Manager and Volunteers • Understanding community-related issues around the region and developing a sensitive approach towards society • Engage in community partnership practices and provide leadership in promoting changes to improve community well-being, Community engagement, and leadership	15

National Service Scheme (NSS) Studies Paper-I
Course Code: U24CC1NSS01
Course Type: Co-curricular
Total Lectures per week:2 **Credits: 2**
Course Objectives:
The syllabus is aimed to achieve the following objectives:

1. To understand the Working, Framework and Contribution of NSS.
2. To Concept of Social Justice and its Importance
3. To understand themselves in relation to their community.
4. To identify the needs and problems of the community and involve them in problem-solving
5. To develop among themselves a sense of social and civic responsibility.
6. To utilize their knowledge in finding practical solutions to individual and community problems.

Learning Outcome:
The learners will be able to:

1. To understand Structural framework of NSS from National Level to College Level
2. Define Social Justice and how it helps the community
3. Enabling the students to contribute towards development of Community
4. Get involved in community betterment and active problem solving
5. Better Sense of social and civic responsibility. Have a better sense of Reduce, Recycle and Reuse
6. Collaborate and Work towards Solving Individua and Community Problems.

Unit No.	Topic	No. of Lectures
Unit-I	**Introduction to National Service Scheme (NSS)** • Formation and development of NSS in India • Structural framework of NSS from National Level to College Level • Objectives of NSS • Symbol and Moto of NSS and its meaning • Basic Social Issues in India (Family System, Division of labour, Cast System in India, Gender Issues, Regional Imbalance) **Introduction to Social justice** Social Justice – the Concept and its features, Contribution for Social Justice – Mahatma Jyotiba Phule, Dr. Babasaheb Ambedkar, Shahu Maharaj, Chhatrapati Shivaji Maharaj, Savitribai Phule.	15
Unit-II	**Suggested Projects:** • Environment awareness – Waste management & segregation, Reduce, Reuse & Recycle, • Organic waste management by composting (maintenance of compost project) • Volunteering at study centers managed by Stree Mukti Sanghatana	15
	Total Lectures	**30**

	Semester – I
Course Name: National Service Scheme (NSS)	**Course Code:**
Course Type	**Co-curricular**
Focuses on	**Skill Development**
Caters to	**Local, National, Global**
Total Lectures per week (1 Period is 60 minutes)	**2 (TBD)**
Credits	**2**

COURSE OUTCOME

Unit	Topics	CO	LO
Unit 1	Introduction to National Service Scheme (NSS)	CO1, CO2	LO1, LO2
Unit 2	Introduction to Social justice	CO3, CO4	LO3, LO3
Unit 3	Community Welfare	CO5, CO6	LO5, LO6

The scheme of Examination shall be divided as follows.

- **Continuous Evaluation Pattern**

Description	Marks
30 hours activity related work such as • Attending lectures/ training sessions (10 Marks) • Field work & Maintenance of work record (25)	35
Project Report	5
Viva-voce by faculty in charge and attendance	10
Total	**50**

References:

1. National Service Scheme Manual (Revised) Government of India, Ministry of Youth Affairs and Sports, New Delhi
2. National Service Scheme Manual University of Mumbai
3. National Service Scheme Manual for NSS District Coordinators National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya
4. Rashtriya Seva Yojana Sankalpana Prof. Dr. Sankey Chakane, Dr. Pramod Diamond Publication, Pune

5. Annual Report of National Service Scheme (NSS) Dept. of Higher and Technical Education Mantralaya. Dept. of Higher and Technical Education Mantralaya.
6. Training Programme on National Programme scheme, TISS.
7. Orientation Courses for N.S.S. Programme officers, TISS.
8. Social Problems in India, Ram Ahuja.
9. National Service Scheme in India : A Case Study of Karnataka, M. B. Dishad, Trust Publications,2001
10. http://www.thebetterindia.com/140/national-service-scheme-nss/
11. http://en.wikipedia.org/wiki/national-service-scheme
12. http://nss.nic.in/adminstruct
13. http://nss.nic.in/propexpan
14. http://nss.nic.in
15. http://socialworkness.org/about.html

AC NO.
Item No. 1.

SIES (Nerul) College of Arts, Science and Commerce (Autonomous)

Syllabus for Approval

B.Sc. (Artificial Intelligence)

(WITH EFFECT FROM THE ACADEMIC YEAR 2025-2026)

Sr. No.	Heading	Particulars
1	Title of the Programme	B.Sc. (Artificial Intelligence)
2	Eligibility for admission	HSC SCIENCE or Equivalent with Mathematics and Statistics as one of the subjects or its equivalent
3	Minimum Percentage for admission	50%
4	Passing Marks	40%
5	Semesters	II
6	Level	UG
7	Pattern	3-4 years & 6-8 semesters Choice Based Grading System
8	Status	New
9	To be implemented from	From Academic year 2025-26 in a progressive manner

Date:
Signature:

Dr. Koel Roychoudhury
AC Chairperson

Dr. Sheeja Ravi
Head of the Department

Sri Chandrasekarendra Saraswati Vidyapuram,, Plot I-C, Sector V,
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www.siesascn.edu.in

SIES (Nerul) College of Arts, Science and Commerce (Autonomous)

(Affiliated to University of Mumbai)
RE-ACCREDITED GRADE "A" BY NAAC (3rd CYCLE)

BOARD OF STUDIES
SYLLABUS FOR
B.Sc. (ARTIFICIAL INTELLIGENCE)

(WITH EFFECT FROM THE ACADEMIC YEAR 2025-2026)

OBJECTIVES OF THE PROGRAMME:

- To develop students to design robust and maintainable solutions for both simple and complex problems using Artificial Intelligence and machine learning.
- To equip students with a solid understanding of mathematics and science, essential for solving real-world problems with Artificial Intelligence technologies.
- To prepare students to analyze requirements and design engineering solutions by applying Artificial Intelligence and machine learning theory.
- To foster competency in Artificial Intelligence/Machine Learning tools and promote collaborative learning through multi-disciplinary projects.
- To ensure adherence to high ethical standards and industry codes of conduct in AI development.
- To equip students to contribute to societal progress through continuous learning and ethical application of emerging Artificial Intelligence technologies.

PROGRAMME OUTCOMES:

- At the end of the program, students will have a strong understanding of Artificial Intelligence and machine learning algorithms, techniques, and tools, enabling them to develop effective and efficient AI-driven solutions.
- Students will possess practical experience in implementing Artificial Intelligence and machine learning models through hands-on projects and real-world applications.
- Students will be equipped with the skills to conduct research, innovate, and stay updated with the latest advancements in Artificial Intelligence technologies and methodologies.
- Students will demonstrate an understanding of the ethical implications of Artificial Intelligence technologies and apply responsible practices in developing Artificial Intelligence systems.
- Students will effectively communicate complex Artificial Intelligence concepts and solutions and collaborate in multi-disciplinary teams to achieve project goals.

SIES(Nerul) College of Arts, Science and Commerce (Autonomous)
NEP Credit Structure for B.SC (ARTIFICIAL INTELLIGENCE)

Semester	Major	Minor	OE (Basket)	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT,FP,CEP,CC, RP	Cum. Cr./ Sem.
II	Supervised Learning Techniques (2+1P) credit Advanced Python Programming for AI (2+1P) credit	Probability Distribution	1. Money Inflation and Monetary Policy 2. Logistics and Supply Chain Management. 3. Introduction to Entrepreneurship 4. Film Appreciation (4-credit)	VSC- Matrix Algebra (2- credit) SEC - Introduction to R-programming (1 + 1 P credit)	AEC- Effective Communication – II (2- credit) VEC- Sustainability Development with Green IT (2- credit)	CC- Life Skills-II, DLLE, NSS, Sports, Theatre Workshop (2- credit)	22
Total	6	2	4	4	4	2	22

SCHEME OF MODULES

SEMESTER II			
Serial No	**Course code**	**Credits**	**Course Name**
I	**Major Department Specific Course (DSC)**		
1	U25AI2MJ01	02	Supervised Learning Techniques
2	U25AI2MJP01	01	Supervised Learning Techniques Practical
1	U25AI2MJ02	02	Advanced Python Programming for AI
2	U25AI2MJP02	01	Advanced Python Programming for AI Practical
II	**Minor**		
1	U25AI2MI01	02	Probability Distribution
III	**Open Electives (OE)/ Generic Electives (Any Two)**		
1		04	1. Money Inflation and Monetary Policy 2. Logistics and Supply Chain Management. 3. Introduction to Entrepreneurship 4. Film Appreciation
IV	**VOCATIONAL COURSE (VC) & SKILL ENHANCEMENT COURSE (SEC)**		
1	U25AI2VSC01	02	Matrix Algebra
2	U25AI2SEC01	01	Introduction to R-programming
3	U25AI2SECP01	01	Introduction to R-programming Practical
IV	**ABILITY ENHANCEMENT COURSE(AEC)/VALUE EDUCATION COURSE (VEC) / INDIAN KNOWLEDGE SYSTEM (IKS)**		
1		02	Effective Communication – II
2		02	Sustainability Development with Green IT
V	**Co-Curricular (CC) (Anyone)**		
1		02	Life Skills II
2		02	DLLE
3		02	NSS
4		02	Sports
5		02	Theatre Workshop
TOTAL CREDITS		**22**	

MAJOR- Supervised Learning Techniques

COURSE CODE: U25AI2MJ01 **COURSE CREDIT: 02**
1 credit – 15 lectures
1 lecture is 60 minutes

Course Objectives:

- Understand the supervised Learning techniques of Artificial Intelligence.
- Learn about Model selection.
- Gain knowledge of decision tree classifier to solve complex problems.

Learning Outcomes:
After successful completion of this course, students would be able to:

- Demonstrate knowledge about supervised learning.
- Analyze and design different algorithms for classification and regression.
- Implement Artificial Intelligence techniques useful for industrial applications.

Unit	Topics	No. of Lectures
I	**Regression Algorithm:** Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, polynomial regression, Logistic regression, Difference between Classification and Regression, Model selection: Complexity versus goodness of fit, lasso and ridge regression, bias, variance, bias-variance trade off, Gradient Descent, Batch Gradient Descent, Stochastic Gradient Descent, Mini-batch Gradient Descent.	15
II	**Introduction to Supervised Learning**: Definition and types of Supervised Learning, Classification Algorithm: Binary Classifier, Naive Base Classifier, Classifying with k-Nearest Neighbour classifier, Decision Tree classifier, support vector machine, Types of Support Vector Machine, Advantages and Disadvantages of Support Vector Machine, Applications of SVM, Performance Measures, Accuracy, Confusion Matrix, Precision and Recall	15

Reference(s):

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson, 2010.
2. Patrick Henry Winston, Artificial Intelligence, Third Edition, Addison-Wesley Publishing Company, 2004.
3. Nils J. Nilsson, Principles of Artificial Intelligence.
4. Artificial Intelligence by Dr. Rajeshri Shinkar, Dr. Rajendra Patil, Ms. Mitali Shewale, University of Mumbai.

Additional Reference(s):

1. Artificial Intelligence: Foundation of Computational Agents, David L Poole, Alan K. Mackworth, 2nd Edition, Cambridge University Press, 2017.
2. Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017

MAJOR- Supervised Learning Techniques Practical

COURSE CODE: U25AI2MJP01 **COURSE CREDIT: 01**

1 credit – 30 lectures

1 lecture is 60 minutes

Practical No.	**List of Practical**
1	Implement the program for Linear regression
2	Implement the program for Logistic Regression
3	Implement the program for binary classifier
4	Implement the program to compute the mean of variable X and Y to determine the value of the slope (m) and y-intercept
5	Implement the program to create a scatter plot to check the relationship between two variables
6	Implement the program for SVM Classifier
7	Implement the program for prediction of house price
8	Implement the program for prediction of diabetes
9	Implement the program for polynomial regression
10	Implement the mini project on the regression or classification

MAJOR- Advanced Python Programming for AI

COURSE CODE: U25AI2MJ02 **COURSE CREDIT: 02**

1 credit – 15 lectures

1 lecture is 60 minutes

Course Objectives:

- To know about use of regular expression and to design GUI Programs also to learn about reading, writing and implementing other operation on files in Python and to implement database interaction using Python.
- To learn and understand the structure and functionality of core scientific and data libraries for AI

Learning Outcomes:

After successful completion of this course, students would be able to:

- to implement regular expression and designing GUI in Python as well as ability to work with files and perform operations on it using Python and knowledge of working with databases.
- Use Python libraries in different applications of AI
- Perform efficient numerical computations
- Handle structured data for AI workflows
- Create visually appealing and informative plots

Unit	Topics	No. of Lectures
I	**Regular expressions**: What is a regular expression?, sequence characters in regular expressions, quantifiers in regular expressions, special characters in regular expressions, using regular expression on files, retrieving information from an html file. **Graphical user interface**: Creating a GUI in python, Widget classes, Working with Fonts and Colours, working with Frames, Layout manager, Event handling **Working with files**: Files, opening and closing a file, working with text files containing strings, knowing whether a file exists or not, working with binary files, the "with" statement, the seek() and tell() methods, random accessing of binary files, zipping and unzipping files, working with directories, running other programs from python program **Database in python**: Using SQL with python, retrieving rows from a table, inserting rows into a table, deleting rows from a table, updating rows in a table, creating database tables through python, Exception handling in databases	15
II	**Core Scientific and Data Libraries for AI** **1. NumPy – Numerical Computing with Python** Introduction to NumPy and ndarray objects, Array creation: array(), arange(), linspace(), zeros(), ones(), Indexing, slicing, and reshaping arrays, Mathematical and statistical operations, Broadcasting and vectorized operations, Matrix multiplication, dot product, Linear algebra: linalg.inv, linalg.eig, linalg.solve, Random module: random.rand(), random.randn(),	15

	random.choice() **2. Pandas – Data Manipulation and Analysis** Introduction to Series and DataFrames**,**Reading data from CSV, Excel, JSON**,** Indexing, slicing, filtering**,** Handling missing data: isnull(), dropna(), fillna()**,**Data transformation: apply(), map(), replace()**,**GroupBy operations: groupby(), aggregation (sum(), mean())**,** Merging and joining DataFrames**,** Time series data basics 3. **Matplotlib – Data Visualization** Basic plots: line, bar, scatter, histogram, pie, Customization: labels, titles, legends, styles, colors, Subplots and figure layout, Annotating plots, Saving plots as image files 4. **Scikit-learn – Machine Learning Library** Introduction to scikit-learn: architecture and workflow, Datasets module: loading and exploring sample datasets, Preprocessing: StandardScaler, MinMaxScaler, LabelEncoder, Splitting data: train_test_split, Supervised learning models: LogisticRegression, DecisionTree, KNeighborsClassifier, Unsupervised learning models: KMeans, PCA, Model evaluation: confusion matrix, accuracy, precision, recall, F1-score, Cross-validation: cross_val_score, GridSearchCV **5.TensorFlow (with Keras API) – Deep Learning Framework** Tensors and operations, Layers and models with Keras Sequential and Functional API, Activation functions: ReLU, Sigmoid, Softmax, Loss functions: MSE, CrossEntropy, Optimizers: SGD, Adam, Training, validation, and testing models, Saving and loading models, Image and text classification basics	

Reference(s):

1. Paul Gries , Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 3rd Edition, 2018
2. Programming through Python, M. T Savaliya, R. K. Maurya, G M Magar, Revised Edition, Sybgen Learning India, 2020
3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron, O'Reilly Media

Additional Reference(s):

1. Advanced Python Programming, Dr. Gabriele Lanaro, Quan Nguyen, SakisKasampalis, Packt Publishing, 2019
2. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018
3. Python: The Complete Reference, Martin C. Brown, McGraw Hill, 2018
4. Python Standard Library by Fredrik Lundh , O'Reilly Media
5. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron, O'Reilly Media
6. Data Visualization with Python and JavaScript by Kyran Dale, O'Reilly Media

MAJOR- Advanced Python Programming for AI Practical

COURSE CODE: U25AI2MJP02 **COURSE CREDIT: 01**

1 credit – 30 lectures

1 lecture is 60 minutes

Practical No.	List of Practical
1	Write a Python program to demonstrate use of regular expression a. To display last four characters. b. To display the substring starting from index 4 and ending at index 8. To check whether string has alphanumeric characters or not.
2	Write a Python program for following a. To trim the last five characters from the string. b. To trim the first four characters from the string. To display the starting index for the substring “wa”.
3	Write a Python program for following a. To change the case of the given string b. To check if the string is in title case To replace all the occurrences of letter ‘a’ in the string with ‘*’
4	Write a GUI Program in Python to design application that demonstrates Different fonts and colors
5	Write a GUI Program in Python to design application that demonstrates Different Layout Managers
6	Write a GUI Program in Python to design application that demonstrates Event Handling
7	Write a program to Python program to read entire text file and to append text to a file and display the text
8	Write a Python Program to work with databases in Python to perform operations such as a. Connecting to database b. Creating and dropping tables. C. Insert and Update in table.
9	Write a program to Python program for matrix addition and multiplication.
10	Write a program to Python program to draw different types of graphs.

MINOR- Probability Distribution

COURSE CODE: U25AI2MI01 **COURSE CREDIT: 02**

1 credit – 15 lectures

1 lecture is 60 minutes

Course Objectives:

- To develop a strong conceptual understanding of counting principles and probability theory for analyzing uncertain events in artificial intelligence applications.
- To equip students with the ability to model, simulate, and interpret random processes using appropriate statistical and programming tools like Python or R.

Learning Outcomes:

After successful completion of this course, students would be able to:

- Apply probability rules to solve real-life AI-related problems, including classification and decision-making under uncertainty.
- Simulate random experiments and interpret distributions using Python, supporting data-driven approaches in AI and machine learning.

Unit	Topics	No. of Lectures
I	Basic Probability Theory: Random Experiments/Trials and outcomes, Sample Space (S): Finite/Discrete, Events: Simple, Mutually Exclusive, Exhaustive, Complementary events, Algebra of Events (Union, Intersection, Difference) Definitions of Probability: Classical, Axiomatic, Elementary Theorems of Probability (without proof), Definition and formula of Conditional Probability, Bayes' Theorem (Statement, No Proof) Independent Events: Concept and examples Case Studies: Python exercises using libraries like numpy, scipy.stats, matplotlib: Simulating permutations & combinations, Probability experiments (coin toss, dice, cards)	15
II	Random Variables: Discrete and Continuous, Probability Mass Function (PMF) – for discrete RVs, Probability Density Function (PDF) – for continuous RVs, Cumulative Distribution Function (CDF): Definition and properties, Examples: Graphical and tabular illustrations Mathematical Expectation: Expected value of a discrete/continuous random variable Expectation of a function of a random variable: Variance and Standard Deviation: Definitions, formulae, and interpretation Properties and examples	15

	Probability Distribution: Binomial, Poisson, Normal-definition, properties, uses, and illustrations Case Studies: Python exercises using libraries like numpy, scipy.stats, matplotlib: PMF/PDF plotting for various distributions, Computing expectations and variances, Fitting and visualizing binomial, Poisson, and normal distributions	

Reference(s):

1. A First Course in Probability – Sheldon Ross
2. Fundamentals of Mathematical Statistics – S.C. Gupta & V.K. Kapoor

Additional Reference(s):

1. Mathematics for Machine Learning – Deisenroth, Faisal, Ong
2. Online Python Labs: Khan Academy, GeeksforGeeks, W3Schools, SciPy Docs

VSC- Matrix Algebra

COURSE CODE: U25AI2VSC01 **COURSE CREDIT: 02**

1 credit – 15 lectures

1 lecture is 60 minutes

Course Objectives:

- To develop a foundational understanding of linear algebra concepts.
- To enable students to apply linear algebra techniques to solve real-world problems.

Learning Outcomes:

After successful completion of this course, students would be able to:

- Solve systems of linear equations using matrix methods.
- Analyze and perform matrix operations, compute eigenvalues and eigenvectors, and visualize linear transformations and vector operations in two and three dimensions.

Unit	Topics	No. of Lectures
I	Systems of Linear Equations: Introduction to Linear Equations, Using Matrices To Solve Systems of Linear Equations, Elementary Row Operations and Gaussian Elimination, Existence and Uniqueness of Solutions, Applications of Linear Systems Matrix Arithmetic: Matrix Addition and Scalar Multiplication, Matrix Multiplication, Visualizing Matrix Arithmetic in 2D, Vector Solutions to Linear Systems, Solving Matrix Equations AX = B, The Matrix Inverse, Properties of the Matrix Inverse	15
II	**Operations on Matrices :** The Matrix Transpose, The Matrix Trace, The Determinant, Properties of the Determinant, Cramer's Rule, **Eigenvalues and Eigenvectors:** Eigenvalues and Eigenvectors, Properties of Eigenvalues and Eigenvectors, **Graphical Explorations of Vectors:** Transformations of the Cartesian Plane, Properties of Linear Transformations, Visualizing Vectors: Vectors in Three Dimensions	15

Reference(s):

1. "Fundamentals of Linear Algebra" by Gregory Hartman
2. "Intro to Linear Algebra" by Gilbert Strang, Wellesley - Cambridge Press

Additional Reference(s):

1. "Linear Algebra and Its Applications" by David Lay, Pearson Publishing
2. "Linear Algebra Done Right" by Sheldon Axler, Springer

Additional Reference(s):

7. Computer Networks by Andrew S. Tanenbaum and David J. Wetherall
8. Artificial Intelligence: Foundations of Computational Agents, David L Poole, Alan K. Mackworth, 2nd Edition, Cambridge University Press ,2017.
9. Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017

SEC- Introduction to R-programming

COURSE CODE: U25AI2SEC01 **COURSE CREDIT: 02**

1 credit – 15 lectures

1 lecture is 60 minutes

Course Objectives:

- To have a good understanding of the R programming environment.
- To perform data importing, cleaning, and transformation in R

Learning Outcomes:

After successful completion of this course, students would be able to:

- apply basic statistical techniques using R.
- create insightful visualizations

Unit	Topics	No. of Lectures
I	Introduction to Algorithms and programming concepts. What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), packageDescription(), help(), find. package(), library() - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions: NA, Inf and –inf. Inspecting variables and workspaces, vectors, matrices, arrays, lists and data frames, Control Structure: if statement, if–else statement, if–else–if statement, switch statement – R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.,a vectorized if and multiple selection, advanced looping, functions, strings, and factors.Indexing, Subsetting, and Manipulating Data Structures, Working with Dates and Times	15

Reference(s):

4. "Learning R ", Richard Cotton, O'reilly Publication

Additional Reference(s):

10. "Beginning R: The Statistical Programming Language", Dr. Mark Garner
11. "The Art of R programming", Norman Matloff, No Starch Press (San Francisco)

SEC- Introduction to R-programming Practical

COURSE CODE: U25AI2SECP01 **COURSE CREDIT: 01**

1 credit – 30 lectures

1 lecture is 60 minutes

Practical No.	List of Practical
1	**Basics of R-** a. Data input, Arithmetic Operators b. Vector Operations, Matrix Operations c. Data Frames, Built-in Functions d. Frequency Distribution, Grouped Frequency Distribution e. Diagrams and Graphs
2	Find the class, type, mode, and storage mode of the following values: Inf, NA, NaN, "".
3	Create some variables named after vegetables. List the names of all the variables in the user workspace that contain the letter "a."
4	You have the results of a simple experiment to look at the visitation of various bee species to different plants. The number of bees observed was as follows: ➤➤ **Buff tail**: 10 1 37 5 12 ➤➤ **Garden bee**: 8 3 19 6 4 ➤➤ **Red tail**: 18 9 1 2 4 ➤➤ **Honeybee**: 12 13 16 9 10 ➤➤ **Carder bee**: 8 27 6 32 23 Make five simple numeric vectors of these data. Now join the bee vectors together to make a data frame. Each row of the resulting frame relates to a specific plant so you could assign names to the rows. The plant names are Thistle, Vipers bugloss, Golden rain, Yellow alfalfa, and Blackberry. Use these names to create row labels for the data.
5	The diag function has several uses, one of which is to take a vector as its input and create a square matrix with that vector on the diagonal. Create a 21-by-21 matrix with the sequence 10 to 0 to 11 (i.e., 11, 10, … , 1, 0, 1, …, 11)
6	The *n*th triangular number is given by $n * (n + 1) / 2$. Create a sequence of the first 20 triangular numbers. R has a built-in constant, letters, that contains the lowercase letters of the Roman alphabet. Name the elements of the vector that you just created with the first 20 letters of the alphabet. Select the triangular numbers

	where the name is a vowel.
7	Create a list variable that contains all the square numbers in the range 0 to 9 in the first element, in the range 10 to 19 in the second element, and so on, up to a final element with square numbers in the range 90 to 99. Elements with no square numbers should be included
8	The beaver1 and beaver2 datasets contain body temperatures of two beavers. Add a column named id to the beaver1 dataset, where the value is always 1. Similarly, add an id column to beaver2, with value 2. Vertically concatenate the two data frames and find the subset where either beaver is active
9	Write a function that accepts a vector of integers (for simplicity, you don't *have* to worry about input checking) and returns a logical vector that is TRUE whenever the input is even, FALSE whenever the input is odd, and NA whenever the input is nonfinite (nonfinite means anything that will make is.finite return FALSE: Inf, -Inf, NA, and NaN). Check that the function works with positive, negative, zero, and nonfinite inputs.
10	Frequency distribution and data presentation- a. Frequency Distribution (Univariate data/ Bivariate data) b. Diagrams c. Graphs
11	Measures of Central Tendency- a. Arithmetic Mean b. Median c. Mode d. Partition Values
12	1. Load the hafu dataset from the learningr package. In the Father and Moth er columns, some values have question marks after the country name, indicating that the author was uncertain about the nationality of the parent. Create two new columns in the hafu data frame, denoting whether or not there was a question mark in the Father or Mother column, respectively. 2. Remove those question marks from the Father and Mother columns
13	1. In the obama_vs_mccain dataset, find the (Pearson) correlation between the percentage of unemployed people within the state and the percentage of people that voted for Obama. 2. Draw a scatterplot of the two variables, using a graphics system of your choice. (For bonus points, use all three systems.) [10] for one plot, [30] for all three

VEC- Sustainability Development with Green IT

COURSE CODE: **COURSE CREDIT: 02**

1 credit – 15 lectures
1 lecture is 60 minutes

Course Objectives:

- Know about Green IT Fundamentals: Business, IT, and the Environment
- Green IT Strategies and Significance of Green IT Strategies
- Green Enterprise Architecture and Green Information Systems

Learning Outcomes:

After successful completion of this course, students would be able to:

- Explain drivers and dimensions of change for Green Technology
- Appreciate Virtualization; smart meters and optimization in achieving green IT
- Gain knowledge about green assets, green processes, and green enterprise architecture

Unit	Topics	No. of Lectures
I	Green IT Overview: Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green I , Holistic Approach to Greening IT, Greening IT, Applying IT for Enhancing Environmental Sustainability,Green IT Standards and Eco-Labelling of IT , Enterprise Green IT Strategy, Green Washing, Green IT: Burden or Opportunity? Green Devices and Hardware: Introduction , Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose Green Software: Introduction , Processor Power States , Energy-Saving Software Techniques, Evaluating and Measuring Software Impact to Platform Power Sustainable Software Development: Introduction, Current Practices, Sustainable Software, Software Sustainability Attributes, Software , Sustainability Metrics, Sustainable Software Methodology, Defining Actions	15
II	Green Data Centers: Data Centers and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, IT Infrastructure Management, Green Data Centre Metrics Green Data Storage: Introduction, Storage Media Power Characteristics, Energy Management Techniques for Hard Disks, System-Level Energy Management Green Networks and Communications: Introduction, Objectives of Green Network Protocols, Green Network Protocols and Standards Enterprise Green IT Strategy: Introduction, Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation.	15

Reference(s):

1. Green IT Strategies and Applications Using Environmental Intelligence, BhuvanUnhelkar, CRC Press, 2016
2. Green Information and Communication Systems for a Sustainable Future, Rajshree Srivastava, Sandeep Kautish, Rajeev Tiwari. CRC Press, 2020

Additional Reference(s):

1. Emerging Green Technologies, Matthew N. O. Sadiku, Taylor and Francis (CRC Press), 2022
2. Sustainability Awareness and Green Information Technologies, TomayessIssa, Springer, 2021
3. Environmental Sustainability Role of Green Technologies, P. Thangavel, and G. Sridevi, Springer, 2016

SCHEME OF THEORY and PRACTICALS EXAMINATION

MAJOR- (3 credit)

The scheme of examination shall be divided into two parts:

- Internal assessment 40% i.e. 20 marks
- Semester end examination 60% i.e. 30 marks

Internal Assessment 20 marks

Description	Marks
Internal test of 10 marks	10
Presentation / Case studies / Assignments / Poster Making / Quiz / Role Play / Subject Specific Activities	05
Attendance and Class behavior	05
Total	20

Semester end examination 30 marks

PAPER PATTERN			
Duration: 2 hours			
Total Marks: 60			
All Questions are Compulsory			
Question	Based on	Options	Marks

Q. 1	Unit 1	A and B/P and Q	10
Q. 2	Unit 2	A and B/P and Q	10
Q. 3	Unit 1 & 2	A and B/P and Q	10
Total			30

Note:

- Q.1, 2, 3 and 4 may be divided into sub questions with internal choice if required.
- Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) in semester end examination.

MINOR- (2 credit)

The scheme of examination shall be divided into two parts:

- Internal assessment 40% i.e. 20 marks
- Semester end examination 60% i.e. 30 marks

Internal Assessment 20 marks

Description	Marks
Internal test of 10 marks	10
Presentation / Case studies / Assignments / Poster Making / Quiz / Role Play / Subject Specific Activities	05
Attendance and Class behavior	05
Total	20

Semester end examination 30 marks

PAPER PATTERN			
Duration: 2 hours			
Total Marks: 60			
All Questions are Compulsory			
Question	Based on	Options	Marks
Q. 1	Unit 1	A and B/P and Q	10

Q. 2	Unit 2	A and B/P and Q	10
Q. 3	Unit 1 & 2	A and B/P and Q	10
Total			30

Note:

- Q.1, 2, 3 and 4 may be divided into sub questions with internal choice if required.
- Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) in semester end examination

VSC & SEC- (2 credit)

The scheme of examination shall be divided into two parts:

- Internal assessment 40% i.e. 20 marks
- Semester end examination 60% i.e. 30 marks

Internal Assessment 20 marks

Description	Marks
Internal test of 10 marks	10
Presentation / Case studies / Assignments / Poster Making / Quiz / Role Play / Subject Specific Activities	05
Attendance and Class behavior	05
Total	20

Semester end examination 30 marks

PAPER PATTERN			
Duration: 2 hours			
Total Marks: 60			
All Questions are Compulsory			
Question	Based on	Options	Marks
Q. 1	Unit 1	A and B/P and Q	10

Q. 2	Unit 2	A and B/P and Q	10
Q. 3	Unit 1 & 2	A and B/P and Q	10
Total			30

Note:

- Q.1, 2, 3 and 4 may be divided into sub questions with internal choice if required.

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) in semester end examination

VEC- (2 credit)

The scheme of examination shall be divided into two parts:

- Internal assessment 40% i.e. 20 marks
- Semester end examination 60% i.e. 30 marks

Internal Assessment 20 marks

Description	Marks
Internal test of 10 marks	10
Presentation / Case studies / Assignments / Poster Making / Quiz / Role Play / Subject Specific Activities	05
Attendance and Class behavior	05
Total	20

Semester end examination 30 marks

PAPER PATTERN			
Duration: 2 hours			
Total Marks: 60			
All Questions are Compulsory			
Question	Based on	Options	Marks

Q. 1	Unit 1	A and B/P and Q	10
Q. 2	Unit 2	A and B/P and Q	10
Q. 3	Unit 1 & 2	A and B/P and Q	10
Total			30

Note:

- Q.1, 2, 3 and 4 may be divided into sub questions with internal choice if required.

Passing criteria: Minimum 40% in Internal (16 out of 40) and 40% (24 out of 60) in semester end examination

SCHEME OF PRACTICAL EXAMINATION

The scheme of Practical examination shall be:

- Practical assessment carries 50 Marks: 40 marks + 05 marks (journal)+ 05 marks(viva)
- Minimum 75 % practical are required to be completed and written in the journal. (Certified Journal is compulsory for appearing at the time of Practical Exam)

(A) Practical Assessment 50 marks

Description	**Marks**
Two practical questions (20 marks each)	40
Journal	05
Viva	05
Total	50

- Passing criteria: Minimum 40% in Practical (20 out of 50)

SCHEME OF PRACTICAL EXAMINATION (20 Marks)

The scheme of Practical examination shall be:

- Practical assessment carries 20 Marks: 10 marks + 05 marks (journal)+ 05 marks(viva)
- Minimum 75 % practical are required to be completed and written in the journal. (Certified Journal is compulsory for appearing at the time of Practical Exam)

(A) Practical Assessment 20 marks

Description	**Marks**

Two practical questions (5 marks each)	10
Journal	05
Viva	05
Total	20

- Passing criteria: Minimum 40% in Practical (08 out of 20)