



Karmaveer Bhaurao Patil University, Satara

Syllabi for

B.Sc. I (Artificial Intelligence)

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2024-2025

Syllabi for Bachelor of Science (B.Sc.) Part – I Artificial Intelligence

PREAMBLE:

This syllabus is framed to give knowledge with an understanding of Artificial Intelligence to undergraduate students in the B.Sc. degree programme.

The Bachelor of Science (B.Sc.-I) in Artificial Intelligence course is designed to provide students with a strong foundation in the principles, theories and applications of Artificial Intelligence enabling them to meet in the intelligent digital era. Aligned with the National Education Policy (NEP) 2020, the program emphasizes multidisciplinary learning, skill development, critical thinking, innovation and experiential education.

The curriculum integrates fundamental concepts of Artificial Intelligence with emerging intelligent technologies, preparing students to analyse complex problems, design intelligent solutions and develop AI-based systems using modern tools, programming languages and machine learning frameworks. It encompasses core areas such as programming, mathematics for AI, data structures and algorithms, machine learning, deep learning, natural language processing, computer vision, data science, cloud computing, AI ethics, software engineering along with practical laboratory work, internships, projects, research-oriented learning.

GENERAL OBJECTIVES OF THE PROGRAMME:

1. To provide students with a strong foundation in the core principles and theories of artificial intelligence and machine learning.
2. To foster a scientific and analytical mindset, encouraging curiosity, critical thinking and innovation in solving complex problems.
3. To develop practical skills in programming, algorithm design, data handling, implementation of AI models and systems.
4. To help students understand key AI concepts, terminologies, techniques, their interrelationships across different domains.
5. To raise students' awareness of ethical, social, environmental implications of artificial intelligence and its applications.
6. To equip students with interdisciplinary knowledge in computer science, mathematics, data science, cognitive science to enable a holistic understanding of intelligent systems.
7. To empower students to apply AI knowledge and tools to address real-world challenges in sectors like healthcare, education, agriculture, business, sustainability.

GENERAL OUTCOME OF THE PROGRAMME:

After completing the B.Sc. program, graduates will:

1. Understand the fundamental concepts of Artificial Intelligence, programming, algorithms, data handling, intelligent systems, apply them to solve real-world problems.
2. Pursue higher education, research, career opportunities in Artificial Intelligence, machine learning, data Science, computer science, related fields.
3. Secure employment in government organizations, public sector undertakings, software companies, IT industries, AI-based organizations and other technology sectors.
4. Demonstrate professional ethics, effective communication, teamwork and leadership, problem-solving skills required in academic and professional environments.
5. Adapt to emerging AI technologies through continuous learning and develop innovative, responsible, sustainable AI-based solutions that contribute to society.

PROGRAMME SPECIFIC OBJECTIVES:

1. Develop a strong foundation in Artificial Intelligence, Machine Learning, Data Science, programming, and related computational sciences
2. Apply analytical thinking, critical reasoning, and problem-solving skills to design and develop AI-based solutions for real-world and interdisciplinary applications.
3. Acquire practical skills in programming, data analysis, algorithm development, and the implementation of AI models and intelligent systems.
4. Prepare for higher education, research, and advanced studies in Artificial Intelligence, Data Science, Robotics, and related fields in India and abroad.
5. Qualify for competitive examinations and technical roles in government organizations, public sector undertakings, and AI-driven industries.
6. Develop entrepreneurial skills to create AI-based products, services, and innovative technology solutions while meeting industry requirements.
7. Demonstrate professional ethics, effective communication, teamwork, leadership, and social responsibility in the development and deployment of Artificial Intelligence technologies.

PROGRAM SPECIFIC OUTCOMES:

After completing the B.Sc. Artificial Intelligence program, students will:

1. Be able to explain, describe, discuss fundamental and advanced concepts in artificial intelligence, machine learning, data science.
2. Design, develop, implement AI models, algorithms, intelligent systems to solve real-world problems.
3. Critically analyze data, models, outcomes to improve decision-making and system performance.
4. Apply AI techniques to build innovative solutions across domains such as healthcare, agriculture, business, education, environmental sustainability.
5. Utilize their technical skills to become self-reliant, by securing employment in AI driven industries, starting their own tech-based ventures, or freelancing in the digital economy.
6. Design and manage AI-based projects with a focus on scalability, performance, ethical responsibility.
7. Gain industry-relevant skills and exposure through internships, workshops, live projects in collaboration with AI and tech companies.
8. Enhance research competencies through academic research, innovation challenges.
9. Critically assess the societal and ethical implications of AI applications and contribute responsibly to the development of sustainable and inclusive technologies.

1. Title: Artificial Intelligence

2. Year of Implementation: from 2024-2025

3. Duration: 01 year

4. Pattern: Semester

5. Medium of Instruction: English

6. Eligibility: 12th Science

7. STRUCTURE OF COURSE:

AS PER NEP-2020 (2.0)

Program Structure for B.Sc. I (Semester I & II)

Sem (Level)	Course I	Course II	Course III	OE	VSC /SEC	AEC/VEC/IKS	OJT/F P/ CEP/C C/RP	Total Credits	Degree/Cum. Cr. MEME
Sem I (4.5)	DSC I(2) DSC II (2) DSC P I (2)	DSC I (2) DSC II (2) DSC P I (2)	DSC I (2) DSC II (2) DSC P I (2)	OE I (2)	-	IKS I (2) (Generic)	-	22	UG Certificate: 44
Sem II (4.5)	DSC III (2) DSC IV (2) DSC P II (2)	DSC III (2) DSC IV (2) DSC P II (2)	DSC III (2) DSC IV (2) DSC P II (2)	OE II (2)	-	VEC I (2) DEGG and IIC	-	22	
Credits	12	12	12	04	-	04	-	44	Exit option: 4 Cr. NSQF/Internship/Skill Courses

Abbreviations: DSC: Discipline Specific Course; OE: Open Elective; TH: Theory, PR: Practical; IKS: Indian Knowledge System, AEC: Ability Enhancement Course, VSC: Vocational Skill Course, DSE: Discipline Specific Elective, DEGG: Democracy Election and Good Governance

8. COURSE TITLE**SEMESTER I**

Level	Course No.	Course Code	Course Title	Category	Credit
4.5	Course – I				
	DSC – I	BAIT-111	Fundamental of Artificial Intelligence	TH	02
	DSC – II	BAIT-112	Programming in C	TH	02
	DSC P- I	BAIP-113	Lab based on Fundamental of Artificial Intelligence and Programming in C	PR	02
	Course – II				
	DSC – I	BAIT- 114	Fundamental of Computers	TH	02
	DSC – II	BAIT- 115	Computational Statistics-I	TH	02
	DSC P- I	BAIP- 116	Lab based on Fundamental of Computers and Computational Statistics-I	PR	02
	Course - III				
	DSC – I	BAIT-117	Software Quality Assurance	TH	02
	DSC – II	BAIT-118	Computational Mathematics-I	TH	02
	DSC P- I	BAIP-119	Lab based on Software Quality Assurance and Computational Mathematics-I	PR	02
	IKS				
	IKS – 1	BAIT IKS	Introduction to Indian knowledge system	TH	02

SEMESTER II

Level	Course No.	Course Code	Course Title	Category	Credit
4.5	Course – I				
	DSC - III	BAIT-121	Object oriented programming using Python	TH	02
	DSC - IV	BAIT-122	Database Systems	TH	02
	DSC P- II	BAIP-123	Lab based on Object oriented programming using Python and Database Systems	PR	02
	Course – II				
	DSC - III	BAIT- 124	Operating Systems	TH	02
	DSC - IV	BAIT- 125	Computation mathematics-II	TH	02
	DSC P- II	BAIP- 126	Lab based on Operating Systems and Computation mathematics-II	PR	02
	Course - III				
	DSC - III	BAIT-127	Introduction to Machine Learning	TH	02
	DSC - IV	BAIT-128	Computational Statistics-II	TH	02
	DSC P- II	BAIP-129	Lab based on Introduction to Machine Learning and Computational Statistics-II	PR	02
	VEC				
	VEC - I	BAIT VEC	Democracy, Election and Indian Constitution	TH	02

9. EVALUATION STRUCTURE:**SEMESTER I, LEVEL 4.5**

Course	Course Category	Course Code	Internal Evaluation	ESE	Total Marks	Credits
Course I	T	BAIT 111	20	30	50	02
	T	BAIT 112	20	30	50	02
	P	BAIP 113	20	30	50	02
Course II	T	BAIT 114	20	30	50	02
	T	BAIT 115	20	30	50	02
	P	BAIP 116	20	30	50	02
Course III	T	BAIP 117	20	30	50	02
	T	BAIP 118	20	30	50	02
	P	BAIP 119	20	30	50	02
OE	T	BAITOE 1	20	30	50	02
IKS I	T	BAITIKS I	20	30	50	02
Total					550	22

SEMESTER II, LEVEL 4.5

Course	Course Category	Course Code	Internal Evaluation	ESE	Total Marks	Credits
Course I	T	BAIT 121	20	30	50	02
	T	BAIT 122	20	30	50	02
	P	BAIP 123	20	30	50	02
Course II	T	BAIT 124	20	30	50	02
	T	BAIT 125	20	30	50	02
	P	BAIP 126	20	30	50	02
Course III	T	BAIP 127	20	30	50	02
	T	BAIP 128	20	30	50	02
	P	BAIP 129	20	30	50	02
OE	T	BAITOE 2	20	30	50	02
VEC – I	T	BAITVEC 1	20	30	50	02
Total					550	22

INTERNAL EVALUATION STRUCTURE

- Internal evaluation of theory papers shall carry a weightage of 40%.
- Activity: For the internal evaluation of theory papers following activities will be adopted for CCE I & CCE II: class test/ open book test/ online course/ Industrial review/ Industrial visit/ e learning video creation/ assignment/ seminar/ case study/ field work/ project.
- CCE III shall consist of multiple-choice questions.
- Each CCE will carry 10 marks for 2-credit theory papers and 20 marks for 4-credit theory papers, the best two scores will be considered for final score.
- Internal evaluation of practical papers shall carry a weightage of 40%.
- For practical examinations, internal evaluation will be based on student performance, attendance, journal records, viva voce

Abbreviations: CCE: Continues Comprehensive Examination, ESE: End Semester Examination.

10. OTHER FEATURES:

A) LIBRARY:

The Institute and Departmental libraries are well-equipped with a wide range of reference books, textbooks, academic journals, periodicals related to Artificial Intelligence, Computer Science and Data Science.

B) EQUIPMENT:

i) DIGITAL INFRASTRUCTURE:

1. High-performance computers with AI-capable GPUs - 120
2. Interactive Panel - 4
3. High-speed internet

ii) LABORATORY EQUIPMENT & TOOLS:

1. AI & Data Science Workstations with pre-installed software (Python, Tensor Flow)
2. Raspberry Pi, Arduino kits, robotics kits for hands-on learning
3. Virtual labs
4. IOT development boards and sensors



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Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - I

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Fundamental of Artificial Intelligence (BAIT 111)

Course Objectives: Students should be able to...

- 1) Understand a historical perspective of AI and its foundations.
- 2) Study basic principles of AI toward problem solving, inference, perception, knowledge representation, learning.
- 3) Identify To design and program python applications.
- 4) Learn to use list, tuples and dictionaries in python program.

Course Outcomes: Students will be able to...

- 1) Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
- 2) Evaluate basic principles of AI In solutions that require problem solving, inference, perception, knowledge representation and learning.
- 3) Apply the structure and components of a python program.
- 4) Analyze to write loops and decision statements in python.

Module	Title and Contents	Hrs
Module -1:	Introduction and Problem-Solving Methods 1.1 Definition – Future of Artificial Intelligence, Characteristics of Intelligent 1.2 Agents–Typical Intelligent Agents 1.3 Problem Solving Approach to Typical AI problems 1.4 Problem solving Methods – Search Strategies, Uninformed, Informed, Heuristics, Local Search Algorithms and Optimization Problems 1.5 Searching with Partial Observations – Constraint Satisfaction Problems, Constraint Propagation 1.6 Backtracking Search – Game Playing, Optimal Decisions in Games 1.7 Alpha – Beta Pruning	07
Module -2:	Knowledge Representation 2.1 Architecture for Intelligent Agents 2.2 First Order Predicate Logic – Prolog Programming, Unification, Forward Chaining, Backward Chaining 2.3 Resolution – Knowledge Representation 2.4 Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects 2.5 Reasoning Systems for Categories -Reasoning with Default Information	08
Module -3:	Basics of Python Programming 3.1 Introduction to Python - Python Interpreter 3.2 Data types - Identifiers and keywords 3.3 Integral Types - Floating Point Types – Strings. Case Sensitive - Scripts - Sequence Types 3.4 Tuples - Named Tuples	08

	3.5 Sets, Mapping Types 3.6 Types, Dictionaries, Generators, Iterators	
Module -4:	Programming Paradigms in Python 4.1 List Definition and Declaration in Python 4.2 Initialization of Lists in Python 4.3 Types of Arrays in Python 4.4 String Handling Methods in Python 4.5 Lists and Functions in Python	07
Reference Books:- 1) Russell, Stuart J., Peter Norvig. Artificial Intelligence: A Modern Approach. 4th ed. Hoboken, NJ: Pearson, 2021. 2) Barry, Paul. Head First Python. 2nd ed. Sebastopol, CA: O'Reilly Media, 2016. 3) Lutz, Mark. Learning Python. 5th ed. Sebastopol, CA: O'Reilly Media, 2013. 4) Luger, George F. Artificial Intelligence: Structures and Strategies for Complex Problem Solving. 6th ed. Boston, MA: Pearson, 2012. 5) Kaushik, S. Artificial Intelligence. Boston: Cengage Learning, 2011.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks: Activity • CCE - II: 10 Marks: Activity • CCE - III: 10 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)		End Semester Examination (30 Marks): • Question -1: Solve the following questions (5 questions of 2 Marks) • Question -2: Attempt any two out of three questions (3 questions of 10 marks) • Question -3: Attempt any four out of Six questions (6 questions of 05 marks)



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Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - I

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Programming in C (BAIT 112)

Course Objectives: Students should be able to...

- 1) Identify the fundamental concepts of computer hardware, software, and operating systems.
- 2) Understand programming languages, number systems, peripheral devices, computer networking, multimedia, and Internet concepts.
- 3) Study of the syntax and semantics of the C programming language.
- 4) Learn the usage of structured programming approaches in solving problems.

Course Outcomes: Students will be able to...

- 1) Perform input and output operations using programs in C.
- 2) Create and Write programs that perform operations on arrays.
- 3) Analyze, read, understand and trace the execution of programs written in C language.
- 4) Decompose a problem into functions and to develop modular reusable code.

Module	Title and Contents	Hrs
Module -1:	Introduction to C Programming 1.1 Overview of C; History and Features of C 1.2 Structure of a C Program with Examples 1.3 Creating and Executing a C Program 1.4 Compilation process in C 1.5 Character Set 1.6 C tokens - keywords, identifiers, constants, variables, 1.7 Data types- Declaration & initialization of variables, Symbolic constants 1.8 Formatted I/O functions - printf and scanf 1.9 control stings and escape sequences 1.10 output specifications with printf functions 1.11 Unformatted I/O functions to read and display single character and a string - getchar, putchar, gets and puts functions.	07
Module -2:	Operators and Control Structures 2.1 Operators- Arithmetic operators, Relational operators, Logical operators; Assignment operators, Increment & Decrement operators, Bitwise operators, Conditional operator 2.2 Special operators, Operator Precedence and Associatively 2.3 Evaluation of arithmetic expressions and Type conversion 2.4 Decision making Statements - Simple if, if else, nested if else, else if ladder, Switch Case, goto, break & continue statements 2.5 Looping, Statements - Entry controlled and exit controlled statements, while, do-while, for loops, Nested loops	08
Module -3:	Arrays and functions 3.1 Arrays: One-Dimensional arrays - Declaration, Initialization and Memory representation 3.2 Two-Dimensional arrays - Declaration, Initialization and Memory	08

	Representation 3.3 Need for user applied functions; Format of C user applied functions; Components of user applied functions 3.4 Return type, name, parameter list, function body, return statement and function call 3.5 Categories of user applied functions - With and without parameters and return type 3.6 Strings: Declaring & Initializing string variables 3.7 String handling functions - strlen, strcmp, strcpy and strcat 3.8 Character handling functions - toascii, toupper, tolower, isalpha, isnumeric	
Module -4:	Pointers in C	
	4.1 Understanding pointers - Declaring and initializing pointers 4.2 Accessing address and value of variables using pointers 4.3 Pointers and Arrays 4.4 Pointer Arithmetic 4.5 Advantages and disadvantages of pointers.	07

Reference Books:-

- 6) Kanetkar, Yashavant. Let Us C. 17th ed. New Delhi: BPB Publications, 2020.
- 7) Balagurusamy, E. Programming in ANSI C. 8th ed. New Delhi: McGraw Hill Education, 2019.
- 8) Gottfried, Byron S. Programming with C. 4th ed. Schaum's Outline Series. New York: McGraw-Hill, 2018.
- 9) Schildt, Herbert. C: The Complete Reference. 4th ed. New York: McGraw-Hill, 2000.
- 10) Kernighan, Brian W., Dennis M. Ritchie. The C Programming Language. 2nd ed. Upper Saddle River, NJ: Pearson, 1988.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation:(20 Marks)	End Semester Examination: (30 Marks)
• CCE I - 10 Marks : Activity • CCE II- 10Marks : Activity • CCE III - 10Marks : MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	• Question -1: Solve the following question (5 questions of 2 Marks) • Question 2: Attempt any Two out of Three questions (3 questions of 10 Marks) • Question -3: Attempt any Four out of Six questions (6 questions of 10 Marks) (50 Marks converted to 30 Marks)

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Artificial Intelligence	
	Programme: B.Sc.	Semester - I
	Type : DSC (P)	Marks: 50
	Credits : 2	From: A. Y. 2024-25
	Name of the Course & Code: Lab based on Fundamental of Artificial Intelligence and Programming in C (BAIP 113) Practical Batch : 20 Student/Batch	

Course Objectives: Students should be able to...

- 1) Study of awareness of fundamental understanding of various applications of AI techniques.
- 2) Identify programming skills in core Python.
- 3) Learn an IDE to create, edit, compile, run and debug.
- 4) Programs understand the various steps in program development.

Course Outcomes: Students will be able to...

- 1) Elaborate problems where artificial intelligence techniques are applicable.
- 2) Use of the python programming language to construct basic programs.
- 3) Translate given algorithms to a working and correct program and correct syntax errors as reported by the compilers.
- 4) Demonstrate and correct logical errors encountered during execution and represent and manipulate data with arrays, strings and structures.

Sr. No.	Title and Contents	Hrs
	Fundamental of Artificial Intelligence	
1	Study of basics of Artificial Intelligence and its algorithms.	60
2	Write a program to demonstrate different number data types in Python.	
3	Write a program to perform different Arithmetic Operations on numbers in Python.	
4	Write Python programs to perform operations on strings, tuples.	
5	Write Python programs to perform operations sets, dictionaries.	
6	Write a program to create, concatenate and print a string and accessing sub-string from a given string.	
7	Check sum of elements in a list.	
8	Find minimum, maximum of two numbers using prolog.	
9	Calculate Factorial of given number using prolog.	
10	Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"	
11	Perform list operations in python.	
12	Write a program to demonstrate working with tuples in python.	
13	Write a program to demonstrate working with dictionaries in python.	
14	Write a python program to find largest of three numbers.	
15	Write a Python program to construct the different patterns using looping statements.	

	Programming in C
1	C "Hello, World!" Program
2	Program to read radius of a circle and to find area and circumference.
3	Program to read three numbers and find the biggest of three
4	Program to read a number, find the sum of the digits, reverse the number and check it for palindrome
5	Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder)
6	Program to find the roots of quadratic equation (demonstration of switch Case statement)
7	C Program to Swap Two Numbers
8	Program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array)
9	C Program to Find the Largest Number Among Three Numbers
10	Program to demonstrate pointers in C.
11	Program to demonstrate string functions.
12	C Program to Find Fibonacci series.
13	Write a program to add two numbers using function.
14	Program to demonstrate student structure to read and display records of n students.
15	Program to demonstrate the difference between structure & union.

Reference Books:-

- 1) Russell, Stuart J., Peter Norvig. Artificial Intelligence: A Modern Approach. 4th ed. Hoboken, NJ: Pearson, 2021.
- 2) Gottfried, Byron S. Programming with C. 4th ed. Schaum's Outline Series. New York: McGraw-Hill, 2018.
- 3) Schildt, Herbert. C: The Complete Reference. 4th ed. New York: McGraw-Hill, 2000.
- 4) Rich, Elaine, Kevin Knight. Artificial Intelligence. 2nd ed. New York: McGraw-Hill, 1991.
- 5) Patterson, Dan W. Introduction to Artificial Intelligence and Expert Systems. Upper Saddle River, NJ: Pearson, 1990.

Evaluation Pattern:

Total Marks: 50

Internal Evaluation(20 Marks):

- Journal – 10 Marks
- Students' Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

- Section I: Attempt any TWO questions (10 Marks)
- Section II: Attempt any TWO questions (05 Marks)



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Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - I

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Fundamentals of Computers (BAIT 114)

Course Objectives: Students should be able to...

- 1) Study the basics of computer.
- 2) Learn algorithm, Flowchart and Pseudo code with Examples.
- 3) Understand the fundamentals of operating systems.
- 4) Identify web Basics and internet features.

Course Outcomes: Students will be able to...

- 1) Apply Internet basics, features, applications, services, internet service providers, domain name system, browsing, email, searching.
- 2) Analyze introduction of computers, classification of computers and anatomy of computer.
- 3) Evaluate the constituents and architecture of computers and microcontrollers.
- 4) Enable students to performs applications in computers.

Module	Title and Contents	Hrs
Module -1:	Fundamentals of Computer	
	1.1 Characteristics of Computers 1.2 Evolution and History of Computers 1.3 Types of Computers 1.4 Basic Organization of a Digital Computer 1.5 Number Systems– different types, conversion from one number system to another 1.6 Computer Codes – BCD, Gray Code, ASCII and Unicode 1.7 Boolean Algebra – Boolean Operators with Truth Tables 1.8 Types of Software – System Software and Utility Software 1.9 Computer Languages - Machine Level, Assembly Level & High Level Languages 1.10 Translator Programs– Assembler, Interpreter and Compiler 1.11 Planning a Computer Program- Algorithm, Flowchart and Pseudo code with Examples	07
Module -2:	Introduction to computers	
	2.1 Input and Output Devices: Keyboard, mouse, touch screen, joystick, scanner, web camera, MICR, OCR, OMR, bar-code reader, monitor, printer, plotter 2.2 Memory: Primary, secondary, auxiliary memory; RAM, ROM, cache memory, magnetic tape, magnetic disks, hard disk drives, optical disks, CD-R, DVD, flash drives, blue ray disc 2.3 Computer Organization and Architecture: C.P.U., registers, system bus, main memory unit 2.4 LOCF - Page: 1 of 35 processors., motherboard, ports and interfaces 2.5 expansion cards, ribbon cables 2.6 SMPS, memory chips	08

Module -3:	Operating System Fundamentals 3.1 Operating Systems: Introduction 3.2 Functions of an operating System 3.3 Classification of Operating Systems 3.4 System programs, Application Programs, Utilities. 3.5 The Unix Operating System 3.6 Basic Unix commands 3.7 Microkernel Based Operating System and Booting process	08
Module -4:	Internet Basics 4.1 Introduction 4.2 Features of Internet 4.3 Internet application 4.4 Services of Internet 4.5 Logical and physical addresses 4.6 Internet Service Providers 4.7 Domain Name System 4.8 Web Basics: Introduction to web, web browsers, http/https, URL, HTML5, CSS	07

Reference Books:-

- 1) Brookshear, J. Glenn. Computer Science: An Overview. 12th ed. Boston: Addison-Wesley, 2015.
- 2) Godse, Atul P., Deepali A. Godse. Computer Fundamentals. 2nd ed. Pune: Technical Publications, 2015.
- 3) Riley, David D., Kenny A. Hunt. Computational Thinking for the Modern Problem Solver. Boca Raton, FL: Chapman & Hall/CRC, 2014.
- 4) Forouzan, Behrouz A. Data Communications and Networking. 5th ed. New York: McGraw-Hill Education, 2013.
- 5) Sinha, Pradeep K., Priti Sinha. Computer Fundamentals. 6th ed. New Delhi: BPB Publications, 2010.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation:(20 Marks) • CCE I - 10 Marks : Activity • CCE II- 10Marks : Activity • CCE III - 10 Marks : MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination: (30 Marks) • Question -1: Solve the following question (5 questions of 2 Marks) • Question 2: Attempt any Two out of Three questions (3 questions of 10 Marks) • Question -3: Attempt any Four out of Six questions (6 questions of 10 Marks) (50 Marks converted to 30 Marks)
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Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - I

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Computational Statistics-I (BAIT 115)

Course Objectives: Students should be able to...

- 1) Learn to impart adequate knowledge on the need of statistics.
- 2) Study the technique of data collection & its presentation, concept of correlation and regression.
- 3) Introduce concept of correction coefficient and how to interpret its value.
- 4) Establish relationship between two or more variables.

Course Outcomes: Students will be able to...

- 1) Evaluate the graph and types of graphs, representation of graphs.
- 2) Compute measure of central tendency and Measure of Dispersion.
- 3) Acquire knowledge about the correlation.
- 4) Analyze linear regression analysis.

Module	Title and Contents	Hrs
Module -1:	Data Condensation, Presentation and Measure of Central tendency 1.1 Introduction to statistics, Scope of Statistics, Data, Primary and secondary data, Classification of data Tabulation and Diagrammatic Representation of statistical data 1.2 Graphical Representation of data Bar-charts, Pie-diagrams Histograms, Frequency Polygon and Frequency curve. Population, Sample, Sampling Methods: Simple Random Sample (SRSWR and SRSWOR), Stratified Random Sample, Systematic sampling, Cluster sampling. 1.3 Mathematical and positional averages: Data Presentation: M, G.M, H.M, relation between them and their properties. Median, mode, partition values	07
Module -2:	Measure of Dispersion and moments 2.1 Measures of Dispersion: Range, Quartile deviation, Mean deviation, standard deviation, coefficient of variation. Various properties of these measures and their utility. 2.2 Raw and central moments, factorial moments, central moments in terms of raw moment's up to 4th order. Definition, Measures of skewness: Bowley's coefficient, Karl Pearson's coefficient, measure of skewness based on moment Kurtosis: Definition, measures of kurtosis, Sheppard's correction	08
Module -3:	Correlation and Regression 3.1 Concept of correlation, Karl Pearson's coefficient of correlation, Correlation coefficient for a bivariate frequency distribution, Spearman's Rank correlation. 3.2 Concept of Regression, Properties of regression coefficient	08

Module -4:	Probability & Conditional Probability 4.1 Events and sets, Sample space, Concept of probability, Addition and multiplications Theorem on probability 4.2 Conditional probability and independence of events, Baye's Theorem, Concept of random variable, Mathematical Expectation	07
Reference Books:- 1) Walpole, Ronald E., Raymond H. Myers, Sharon L. Myers, Keying E. Ye. Probability & Statistics for Engineers & Scientists. 9th ed. Boston: Pearson, 2012. 2) Mukhopadhyay, Parimal. An Introduction to the Theory of Probability. Singapore: World Scientific Publishing Company, 2011. 3) Gupta, S. P. Statistical Methods. 4th ed. New Delhi: Sultan Chand & Sons, 2011. 4) Arumugam, S., A. Dhandapani Isaac. Statistics. Chennai: New Gamma Publication House, 2002. 5) Trivedi, Kishor S. Probability and Statistics with Reliability, Queueing, Computer Science Applications. New Delhi: Prentice Hall of India (P) Ltd., 1997.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation:(20 Marks) • CCE I - 10 Marks : Activity • CCE II- 10Marks : Activity • CCE III - 10 Marks : MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)		End Semester Examination: (30 Marks) • Question -1: Solve the following question (5 questions of 2 Marks) • Question 2: Attempt any Two out of Three questions (3 questions of 10 Marks) • Question -3: Attempt any Four out of Six questions (6 questions of 10 Marks) (50 Marks converted to 30 Marks)



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - I

Type : DSC P

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Fundamentals of Computers & Computational Statistics- I (BAIP 116)

Practical Batch : 20 Student/Batch

Course Objectives: Students should be able to...

- 1) Learn to impart adequate knowledge on the need of statistics.
- 2) Study the technique of data collection & its presentation, concept of correlation and regression.
- 3) Introduce concept of correction coefficient and how to interpret it's value.
- 4) Establish relationship between two or more variables and predict the value by Regression analysis

Course Outcomes: Students will be able to...

- 1) Evaluate web basics and internet features.
- 2) Solve algorithm, Flowchart and Pseudo code with Examples.
- 3) Acquire Knowledge about the correlation.
- 4) Analyze Linear regression analysis

Sr. No.	Title and Contents	Hrs
Fundamentals of Computer		
1	Identification of the peripherals of a computer, components in a CPU and their functions.	60
2	Assembling and disassembling the system hardware components of personal computer.	
3	Basic Computer Hardware Trouble shooting.	
4	Study of internet basics.	
5	Familiarization of Basic Software – Operating System, Word Processors.	
6	Study of Internet Browsers, Integrated Development Environment (IDE) with Examples.	
7	Solving Boolean Algebra Problems and Verification Using Truth Tables and Logic Gate Simulators.	
8	Identification and Classification of System Software, Utility Software, Application Software Installed on a Computer.	
9	Verify the components of a typical computer system.	
10	Study of number systems.	
11	Implementation of BCD, Gray Code, ASCII, Unicode Encoding with Practical Examples	
12	Installation, Boot Process Observation, Basic File Management in a Unix/Linux Operating System.	
13	Practice of Basic Unix/Linux Commands for File, Directory, User Management.	
14	Study of HTML tags.	
15	Study of table tags, ordered and unordered lists.	
Computational Statistics-I		
1	Graphical Representation	
2	Measures of Central Tendency I	
3	Measures of Central Tendency II	
4	Computation of Raw Moments, Central Moments, Factorial Moments up to Fourth Order	
5	Selection of Samples Using Simple Random, Stratified, Systematic, Cluster Sampling Techniques	
6	Computation of Arithmetic Mean, Geometric Mean, Harmonic Mean with Comparative Analysis	
7	Measures of dispersion I	
8	Measures of dispersion II	

9	Correlation coefficient	
10	Spearman's Rank correlation coefficient	
11	Regression	
12	Solving Probability Problems Using Addition and Multiplication Theorems	
13	Computation of Conditional Probability, Bayes' Theorem, Mathematical Expectation Using Real-Life Data	
14	Application of Probability and Conditional probability	
15	Application on Baye's Theorem	

Reference Books:-

- 1) Brookshear, J. Glenn. Computer Science: An Overview. 12th ed. Boston: Addison-Wesley, 2015.
- 2) Riley, David D., Kenny A. Hunt. Computational Thinking for the Modern Problem Solver. Boca Raton, FL: Chapman & Hall/CRC, 2014.
- 3) Lipschutz, Seymour, Marc Lars Lipson. Schaum's Outline of Discrete Mathematics. 3rd ed. New Delhi: Tata McGraw Hill Education Pvt. Ltd., 2012.
- 4) Mukhopadhyay, Parimal. An Introduction to the Theory of Probability. Singapore: World Scientific Publishing Company, 2011.
- 5) Gupta, S. P. Statistical Methods. 4th ed. New Delhi: Sultan Chand & Sons, 2011.

Evaluation Pattern:

Total Marks: 50

Internal Evaluation(20 Marks):

- Journal – 10 Marks
- Students' Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

- Section I: Attempt any TWO questions (10 marks each)
- Section II: Attempt any TWO questions (05 marks each)



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - I

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Software Quality Assurance (BAIT 117)

Course Objectives: Students should be able to...

- 1) Understand principles of quality assurance used for software development.
- 2) Implementing quality attributes, standard quality procedures used for Quality checking of software product.
- 3) To study Software Quality Assurance activities during the SDLC.
- 4) To learn Software Quality Assurance planning and documentation.

Course Outcomes: Students will be able to...

- 1) Understand Quality Assurance.
- 2) To check and verify Quality Standards for Software.
- 3) Analyze software defects using root cause analysis techniques.
- 4) Use software quality metrics to evaluate software quality.

Module	Title and Contents	Hrs
Module -1:	Introduction to Software Quality Assurance 1.1 Definitions of Quality, Quality Attributes, Organizational Framework for Software Quality Assurance 1.2 Different Views of Quality, Principles of Software Quality Assurance 1.3 Quality Assurance vs Quality Control	07
Module -2:	Managing SQA Operations 2.1 Quality Assurance indicators during SDLC phase 2.2 Contents of SQA Plan, Software Quality Assurance. 2.3 Organizational Initiatives, Need for SQA function benefits	08
Module -3:	Defect Management for Quality and Improvement 3.1 Defect Life Cycle, Defect Classification with Bug Tracking Process 3.2 Importance of Defect Leakage Prevention, Residual Defect Density, 3.3 Detecting and Analyzing Software Defects - Techniques for Root 3.4 Cause Analysis, Orthogonal Defect Classification	08
Module -4:	Metrics and Measurements 4.1 Understanding Measurement and Metrics, Metrics for Tracking System Test 4.2 Metrics for Defect Management, Metrics for Software Maintenance, Metrics for Requirement, Defect Causal Analysis, Metrics for SDLC phases	07

Reference Books:-

- 1) Pressman, Roger S., Bruce R. Maxim. Software Engineering: A Practitioner's Approach. 9th ed. New York: McGraw-Hill Education, 2019.
- 2) Myers, Glenford J., Corey Sandler, Tom Badgett. The Art of Software Testing. 3rd ed. Hoboken, NJ: John Wiley & Sons, 2011.
- 3) IEEE Computer Society. IEEE Standard for Software and System Test Documentation (IEEE Std 829-2008). New York: IEEE, 2008.
- 4) Galin, Daniel. Software Quality Assurance: From Theory to Implementation. Harlow, England: Pearson Education Limited, 2004.
- 5) Kan, Stephen H. Metrics and Models in Software Quality Engineering. 2nd ed. Boston: Addison-Wesley Professional, 2002.

Evaluation Pattern:**Total Marks: 50****Internal Continuous Evaluation (20 Marks):**

- CCE - I : 10 Marks: Activity
- CCE - II: 10 Marks: Activity
- CCE - III: 10 Marks: MCQ Test
(Best of 2 from CCE I, II & III Selected for final Score)

End Semester Examination (30 Marks):

- Question -1: Solve the following questions
(5 questions of 2 Marks)
- Question -2: Attempt any two out of three questions
(3 questions of 10 marks)
- Question -3: Attempt any four out of Six questions
(6 questions of 05 marks)



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - I

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course: Computational Mathematics – I (BAIT 118)

Course Objectives: Students should be able to...

- 1) Introduce numerical methods for solution of AI problems.
- 2) Provide a strong foundation in mathematical concepts required for AI and computational problem-solving.
- 3) Develop analytical and numerical methods for solving complex mathematical problems using computational techniques.
- 4) Understands matrices using python.

Course Outcomes: Students will be able to...

- 1) Compute numerical methods.
- 2) Solve the errors and approximation.
- 3) Calculate differentiation using numerical methods.
- 4) Analyze numerical differentiation formulae.

Module	Title and Contents	Hrs
Module -1:	Error and Approximation	
	1.1 Introduction, Importance of Numerical Methods 1.2 Approximation and Errors in computation 1.3 Newton's Finite differences (forward, backward, central difference, divided difference) 1.4 Difference operators, shift operators, differential operators	07
Module -2:	Interpolation	
	2.1 Newton's forward Interpolation 2.2 Newton's backward Interpolation 2.3 Central difference interpolation: Stirling's Formula, Bessel's Formula. 2.4 Divided difference interpolation 2.5 Lagrange interpolation	08
Module -3:	Numerical Interpolation and Differentiation	
	3.1 Numerical Differentiation formulae 3.2 Newton-Cote general quadrature formula 3.3 Trapezoidal rule 3.4 Simpson's 1/3 rule 3.5 Simpson's 3/8 rule 3.6 Romberg integration	08

Module -4:	Solution of Ordinary Differential Equation	07
	4.1 Euler's Method 4.2 Modified Euler's method 4.3 Runge Kutta methods for 1 st order ordinary differential equations 4.4 Runge Kutta methods for 2 nd order ordinary differential equations	

Reference Books:-

- 1) Grewal, B. S. Numerical Methods in Engineering and Science. New Delhi: Khanna Publishers, 2013.
- 2) Kiusalaas, Jaan. Numerical Methods in Engineering with MATLAB. Cambridge: Cambridge University Press, 2005.
- 3) Schilling, Robert J., Sandra L. Harris. Applied Numerical Methods for Engineers Using MATLAB and C. Belmont, CA: Thomson Brooks/Cole, 2000.
- 4) Mathews, John H., Kurtis D. Fink. Numerical Methods Using MATLAB. Upper Saddle River, NJ: Prentice Hall, 1999.
- 5) Burden, Richard L., J. Douglas Faires. Numerical Analysis. Belmont, CA: Thomson Brooks/Cole, 1997.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks: Activity • CCE - II: 10 Marks: Activity • CCE - III: 10 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (30 Marks): • Question -1: Solve the following questions (5 questions of 2 Marks) • Question -2: Attempt any two out of three questions (3 questions of 10 marks) • Question -3: Attempt any four out of Six questions (6 questions of 05 marks)
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Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B. Sc.

Semester - I

Type : DSC P

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code : Software Quality Assurance & Computational Mathematics - I (BAIP 119)

Practical Batch : 20 Student/Batch

Course Objectives: Students should be able to...

- 1) Improve Computational Skills.
- 2) Introduce numerical methods for solution of AI problems..
- 3) Develop testing Skills.
- 4) Apply Quality Assurance Methodology.

Course Outcomes: Students will be able to...

- 1) Understanding Forward and backward interpolation and solve example on it.
- 2) Understanding to solve Numerical Differentiation and Integration.
- 3) Solve the Errors and Approximation.
- 4) Demonstrate Understanding of Quality Assurance.

Module	Title and Contents	Hrs
	Computational Mathematics - I	
1	Newton finite difference forward and backward difference	60
2	Newton finite difference central and divided difference	
3	Study of Approximation Errors: Absolute Error, Relative Error, Percentage Error in Numerical Computations	
4	Central difference interpolation	
5	Newton's backward interpolation	
6	Newton's forward interpolation	
7	Numerical Integration Using the Trapezoidal Rule	
8	Lagrange's interpolation	
9	Divided Difference interpolation	
10	Polynomial Interpolation Using Newton's Divided Difference Method	
11	Trapezoidal Rule	
12	Simpsons 1/3 rd rule	
13	Simpsons 3/8 th rule	
14	Euler Method	
15	Solution of First- and Second-Order Ordinary Differential Equations Using Runge-Kutta Method	
	Software Quality Assurance	
1	Application of Requirement Stability Index and Requirement Traceability Matrix for given case study.	

2	Study of Pareto Chart on the given case study	
3	Defect Matrices Calculation	
4	Maintenance Metrics visualization and creation	
5	Study of Software Testing Metrics	
6	Application of Quality Indicators of SDLC	
7	SQA plan creation	
8	Audit Checklist for SQA plan	
9	Root Cause Analysis Techniques	
10	Application of Orthogonal Defect Classification (ODC) for Software Defect Analysis	
11	Calculation and Analysis of Defect Leakage and Residual Defect Density Metrics	
12	Design and Analysis of System Testing Metrics for Software Quality Assessment	
13	Implementation of Root Cause Analysis Technique	
14	Computation and Interpretation of Defect Management Metrics Using Sample Project Data	
15	Preparation of a Software Quality Metrics Dashboard for SDLC Phase-wise Performance Evaluation.	

Reference Books:-

- 1) Naik, Kshisagar, Priyadarshini Tripathy. Software Testing and Quality Assurance: Theory and Practice. Hoboken, NJ: Wiley, 2017.
- 2) Godbole, Nina S. Software Quality Assurance. 2nd ed. Oxford: Alpha Science International Ltd., 2017.
- 3) Marchewka, Jack T. Information Technology Project Management. 4th ed. New Delhi: Wiley India, 2014.
- 4) Kiusalaas, Jaan. Numerical Methods in Engineering with MATLAB. Cambridge: Cambridge University Press, 2005.
- 5) Mathews, John H., Kurtis D. Fink. Numerical Methods Using MATLAB. Upper Saddle River, NJ: Prentice Hall, 1999.

Evaluation Pattern:

Total Marks: 50

Internal Evaluation (20 Marks): • Journal : 10 Marks • Students' Performance: 05 Marks • Viva: 05 Marks	Practical Exam Paper (30 Marks): • Section I: Attempt any TWO questions (10 marks each) • Section II: Attempt any TWO questions (05 marks each)
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SEM II



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - II

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Object Oriented Programming using Python(BAIT 121)

Course Objectives: Students should be able to...

- 1) Learn fundamental concepts of objects.
- 2) Study of principles of programming.
- 3) Understand the concept of object-oriented programming like classes, constructors,
- 4) Polymorphism, inheritance, file handling.

Course Outcomes: Students will be able to...

- 1) Evaluate the basic concepts of OOPs.
- 2) Apply different Python library to solve programming problems.
- 3) Explain the advanced concepts of python and apply for accessing databases and web data.
- 4) Analyze APIs and third-party libraries to be used with Python.

Module	Title and Contents	Hrs
Module -1:	Introduction to Object Oriented Programming	
	1.1 Introduction to Object-Oriented Programming (OOP) – Features, advantages, Classes and Objects. 1.2 Encapsulation and Abstraction – Concepts and implementation. 1.3 Classes and Objects in Python – Creating a class, objects, the self variable, constructors. 1.4 Variables, Namespaces, Methods – Types of variables, namespaces, types of methods. 1.5 Inheritance – Types of inheritance, constructors in inheritance, the super() Method. 1.6 Polymorphism – Method overriding, method overloading (concept), runtime polymorphism. 1.7 Abstract Classes and Interfaces – Concepts and implementation. 1.8 Applications of OOP – Practical implementation of OOP concepts using Python.	07
Module -2:	Strings, functions and Python libraries	
	2.1 Strings – Creating strings, basic string operations, string-testing methods. 2.2 Functions – Defining and calling functions, returning multiple values, functions as first-class objects. 2.3 Function Arguments – Formal and actual arguments, positional arguments, recursive functions. 2.4 Open-Source Python Libraries – Basics of libraries for data preprocessing, modelling, visualization. 2.5 Using Python to Access Web Data – Introduction to accessing web data using Python. 2.6 Regular Expressions – Pattern matching and extracting data.	08

	2.7 Sockets and HTTP – Sockets, using the Developer Console to explore HTTP, retrieving web pages. 2.8 Parsing Web Pages – Extracting and processing information from web pages.	
Module -3:	Exception Handling 3.1 Introduction to Exceptions – Errors in Python programs and exceptions. 3.2 Exception Handling – Using try, except, else, finally blocks. 3.3 Types of Exceptions – Built-in exceptions and their handling. 3.4 The except Block – Handling single and multiple exceptions. 3.5 The assert Statement – Assertions and debugging. 3.6 User-Defined Exceptions – Creating and raising custom exceptions.	08
Module -4:	Graphical User Interface and databases 4.1 Introduction to GUI in Python – The root window, fonts, colors, working with containers. 4.2 GUI Components – Canvas and Frames. 4.3 Widgets in Python – Button, Label, Message, Text, Radio Button, Entry widgets. 4.4 Introduction to Databases – Using databases with Python. 4.5 Single Table CRUD Operations – Create, Read, Update, Delete operations. 4.6 Designing and Representing a Data Model – Database design concepts. 4.7 Inserting Relational Data – Working with relational database tables. 4.8 Reconstructing Data with JOINS and Many-to-Many Relationships – JOIN operations and handling many-to-many relationships.	07

Reference Books:-

- 1) Sedgewick, Robert, Kevin Wayne, Robert Dondero. Introduction to Programming in Python: An Inter-Disciplinary Approach. Noida: Pearson India Education Services Pvt. Ltd., 2016.
- 2) Budd, Timothy A. Exploring Python. New Delhi: McGraw Hill Education (India) Private Ltd., 2015.
- 3) Dierbach, Charles. Introduction to Computer Science Using Python: A Computational Problem Solving Focus. New Delhi: Wiley India Edition, 2013.
- 4) Lambert, Kenneth A. Fundamentals of Python: First Programs. Boston: Cengage Learning, 2012.
- 5) Goldwasser, Michael H., David Letscher. Object Oriented Programming in Python. Upper Saddle River, NJ: Prentice Hall, 2007.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks: Activity • CCE - II: 10 Marks: Activity • CCE - III: 10 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (30 Marks): • Question -1: Solve the following questions (5 questions of 2 Marks) • Question -2: Attempt any two out of three questions (3 questions of 10 marks) • Question -3: Attempt any four out of Six questions (6 questions of 05 marks)
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Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - II

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Database Systems (BAIT 122)

Course Objectives: Students should be able to...

- 1) Understand various basics of DBMS and query languages.
- 2) Learn different types of database systems and their applications in different scenarios.
- 3) Identify the process of drawing the ER-Diagrams.
- 4) Study of the importance of database analysis and learn any database application.

Course Outcomes: Students will be able to...

- 1) Apply the basics of databases and data management.
- 2) evaluate various theoretical and practical principles involved in the design and use of databases systems with the help of database
- 3) Design and implement databases for various scenarios.
- 4) Modify database scenario for handling large data.

Module	Title and Contents	Hrs
Module -1:	Introduction to Database Management Systems (DBMS) 1.1 Introduction to DBMS – Data vs. Information, Database, Definition of DBMS. 1.2 Need, Features, Functions, Advantages and Disadvantages of DBMS. 1.3 File Processing System vs. DBMS. 1.4 Structure and Architecture of Database Systems. 1.5 Schema, Subschema, Data Abstraction, Data Independence, Data Dictionary, Database Users.	07
Module -2:	Data Models and Database Design 2.1 Introduction to Data Models – Definition and Features. 2.2 Data Flow Diagram (DFD). 2.3 Object-Based Data Model – Entity Relationship (ER) Model and Cardinality. 2.4 Record-Based Data Models – Hierarchical, Network, Relational Models. 2.5 Physical Data Models and Database Keys (Primary, Foreign, Candidate, Super, Unique Keys). 2.6 Normalization – Concept, Advantages, First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), Examples.	08

Module -3:	Database Management Using MS-Access 3.1 Introduction to MS-Access and its Features. 3.2 Database and Table Creation. 3.3 Record Insertion, Queries, Forms, Report Creation. 3.4 Case Study – Normalized Database Design for Library Management System and Inventory Management System	08
Module -4:	Structured Query Language (SQL) 4.1 Introduction to SQL – Features and SQL Data Types. 4.2 Data Definition Language (DDL) – CREATE, DESCRIBE, ALTER, DROP Commands. 4.3 Data Manipulation Language (DML) – INSERT, UPDATE, DELETE Commands. 4.4 Data Query Language (DQL) – SELECT Statements, Aggregate Functions, ORDER BY Clause.	07

Reference Books:-

- 1) Silberschatz, Abraham, Henry F. Korth, S. Sudarshan. Database System Concepts. New Delhi: Tata McGraw Hill, 2006.
- 2) Elmasri, Ramez, Shamkant B. Navathe. Fundamentals of Database Systems. Boston: Pearson Education, 2013.
- 3) Ramakrishnan, Raghu, Johannes Gehrke. Database Management Systems. New York: McGraw-Hill, 2003.
- 4) Date, C. J., A. Kannan, S. Swamynathan. An Introduction to Database Systems. New Delhi: Pearson, 2006.

Evaluation Pattern:

Total Marks: 50

Internal Evaluation (20 Marks): • Journal : 10 Marks • Students' Performance: 05 Marks • Viva: 05 Marks	Practical Exam Paper (30 Marks): • Section I: Attempt any TWO questions (10 marks each) • Section II: Attempt any TWO questions (05 marks each)
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Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - III

Type : DSC (P)

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Object Oriented Programming using Python and Database Systems (BAIT 123)

Practical Batch : 20 Student/Batch

Course Objectives: Students should be able to...

- 1) Learn principles of programming.
- 2) Understand the concept of object-oriented programming like classes, constructors, Polymorphism, inheritance, file handling.
- 3) Study of how to implement databases for various scenarios.
- 4) Identify the design a database scenario for handling large data.

Course Outcomes: Students will be able to...

- 1) Explain basic principles of Python programming language.
- 2) Implement database and GUI applications.
- 3) Demonstrate normalization techniques with simple examples.
- 4) Describe transaction processing and concurrency control concepts.

Module	Title and Contents	Hrs
	Object Oriented Programming using python	
1	NumPy program to compute the cross product of two given vectors	60
2	NumPy program to calculate QR decomposition of a given matrix	
3	Converting Series Objects to Python Lists and Validating Their Types	
4	Transforming NumPy Arrays into Series Objects and Examining Their Properties	
5	Python program to implement classes and objects	
6	Python program to implement inheritance	
7	Python program to implement polymorphism	
8	Menu-driven program to create 3D mathematical objects (curve, sphere, cone, arrow, ring, cylinder)	
9	Python program to read n integers and display histogram	
10	Python program to plot graph of pulse rate vs height (user input values)	
11	NumPy program to perform basic matrix operations (addition, subtraction, multiplication)	
12	NumPy program to compute eigenvalues and eigenvectors of a matrix	
13	Pandas program to create and manipulate DataFrame	
14	Pandas program to perform data cleaning and handling missing values	
15	Python program to visualize data using basic Matplotlib plots (line, bar, scatter)	
	Database Systems	
1	Study of DBMS Concepts and Database Architecture	
2	Entity Relationship (ER) Diagram Design	
3	Data Flow Diagram (DFD) Design	
4	Identification and Implementation of Database Keys	

5	Database Normalization (1NF, 2NF, 3NF)
6	Database Creation using MS-Access
7	Table Creation and Record Management in MS-Access
8	Creating Queries, Forms, Reports in MS-Access
9	Library Management System Database Design using MS-Access
10	Inventory Management System Database Design using MS-Access
11	SQL DDL Commands (CREATE, ALTER, DESCRIBE, DROP)
12	SQL DML Commands (INSERT, UPDATE, DELETE)
13	SQL SELECT Queries and WHERE Clause
14	SQL Aggregate Functions and ORDER BY Clause
15	SQL Joins and Relational Database Queries

Reference Books: -

- 1) Sedgewick, Robert, Kevin Wayne, Robert Dondero. Introduction to Programming in Python: An Inter-Disciplinary Approach. Noida: Pearson India Education Services Pvt. Ltd., 2016.
- 2) Budd, Timothy A. Exploring Python. New Delhi: McGraw Hill Education (India) Private Ltd., 2015.
- 3) Dierbach, Charles. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus. New Delhi: Wiley India Edition, 2013.
- 4) Ramakrishnan, Raghu, Johannes Gehrke. Database Management Systems. New York: McGraw-Hill, 2003.
- 5) Date, C. J., A. Kannan, S. Swamynathan. An Introduction to Database Systems. New Delhi: Pearson, 2006.

Evaluation Pattern:

Total Marks: 50

Internal Evaluation(20 Marks):

- Journal – 10 Marks
- Students' Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

- Question 1 (10 Marks)
 - Question 2 (10 Marks)
 - Question 3 (10 Marks)
 - Question 4 (10 Marks)
- (Attempt any 3 of the following)



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - II

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Operating Systems (BAIT 124)

Course Objectives: Students should be able to...

- 1) Aware different types of Operating System and their services.
- 2) Learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- 3) Understand virtual memory concepts.
- 4) Remember the concept of secondary memory management.

Course Outcomes: Students will be able to...

- 1) Control access to a computer and the files that may be shared.
- 2) Demonstrate the knowledge of the components of computer and their respective roles in computing.
- 3) Recognize and resolve user problems with standard operating environments.
- 4) Apply practical knowledge of how programming languages, operating systems, architectures interact and how to use each effectively.

Module	Title and Contents	Hrs
Module -1:	Concepts of Operating Systems 1.1 Computer System Overview – Basic structure of computer system, general system architecture, system components. 1.2 Concept of Operating System – Definition of OS and its role in computer systems. 1.3 Batch System and Multiprogramming – Batch processing systems and multiprogramming concepts. 1.4 Multiprocessing, Multi-user, Time Sharing Systems – Features and working of these operating system types. 1.5 Personal, Parallel, Real-Time Systems – Characteristics and applications of different systems. 1.6 Operating System Services, System Calls, System Programs – Services provided by OS and interaction with users/programs. 1.7 System Structure and Simple Monitors – OS structure and concept of simple monitors. 1.8 Approaches to OS Design and Implementation – Microkernel approach, layered approach, kernel-based approach.	07

Module -2:	Processes and Threads 2.1 Concept of Process – Definition of process, process states, process state transitions, Process Control Block (PCB). 2.2 Operations on Processes – Creation, scheduling, execution, termination of processes. 2.3 Threads and Concurrent Processes – Concept of threads, multithreading, concurrent execution. 2.4 Mutual Exclusion and Synchronization – Critical section problem and synchronization mechanisms. 2.5 Deadlocks – Principles of deadlock, conditions, prevention, avoidance, detection, recovery strategies. 2.6 Scheduling in Operating System – Scheduling levels, scheduling criteria, types of CPU scheduling. 2.7 Inter-Process Communication (IPC) – IPC mechanisms, synchronization, communication models. 2.8 Advanced OS Concepts – Linux IPC mechanisms, Remote Procedure Calls (RPC), RPC exception handling, security issues.	08
Module -3:	Memory Management and Data Management 3.1 Address Space Concepts – Logical and physical address space, storage allocation techniques. 3.2 Memory Management Basics – Swapping and concepts of multiprogramming. 3.3 Paging and Segmentation – Paging, segmentation, virtual memory management strategies. 3.4 Demand Paging and Page Replacement – Demand paging, page replacement algorithms, thrashing. 3.5 File System Basics – File organization, record blocking, access methods. 3.6 Directory and Protection – Directory structure, directory implementation, file protection mechanisms. 3.7 Disk Structure and Management – Disk structure, disk scheduling, disk management, buffering techniques. 3.8 Advanced Storage Concepts – Swap space management and RAID levels.	08
Module -4:	Case Studies and OS Abstractions 4.1 Linux/Unix OS Design and Architecture – Structure of Unix/Linux operating system and design principles. 4.2 Unix Shell and Operating System Services – Shell concepts, user perspective, OS services in Unix. 4.3 File System in Unix – Representation of files, file structure, input-output system. 4.4 Process Management in Unix – System calls: fork, wait, exec, exit, kill, getpid, brk, nice, sleep, trace. 4.5 File Handling System Calls – open, close, read, write, lseek, stat, sync. 4.6 Directory Management in Unix – mkdir, rmdir, link, unlink, mount, umount, user operations. 4.7 Security and Access Control – chown, chmod, getuid, setuid and Unix security mechanisms. 4.8 Inter-Process Communication and Networking – Signals, pipes, sockets, networking system calls (accept, send, recv, connect).	07

Reference Books:-

- 1) Walia, Ekta. Operating System Concepts. New Delhi: Khanna Book Publishing, 2020.
- 2) Crowley, Charles. Operating System: A Design Approach. New York: McGraw Hill Education, 2017.
- 3) Kernighan, Brian W., Rob Pike. The UNIX Programming Environment. New Delhi: PHI/Pearson Education, 2015.
- 4) Tanenbaum, Andrew S. Modern Operating Systems. 2nd ed. New Delhi: Pearson/PHI, 2014.
- 5) Stallings, William. Operating Systems: Internals and Design Principles. New Delhi: Pearson Education, 2012.

Evaluation Pattern:**Total Marks: 50****Internal Continuous Evaluation (20 Marks):**

- CCE - I : 10 Marks: Activity
- CCE - II: 10 Marks: Activity
- CCE - III: 10 Marks: MCQ Test
(Best of 2 from CCE I, II & III Selected for final Score)

End Semester Examination (30 Marks):

- Question -1: Solve the following questions
(5 questions of 2 Marks)
- Question -2: Attempt any two out of three questions
(3 questions of 10 marks)
- Question -3: Attempt any four out of Six questions
(6 questions of 05 marks)



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B.Sc.

Semester - II

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Computational Mathematics –II (BAIT 125)

Course Objectives: Students should be able to...

- 1) Learn to impart adequate knowledge on the need of mathematics.
- 2) Understand the need of problem-solving techniques.
- 3) Introduce the fundamental of logic, relations and counting.
- 4) Identify basic concept of graphs, matrices, different types of graphs and matrices.

Course Outcomes: Students will be able to...

- 1) Evaluate fundamental of logic, application of logic and relations.
- 2) Explain the pigeonhole principle and applications of recurrence relations.
- 3) Demonstrate graphs and its types, solve problems on it.
- 4) Apply matrices and its types, design values and design vectors.

Module	Title and Contents	Hrs
Module -1:	The Fundamental of Logic and Relations	
	1.1 Propositional Logic – Basic concepts of propositions and logical connectives. 1.2 Applications of Propositional Logic – Use of logic in problem solving and computer science. 1.3 Propositional Equivalences – Logical equivalences and transformations (excluding satisfiability topics). 1.4 Predicates and Quantifiers – Predicate logic, universal and existential quantifiers. 1.5 Rules of Inference – Logical reasoning and inference rules. 1.6 Relations and Their Properties – Types of relations and their properties. 1.7 Representation and Closures of Relations – Matrix and graph representation, reflexive, symmetric, transitive closures. 1.8 Partial Orderings – Concept and properties (theorems statement only, excluding lattices and lexicographic ordering).	07
Module -2:	Counting	
	2.1 Basics of Counting – Fundamental counting principles and rules (theorems/results only). 2.2 Pigeonhole Principle – Statement and applications of pigeonhole principle. 2.3 Permutation and Combinations – Basic formulas and results of permutations and combinations. 2.4 Recurrence Relations – Applications of recurrence relations in problem solving. 2.5 Solving Recurrence Relations – Methods for solving recurrence relations (theorems/results only). 2.6 Divide and Conquer Algorithms – Concept and analysis using recurrence relations. 2.7 Recurrence Relations in Algorithms – Application of recurrence relations in algorithm analysis.	08

Module -3:	Graphs 3.1 Graphs and Graph Models – Introduction to graphs and graph models (excluding biological networks, tournaments, related examples/problems). 3.2 Graph Terminology and Special Types of Graphs – Basic terminology and types of graphs. 3.3 Graph Representation and Isomorphism – Representation of graphs using matrices and lists, graph isomorphism. 3.4 Connectivity in Graphs – Paths, connectedness in undirected graphs, counting paths between vertices. 3.5 Shortest Path Problems – Introduction to shortest path problems and basic algorithms.	08
Module -4:	Matrices 4.1 Introduction to Matrices – Basic concepts and definitions. 4.2 Operations on Matrices – Addition, subtraction, multiplication, related examples. 4.3 Inverse of Matrices – Concept of inverse and examples. 4.4 Rank of a Matrix – Definition, properties, computation. 4.5 Solution of Simultaneous Linear Equations – Methods using matrices. 4.6 Eigen Values and Eigen Vectors – Concept, properties, basic problems.	07

Reference Books:-

- 1) Rosen, Kenneth H. Discrete Mathematics and Its Applications. 7th ed. New York: McGraw-Hill Publishing Company, 2012.
- 2) Lipschutz, Seymour, Marc Lars Lipson. Schaum's Outline of Discrete Mathematics. 3rd ed. New Delhi: Tata McGraw Hill Education Pvt. Ltd., 2012.
- 3) Kolman, Bernard, Robert C. Busby, Sharon Cutler Ross. Discrete Mathematical Structures. 6th ed. New Delhi: Pearson Education, 2009.
- 4) Grimaldi, Ralph P. Discrete and Combinatorial Mathematics: An Applied Introduction. 5th ed. Boston: Addison-Wesley, 2004.
- 5) Tremblay, Jean-Paul, R. Manohar. Discrete Mathematical Structures with Applications to Computer Science. New York: McGraw-Hill, 1975.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks: Activity • CCE - II: 10 Marks: Activity • CCE - III: 10 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (30 Marks): • Question -1: Solve the following questions (5 questions of 2 Marks) • Question -2: Attempt any two out of three questions (3 questions of 10 marks) • Question -3: Attempt any four out of Six questions (6 questions of 05 marks)
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Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B. Sc.

Semester - III

Type : DSC (P)

Marks: 50

Credits : 2

From: A. Y. 2024-25

**Name of the Course & Code: Operating Systems & Computational Mathematics
-I (BAIP 126)**

Practical Batch : 20 Student/Batch

Course Objectives: Students should be able to...

- 1) Understand and implement shell programming.
- 2) Learn how to create and/or modify concurrent programs.
- 3) Understand the need of problem-solving techniques.
- 4) Introduce the fundamental of logic, relations and counting.

Course Outcomes: Students will be able to...

- 1) Evaluate the basics of an operating systems and its major components.
- 2) Apply security as well as recovery features in the design of algorithm.
- 3) Demonstrate graphs and its types, solve problems on it.
- 4) Apply matrices and its types, design values and design vectors..

Module	Title and Contents	Hrs
Operating Systems		
1	Study on different operating systems	60
2	Ubuntu installation, file system partitioning, dual boot setup	
3	Command Line Interface (CLI) and basic UNIX commands	
4	Shell scripting – creation and execution of shell scripts	
5	Implementation of CPU scheduling algorithms	
6	UNIX/Linux file I/O system calls (open, read, write, close, seek, stat)	
7	Directory operations using system calls (opendir, readdir, closedir)	
8	Simulation of Banker's Algorithm for deadlock avoidance	
9	File and directory management system calls (mkdir, rmdir, link, unlink)	
10	File system control operations (mount, umount, sync, fcntl)	
11	Process management system calls (fork, wait, exec, exit, getpid)	
12	Process control system calls (kill, nice, sleep, trace, brk)	
13	File permission and user management system calls (chmod, chown, getuid, setuid)	
14	Inter-process communication using pipes and signals	
15	Socket programming using system calls (socket, connect, accept, send, recv)	
Computational Mathematics –I		
1	Write a Python program to print multiplication table for a given number	60
2	Write a Python program to check whether a number is prime or not	
3	Write a Python program to display Fibonacci series	
4	Write a menu-driven program for temperature conversion (Fahrenheit ↔ Celsius)	
5	Write a Python program to find factorial of a given number	
6	Write a Python program to generate calendar for a given month and year	
7	Write a Python program to transpose a matrix	

8	Write a Python program to multiply two matrices
9	Write a Python program to find inverse of a matrix using Cayley-Hamilton method
10	Write a Python program to compute eigen values and eigen vectors of a matrix
11	Write a Python program to check whether a number is even or odd
12	Write a Python program to find the greatest of three numbers
13	Write a Python program to find GCD and LCM of two numbers
14	Write a Python program to sort a list of numbers
15	Write a Python program to search an element in a list
Reference Books: - 1) Krishna, Marlapalli, S. Jaya Prakash, K. Varada Rajkumar. Basic Python Programming for Beginners. New Delhi: Bluerose Publishers Pvt. Ltd., 2021. 2) Matthes, Eric. Python Crash Course: A Hands-On, Project-Based Introduction to Programming. 2nd ed. San Francisco: No Starch Press, 2019. 3) Gupta, S. P. Statistical Methods. 4th ed. New Delhi: Sultan Chand & Sons, 2011. 4) Dhamdhare, Dhananjay M. Operating Systems: A Concept-Based Approach. New Delhi: Tata McGraw Hill, 2006.	
Evaluation Pattern:	
Total Marks: 50	
Internal Evaluation (20 Marks): • Journal : 10 Marks • Students' Performance: 05 Marks • Viva: 05 Marks	Practical Exam Paper (30 Marks): • Section I: Attempt any TWO questions (10 marks each) • Section II: Attempt any TWO questions (05 marks each)



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B. Sc

Semester - II

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Introduction to Machine Learning (BAIT 127)

Course Objectives: Students should be able to...

- 1) Understand principles of Machine Learning.
- 2) Develop foundational knowledge in various machine learning techniques.
- 3) Implement supervised learning algorithms including regression and classification models.
- 4) Apply unsupervised learning techniques such as clustering and dimensionality reduction.

Course Outcomes: Students will be able to...

- 1) Implement and evaluate various machine learning algorithms.
- 2) Perform data manipulation and visualization using Python.
- 3) Understand and apply quality assurance methods in the context of machine learning.
- 4) Illustrate applications of machine learning.

Module	Title and Contents	Hrs
Module -1:	Fundamental of Machine Learning 1.1 Definition and types (supervised, unsupervised, reinforcement learning). 1.2 Applications of machine learning. Basic Concepts of ML- Data, features, labels. 1.3 Training and testing datasets. 1.4 Overfitting and under fitting.	07
Module -2:	Supervised Machine Learning 2.1 Types of Regression (Linear Regression, Simple linear regression, Multiple linear regression) 2.2 Evaluation metrics (R-squared, Mean Squared Error). 2.3 Classification Algorithms 2.4 Logistic regression 2.5 K-Nearest Neighbors (KNN) 2.6 Decision Trees.	08
Module -3:	Unsupervised Learning 3.1 Clustering Techniques 3.2 K-Means clustering. 3.3 Hierarchical clustering. 3.4 Dimensionality Reduction 3.5 Principal Component Analysis (PCA). 3.6 T-Distributed Stochastic Neighbor Embedding (t-SNE)	08

Module -4:	Reinforcement learning 4.1 Basic Concepts 4.2 Definition of reinforcement learning (RL). 4.3 Difference between RL, supervised learning, unsupervised learning. 4.4 Key components: agent, environment, states, actions, rewards. 4.5 Examples of RL applications (e.g., games, robotics, finance)	08
Reference Books:- 1) Murphy, Kevin P. Probabilistic Machine Learning: An Introduction. Cambridge, MA: MIT Press, 2022. 2) Alpaydin, Ethem. Introduction to Machine Learning. 4th ed. Cambridge, MA: MIT Press, 2020. 3) Raschka, Sebastian, Vahid Mirjalili. Python Machine Learning. 3rd ed. Birmingham: Packt Publishing, 2019. 4) Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. The Elements of Statistical Learning: Data Mining, Inference, and Prediction. 2nd ed. New York: Springer, 2009. 5) Bishop, Christopher M. Pattern Recognition and Machine Learning. New York: Springer, 2006.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks: Activity • CCE - II: 10 Marks: Activity • CCE - III: 10 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (30 Marks): • Question -1: Solve the following questions (5 questions of 2 Marks) • Question -2: Attempt any two out of three questions (3 questions of 10 marks) • Question -3: Attempt any four out of Six questions (6 questions of 05 marks)	



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B. Sc

Semester – II

Type : DSC

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course & Code: Computational Statistics-II (BAIT 128)

Course Objectives: Students should be able to...

- 1) Find multiple and partial correlation.
- 2) Establish relationship between two or more variables and predict the value by Regression analysis.
- 3) Evaluate mathematical expectation for univariate distribution.
- 4) Introduce students with standard discrete probability distributions.

Course Outcomes: Students will be able to...

- 1) Find multiple and partial correlation.
- 2) Know multiple regression coefficient
- 3) Understand probability mass function, cumulative distribution function.
- 4) Evaluate expectation of random variable.

Module	Title and Contents	Hrs
Module -1:	Multiple and Partial Correlation	
	1.1 Concept of multiple correlations. Definition of multiple correlation coefficient $R_{i.jk}$, derivation of formula for multiple correlation coefficient. Properties of multiple correlation coefficient; coefficient of multiple determination R^2. 1.2 Concept of partial correlation. Definition of partial correlation coefficient, derivation of formula for $r_{ij.k}$. Properties of partial correlation, relation between simple, multiple and partial correlation. Illustrative Examples.	07
Module -2:	Multiple Linear Regression	
	2.1 Concept of multiple linear regression, Plane of regression, Yule's notation, correlation matrix. Fitting of regression plane by method of least squares, definition of partial regression coefficients and their interpretation. 2.2 Residual: definition, order, properties, derivation of mean and variance, Covariance between residuals. Illustrative Examples.	08
Module -3:	Univariate Probability Distributions And Mathematical expectation	
	3.1 Definition of discrete random variable. Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.) of a discrete random variable, Properties of c.d.f. (statements only). 3.2 Definition of expectation of a random variable, expectation of a function of a random variable. Results on expectation, Definitions of mean, variance of univariate distributions. Definition of probability generating function (p.g.f.) of a random variable. 3.3 Effect of change of origin and scale on p.g.f. Definition of mean and variance by using p.g.f. examples	08

Module -4:	Some Standard Probability Distribution	07
	4.1 Bernoulli distribution: p.m.f., mean, variance, distribution of sum of independent and identically distributed Bernoulli variables. 4.2 Discrete Uniform Distribution: p.m.f., mean and variance 4.3 Binomial Distribution: Binomial random variable, p.m.f. with parameters (n, p), Recurrence relation for successive probabilities, Computation of probabilities of different events, mean and variance, mode, skewness, p.g.f., Additive property of binomial variates. Examples. 4.4 Poisson distribution: Definition of Poisson with parameter λ. Mean, variance, probability generating function (p.g.f.). Recurrence relation for successive Probabilities, Additive property of Poisson distribution. Poisson distribution as a limiting case of Binomial distribution, examples. 4.5 Normal Distribution: Probability density function, mean and variance, properties of normal curve, standard normal distribution, numerical problem.	

Reference Books:-

- 1) Mukhopadhyay, Parimal. An Introduction to the Theory of Probability. Singapore: World Scientific Publishing Company, 2011.
- 2) Gupta, S. P. Statistical Methods. 4th ed. New Delhi: Sultan Chand & Sons, 2011.
- 3) Arumugam, S., A. Dhandapani Isaac. Statistics. Chennai: New Gamma Publication House, 2002.
- 4) Trivedi, Kishor S. Probability and Statistics with Reliability, Queueing, Computer Science Applications. New Delhi: Prentice Hall of India (P) Ltd., 1997.
- 5) Grewal, P. S. Methods of Statistical Analysis. New Delhi: Sterling Publishers, 1990.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks): • CCE - I : 10 Marks: Activity • CCE - II: 10 Marks: Activity • CCE - III: 10 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (30 Marks): • Question -1: Solve the following questions (5 questions of 2 Marks) • Question -2: Attempt any two out of three questions (3 questions of 10 marks) • Question -3: Attempt any four out of Six questions (6 questions of 05 marks)
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Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Artificial Intelligence

Programme: B. Sc.

Semester - III

Type : DSC (P)

Marks: 50

Credits : 2

From: A. Y. 2024-25

Name of the Course& Code : Introduction to Machine Learning & Computational Statistics-II (BAIP 129)

Course Objectives: Students should be able to...

- 1) To Enhance Computational Skills.
- 2) Solve real-world problems using various machine learning techniques.
- 3) Analyze model results and identify areas for improvement.
- 4) Introduce students with standard discrete probability distributions.

Course Outcomes: Students will be able to...

- 1) Implement and evaluate various machine learning algorithms.
- 2) Perform data manipulation and visualization using Python.
- 3) Apply quality assurance methods in the context of machine learning.
- 4) Analyze the expected behavior of a random variable using mathematical expectation.

Module	Title and Contents	Hrs
Introduction to Machine Learning		
1	Installation of Python, pip, setup of ML environment	60
2	Perform Machine Learning libraries using Python	
3	Perform Machine Learning and application-oriented algorithms	
4	Working with NumPy for basic mathematical operations	
5	Pandas installation and basic data handling using pip	
6	Python program using NumPy for array operations	
7	Python program using Pandas to create and manipulate dataframes	
8	Python program using Matplotlib for data visualization	
9	Implementing KNN classification algorithm using Python on IRIS dataset	
10	Python script using SciPy for image manipulation	
11	Python program using TensorFlow for basic tensor operations (array multiplication)	
12	Python program using Theano for computing a logistic function	
13	Data preprocessing using Pandas (handling missing values and cleaning data)	
14	Data visualization using Matplotlib (line, bar, scatter plots)	
15	Comparative study of ML libraries (NumPy, Pandas, Matplotlib, TensorFlow, SciPy)	
Computational Statistics-II		
1	Multiple Correlation Coefficients	60
2	Partial Correlation Coefficients	
3	Multiple Regression – I	
4	Multiple Regression –II	
5	Bivariate Discrete distribution I. (Marginal Distribution)	
6	Bivariate Discrete distribution II (Conditional distribution)	
7	Bivariate Discrete distribution III (Expectations /conditional expectations)	
8	Bivariate Discrete distribution IV (variances / conditional variance)	
9	Bivariate Discrete distribution V (covariance/correlation coefficient)	
10	Applications of Binomial Distributions – I	
11	Applications of Binomial Distributions - II	
12	Applications of Poisson Distributions.	
13	Applications of Normal Distributions.	
14	Application of Bernoulli Distribution	
15	Application of negative Binomial Distribution	

Reference Books:-

- 1) Géron, Aurélien. Hands-On Machine Learning with Scikit-Learn, Keras, TensorFlow. 3rd ed. Sebastopol, CA: O'Reilly Media, 2022.
- 2) Goon, A. M., M. K. Gupta, B. Dasgupta. Fundamentals of Statistics, Vols. I and II. Calcutta: World Press, 2016.
- 3) Agarwal, B. L. Basic Statistics. New Delhi: New Age International (P) Ltd., 2015.
- 4) Bishop, Christopher M. Pattern Recognition and Machine Learning. New York: Springer, 2006.
- 5) Walpole, Ronald E., Raymond H. Myers, Sharon L. Myers, Keying E. Ye. Probability & Statistics for Engineers & Scientists. 9th ed. Boston: Pearson, 2012.

Evaluation Pattern:**Total Marks: 50****Internal Evaluation (20 Marks):**

- Journal : 10 Marks
- Students' Performance: 05 Marks
- Viva: 05 Marks

Practical Exam Paper (30 Marks):

- Section I: Attempt any TWO questions (10 marks each)
- Section II: Attempt any TWO questions (05 marks each)