Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Lead College of Karmaveer Bhaurao Patil University

Bachelor of Science

Part - II

Artificial Intelligence (Entire)

Syllabus

to be implemented

w.e. f. June, 2024

NEP 2020

Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)
Department of Artificial Intelligence (Entire)

Syllabus for Bachelor of Science Part-II

1. **TITLE:** ARTIFICIAL INTELLIGENCE (ENTIRE)

2. **YEAR OF IMPLEMENTATION:** New Syllabi for the B.Sc. II ArtificialIntelligence (Entire) will be implemented from June 2024 onwards.

3. **PREAMBLE:**

Bachelor of Science is an integrated academic degree in the faculty of science. The revision of existing syllabus of Artificial Intelligence subject in Science Faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge. Intelligent machines have replaced human capabilities in many areas. Artificial intelligence is the intelligence exhibited by machines or software. It is the branch of computer science that emphasizes on creating intelligent machines that work and reacts like humans. This course is designed to span a wide variety of topics in computer science research, including machine learning, Game playing, Expert Systems etc.

4. **GENERAL OBJEVTIVES OF THE COURSE:**
   1) To undertake industry careers involving innovation and problem-solving using software and other information technologies.
   2) To undertake research careers in Computer Sciences and allied areas.
   3) To contribute to society by becoming a model professional who can communicate effectively and observes ethical behavior
   4) To inculcate the software development attitude and generate interest in the field of Technology.
   5) To develop programming skills, management skills, writing skills, Project Analysis skill among students.

5. **PROGRAM SPECIFIC OUTCOMES (PSO's):**
   1) Ability to contribute to problem identification, analysis, design, and development of systems using principles and concepts of Artificial Intelligence and Machine Learning.
   2) Apply the concepts and practical knowledge in analysis, design and development of computing systems and applications to multi-disciplinary problems.
   3) To provide a concrete foundation and enrich their abilities to qualify for Employment, Higher studies and Research in Artificial Intelligence and Data science with ethical values.
   4) Ability to use Artificial Intelligence and Machine Learning models on data for enabling better decision making.

6. **DURATION:**
   - The course shall be a full-time course.

7. **PATTERN:** Semester

8. **MEDIUM OF INSTRUCTION:** ENGLISH

Course Structure

Level	Sem	Subject - 1 Major				Subject - 2 Minor		Subject - 3 GE / OE		VSEC		AEC, VEC, IKS			OJT, FP, CEP, CC, RP					Total	Non - CGPA
		DSC		DSE						VSC	SEC	AEC	IKS	VEC	CC	FP	CEP	OJT /Int/App/ RT	RM		
		T	P	T	P	T	P	T	P												
5	III	4	4	---	---	2	2			2	2	4	---	2						22	
	IV	4	4	---	---	2	2			2	2	4	---		2					22	
5.5	V	4	2	4	2	---	---	---		4			---		2	2	2			22	
	VI	4	2	4	2	---	---	---		2					2	2		4		22	IIC
6	VII	8	2	8			---	---		---		---	---			---			4	22	
	VIII	8	2	8		---	---	---		---		---	---			---		4		22	
Total		40	20	24	4	12	8	12		10	6	8	2	4	8	4	2	8	4	176	
		88				20		12		16		14			26						

Course Structure for B.Sc. II (Semester- III)

Sr.no	Course Category	Course Code	Name of Course
1	Major -I	BAIT 231	Web Programming with AI
2	Major-II	BAIT 232	AI- Enhanced Software Engineering
3	Major Practical –I	BAIP 233	Lab I (Based on BAIT 231)
4	Major Practical-II	BAIP 234	Lab II (Based on BAIT 232)
5	Minor-I	BAIT 235	AI for Electronics Application Development
6	Minor Practical-I	BAIP 236	Lab I (Based on BAIT 235)
7	VSC	BAIPVSC I	Basics of MySQL
8	SEC	BAIPSEC II	OpenCV for AI Solutions
9	AEC	BAITAEC I	English I
10		BAITAEC II	English II
10	VEC	BAITVEC II	Artificial Intelligence for Environmental solutions

Course Structure for B.Sc. II (Semester- IV)

Sr.no	Course Category	Course Code	Name of Course
1	Major -I	BAIT 241	Algorithms in Artificial Intelligence
2	Major-II	BAIT 242	Object Oriented Programming for AI
3	Major Practical –I	BAIP 243	Lab III (Based on BAIT 241)
4	Major Practical-II	BAIP 244	Lab IV (Based on BAIT 242)
5	Minor-I	BAIT 245	AI Applications for Internet of things
6	Minor Practical-I	BAIP 246	Lab II (Based on BAIT 245)
7	VSC	BAIPVSC II	Desktop publishing
8	SEC	BAIPSEC III	Data analytics using R programming
9	AEC	BAITAEC III	English III
		BAITAEC IV	English IV
10	CC	BAITCC II	Case studies on AI for yoga application

Major Syllabus

B.Sc. II- Semester-III

Major Paper- I: BAIT 231: Web Programming With AI

Course Objectives: Students should be able to…

1. Analyze the skills and project-based experience needed for entry into web application and development careers.
2. Learn the key technology components are descriptive languages, server-side program elements and client-side program elements.
3. Use specific contents that are beneficial for developing web-based solutions

Credits= 2	**SEMESTER-III** **BAIT 231: Web Programming With AI**	**No. of hours per unit/ Credits**
Unit I	**Introduction to Web Development and AI**	**(8)**
	Overview of Web Programming: Understanding the fundamentals of web development – including client-side and server-side scripting languages – Introduction to Artificial Intelligence (AI): Definition, scope and applications of AI in various fields – Intersection of Web Development and AI: Exploring how AI technologies enhance web applications and user experiences – Tools and Technologies: Introduction to essential tools and technologies for web development and AI integration.	
Unit II	**Frontend Development and AI Integration**	**(8)**
	What is HTML: History, HTML Documents – Basic structure – Creating an HTML document – Features and Limitations – Mark up Tags – Heading-Paragraphs – Line Breaks – HTML Tags – Formatting tags, Introduction to elements of HTML – Working with Text. Working with Lists, Tables and Frames – Working with Hyperlinks – Images – Image format (quality, size, type, …) – Importing images (scanners) – Working with Forms and controls. Responsive Web Design: Techniques for creating web applications that adapt to different screen sizes and devices. – Introduction to AI Libraries and APIs: Overview of popular AI libraries and APIs for frontend integration.	
Unit III	**Introduction to Cascading Style Sheets**	**(8)**
	Concept of CSS – Creating Style Sheet, CSS Properties – CSS Styling (Background, Text Format, Controlling Fonts) – Working with block elements and objects – Working with Lists and Tables - CSS Id and Class Box Model (Introduction, Border properties, Padding Properties, Margin properties) – CSS Advanced (Grouping, Dimension, Display, Positioning – Floating, Align, Pseudo class – Navigation Bar – Image Sprites – Attribute sector) – CSS Color – Creating page Layout and Site Designs.	
Unit IV	**Introduction to Web Publishing, Multimedia and Hosting**	**(6)**
	Creating the Web Site – Saving the site Working on the web site – Creating web site structure – Creating Titles for web pages Themes - Publishing web sites – Inserting audio files – Video files and acceptable formats (MPEG, Quick Time – Video for Windows).	

	Inserting video files – Screen control attributes (WIDTH, HEIGHT, ALIGN) – Start control attributes (START, FILEOPEN, LOOP, LOOPDELAY, and MOUSEOVER) – Basic concepts of Images: Digital Images and Digital Image Representation – Image Formats: TIFF, BMP, JPG/JPEG, GIF, And PIC.PDF, Hosting Basics – Types of Hosting.	

Course Outcomes: Students will be able to…

1. Analyze the history and basic concepts of artificial intelligence.
2. Understand the fundamentals of web development including HTML, CSS, and JavaScript
3. Recognize the intersection and potential synergies between web programming and AI.
4. Familiar with various tools and frameworks used for integrating AI into web applications.

Reference Books:

1. AI for Web Development: Leverage the Power of Machine Learning and Deep Learning to Build Smart Web Applications" by Sandeep Kumar Patel (Year: 2019)

2. "Deep Learning for Web Developers: Leverage the Power of Deep Learning to Create and Deploy Neural Network-Driven Web Applications" by David Pine (Year: 2018)

3. "Building Intelligent Web Applications: How to Get Started with Artificial Intelligence-Driven Web Applications" by Mark Watson (Year: 2019)

4. "Web Development with Artificial Intelligence" by Ibrahim Naji (Year: 2020)

5. "Machine Learning for Web Developers: Leverage the Power of Machine Learning to Build Smart Web Applications" by Paul Campillo (Year: 2018)

B.Sc. I- Semester-III

Major Paper- II: BAIT 232: AI-Enhanced Software Engineering

Course Objectives: Students should be able to…

1. Learn concepts of Software Engineering Lifecycle models.
2. Analyze Software requirement specifications and the SRS documents.
3. Design and development solutions with proper analysis.

Credits=2	**SEMESTER-III** **Course II: BAIT 232: AI-Enhanced Software Engineering**	**No. of hours per unit/ credits (30)**
Unit I:	**Introduction to Software engineering**	**(8)**
	Introduction to Software Engineering - Software Development Life Cycle- Waterfall Model-Prototyping Model-Spiral Model-time boxing model Requirements Analysis and Specification-Problems without a SRS document-Decision Tree	
Unit II:	**System Design**	**(8)**
	Software Design-Software Design Strategies-Software Analysis & Design Tool- Structured Design-Object Modelling Using UML- Use Case Diagram-Class Diagrams-Deployment Diagram-Activity and State Chart Diagram	
Unit III:	**Project models**	**(8)**
	Software Project Planning, COCOMO Model, Staffing Level Estimation, Project Scheduling, Organization Structure, Risk Management, Computer Aided Software Engineering, Software Reuse.	
Unit IV:	**Testing and Maintenance**	**(6)**
	Definition- verification and validation-Types of testing: Black box and white box testing, Unit testing, integration testing-definition of maintenance, type of maintenance	

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. Analyse, read, understand and trace the execution of programs written in C language
4. Decompose a problem into functions and to develop modular reusable code.

Reference Books:

1. "Artificial Intelligence for Software Engineering: Methods, Tools, and Applications" by Xavier Franch, Jordi Marco, and Xavier Oriol (Publisher: Springer; Year: 2020)
2. "AI in Software Engineering" by Bart Selman and Tim Menzies (Publisher: Apress; Year: 2019)
3. "Software Engineering for AI-Driven Systems" by Jeff Tian and Barry Boehm (Publisher: CRC Press; Year: 2020)
4. "Machine Learning for Software Engineers" by Carl Haynes (Publisher: Packt Publishing; Year: 2019)
5. "Intelligent Software Engineering: Evolutionary Algorithms in Combination with Neural Networks" by Stefan Voß and Stephan Dempe (Publisher: Springer; Year: 2001)

Major Practical –I
BAIP 231: Lab based on BAIT 231

Course Objectives: Students should be able to…

1. Analyze the usability of development skills and website.
2. Create different kinds Web page using HTML.
3. Understand different tags in HTML.

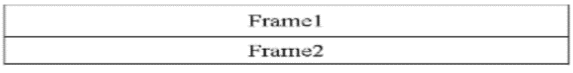
Credits=2	**SEMESTER-III** **Major Practical –I: Lab based on BAIT 231**	**No. of hours per unit/ Credits (60)**

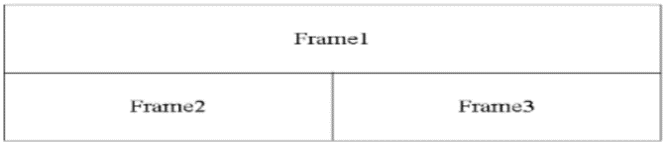
1. Create a simple HTML document with appropriate structure and markup tags.
2. Explain the basic features and limitations of HTML.
3. Create a basic HTML file.
4. Create an HTML document with the following formatting options:
   Bold, Italics, Underline, Headings (Using H1 to H6 heading styles), Font (Type, Size and Color) Background (Colored background/Image inbackground), Paragraph, Line Break, Horizontal Rule, Pretag.
5. Create an HTML document which consistsof: OrderedList, UnorderedList, Nested List, Image.
6. Create an HTML document which implements Internal linking as well as External linking.
7. Create a table using HTML which consists of columns for Roll
8. No., Student's name and grade.

Result		
Roll No.	Name	Grade

Result		
Roll No.	Name	Grade

9. Create a form using HTML which has the following types of controls: Text Box, Option/radiobuttons, Check boxes, Reset and Submit buttons
10. Create HTML documents (having multiple frames) in the following three formats:





	11. Create table displaying student's information and place photo of each student in a separate column. 12. Create a static webpage using table tags of HTML. 13. Create webpage to include image using HTML tag. 14. Create employee registration webpage using HTML form objects. 15. Design a web page, which shows your bio-data using CSS. 16. Design a web page using CSS Layers. 17. Create a web page for product advertisement using CSS. 18. Create a html program that import an External Cascading Style Sheet (CSS) whereas the style for the html program is defined in CSS file. 19. Create an external style sheet for creating a font family. 20. Design a web page by applying style sheet. [inline, embedded and linked]	

Course Outcomes: - Students will able to…

1. Apply various HTML tags on web page.
2. Create web pages using different controls.
3. Build usable forms and display data clearly using tables.
4. Design web pages using various types of CSS.

Reference Books:

1. "AI for Web Development Lab Exercises" by Sandeep Kumar Patel (Year: 2022)

2. "Deep Learning for Web Developers: Hands-On Labs" by David Pine (Year: 2023)

3. "Building Intelligent Web Applications: Lab Workbook" by Mark Watson (Year: 2024)

4. "Web Development with Artificial Intelligence: Practical Labs and Exercises" by Ibrahim Naji (Year: 2023)

5. "Machine Learning for Web Developers: Lab Manual" by Paul Campillo (Year: 2022)

Major Practical –II
BAIP 232: Lab based on BAIT 232

Course Objectives: Students should be able to…

1. To discuss and analyze how to develop software requirements specification for a given problem.
2. To implement various software designs, data flow diagram models
3. To implement various testing techniques including white box testing black box testing, regression testing.

Credits=2	**SEMESTER-III** **Major Practical II-Based on BAIT 232**	**No. of hours per unit/ credits (60)**
	1. Problem Analysis: study of the problem Identification. 2. Project Planning: study of the Project scope. 3. Project Planning: study of the Project Objectives and Infrastructure. 4. Identifying Domain Classes from the Problem Statements 5. Software Requirement Analysis: Preparation of Software Requirement Specification Document. 6. Data Dictionary: Use work products data dictionary. 7. Data Modeling: Develop E-R Models. 8. Data Modeling: Develop the Data Flow Diagram (DFD). 9. Software Designing: Develop use case diagrams. 10. Software Designing: Develop the activity diagrams. 11. Software Designing: Develop the class diagrams. 12. Software Designing: Develop the sequence diagrams. 13. Software Designing: Develop the Component Diagrams. 14. Software Designing: Develop the Deployment Diagram. 15. Describe various phases of a software project. 16. Testing: Develop test cases for various white box. 17. Testing: Develop test cases for various black box. 18. Estimation of Project Metrics 19. Estimation of Test Coverage Metrics and Structural Complexity 20. Designing Test Suites	

Course Outcome: Students will able to…

1. Ability to develop various structure and behavior UML diagrams.
2. Ability to identify the minimum requirements for the development of application.

3. Ability to develop, maintain efficient, reliable and cost effective software solution.

Reference Books:

1. Artificial Intelligence for Software Engineering Lab Workbook" by Xavier Franch, Jordi Marco, and Xavier Oriol (Year: 2022)

2. "AI in Software Engineering: Practical Lab Exercises" by Bart Selman and Tim Menzies (Year: 2023)

Minor Paper-I
BAIT 235: AI for Electronics Application Development

Course Objectives: - Students will be able to:

1. Understand AC sources, DC sources and their concept.
2. Learn the number systems and logic gates.
3. Gain knowledge on basic functioning of sensors and display devices.
4. Acquire the knowledge of MC's family.

Credits (2)	**SEMESTER-IV** **BAIT 235: AI for Electronics Application Development**	**No. of hours per unit/ credits (30)**
UNIT - I	**Electronics Circuits**	**(8)**
	Introduction, AC Sources, DC Sources, Concept of Single Phase and Three phase Power Supplies, Types of Electronic Components, Passive Components: Resistor, Capacitor, Inductor, Transformer. Active Components: Diode, Transistor. (Qualitative Idea) Ohm's Law.	
UNIT - II	**Digital E**lectronics	**(8)**
	Introduction, AC Sources, DC Sources, Concept of Single Phase and Three phase Power Supplies, Types of Electronic Components, Passive Components: Resistor, Capacitor, Inductor, Transformer. Active Components: Diode, Transistor. (Qualitative Idea) Ohm's Law.	
UNIT - III	**Unit III: Transducers and displays**	**(8)**
	Traducers-Classification, Potentiometer, Strain Guage, Piezoelectric Sensor, Linear Variable Differential Transformer (LVDT), Resistance temperature detectors (RTD), Thermocouples, Displays- LCD, Light Emitting Diode (including OLED) displays.	
UNIT - IV	**Unit IV: Introduction to MC's Family**	**(8)**

	Difference between Microprocessor and Microcontroller, Introduction of Microcontroller, 4 bit, 8 bit, 16 bit, 32 bit Microcontroller, Study of Families- 89C51, DS 5000, 89C51RD2, Architecture of 8051: Block Diagram of 8051 and Internal Blocks.	

Course Outcomes: Students should be able to:

1. Design the circuit using AC and DC Sources.
2. Design the Logic gates using Universal gates.
3. Use Sensors and Display in multiple Applications.
4. Describe the fundamental concepts of MC's Family.

Reference Books:

1. R. S. Sedha. (2012) A textbook of Applied Electronics: New Delhi. S Chand Publication.
2. B. L. Thereja. (2005) Basic Electronics Solid State: New Delhi, S. Chand & Company LTD.
3. M. Morris Mano. (2010) Digital System Design: Pearson Education Delhi.
4. H.C. Kalsi, McGraw Hill (2014) Electronic Instrumentation: New Delhi, 12th Edition.
5. Ramakant A. Gayakwad (2014) OP-AMP and Linear Integrated Circuits: Delhi, 4th Edition.
6. Muhammad A. Mazidi, J.G. Mazidi, R.D. Mckinlay (2017) The 8051 Microcontroller and Embedded Systems, 7th Edition.
7. Kenneth Ayala (2014) The 8051 Microcontroller, 3rd Edition.

Minor Practical-I
BAIP 236: AI for Electronics Application Development

Course Outcomes: Students will be able to**…**

1. Understand AC sources, DC sources and their concept.
2. Learn the number systems and logic gates.
3. Gain knowledge on basic functioning of sensors and display devices.
4. Acquire the knowledge of MC's family.

Credits (2)	**SEMESTER-IV** **BAIP 236: AI for Electronics Application Development**	**No. of hours per unit/ credits (60)**
	1. Study of Electronics components. 2. Study of CRO. 3. Verification of Ohm's law. 4. Study of I-V characteristics of PN junction Diode. 5. Study of Half wave Rectifier. 6. Study of Full wave Rectifier. 7. Design and study of 5v power supply. 8. Study of transistor as a switch. 9. Study of Logic Gates. 10. Basic gates using NAND gate. 11. Basic gates using NOR gate. 12. Study of CPU and I/O devices. 13. Study of various memory devices. 14. Study of Temperature Sensor using LM35. 15. Study of Piezoelectric senor. 16. Study of resistance temperature detector. 17. Study of strain gauge. 18. Study of Keil simulator. 19. Interfacing of LEDs with 8051 microcontroller 20. Interfacing of Liquid crystal display with 8051 microcontrollers	

Course Outcomes: Students should be able to:

1. Design the circuit using AC and DC Sources.
2. Design the Logic gates using Universal gates.
3. Use Sensors and Display in multiple Applications.
4. Describe the fundamental concepts of MC's Family.

Reference Books:

1. R. S. Sedha. (2012) A textbook of Applied Electronics: New Delhi. S Chand Publication.
2. B. L. Thereja. (2005) Basic Electronics Solid State: New Delhi, S. Chand & Company LTD.
3. M. Morris Mano. (2010) Digital System Design: Pearson Education Delhi.
4. H.C. Kalsi, McGraw Hill (2014) Electronic Instrumentation: New Delhi, 12th Edition.
5. Ramakant A. Gayakwad (2014) OP-AMP and Linear Integrated Circuits: Delhi, 4th Edition.
6. Muhammad A. Mazidi, J.G. Mazidi, R.D. Mckinlay (2017) The 8051 Microcontroller and Embedded Systems, 7th Edition.
7. Kenneth Ayala (2014) The 8051 Microcontroller, 3rd Edition.

B.Sc. II- Semester-III
BAIPVSC 1: Basic of MySQL

Course Objectives: Students should be able to…

1. Analyze the fundamental concepts of relational databases.
2. Understand how to insert, update, delete, and retrieve data from tables using SQL Commands.
3. Lean the basic principles of database design, including creating tables.

Credit=2	**SEMESTER-III** **Minor Practical I- BAIPVSC (Basic of MySQL)**	**No. of hours per unit/ credits (60)**
	1. Introduction to MySQL 2. E-R Model: Analyze the problem with the entities which identify data persisted in the database which contains entities, attributes. 3. Concept design with E-R Model: Apply cardinalities for each relationship, identify strong entities and weak entities for relationships like generalization, aggregation, specialization 4. Relation Model: Represent attributes as columns in tables and different types of attributes like Composite, Multivalued, and Derived. 5. CREATE TABLE in database using MySQL 6. SHOW TABLE in database using MySQL 7. ALTER TABLE in database using MySQL 8. DESCRIBE TABLE in database using MySQL 9. TRUNCATE TABLE in database using MySQL 10. DROP TABLE in database using MySQL 11. RENAME TABLE in database using MySQL 12. INSERT INTO in database using MySQL 13. UPDATE TABLE in database using MySQL 14. DELETE TABLE in database using MySQL 15. ADD COLUMNS and DELETE COLUMNS in database using MySQL 16. SHOW COLUMNS in database using MySQL 17. RENAME COLUMNS in database using MYsql 18. **.** Normalization 19. Querying Queries using ANY, ALL, IN, INTERSECT, UNION 20. Querying Using aggregate functions COUNT, SUM using GROUPBY and HAVING. TRIGGER	

Course Outcomes: - Students will be able to…

1. Create and Manage Databases
2. Perform basic data manipulation tasks such as inserting, updating, deleting, and querying data.
3. Competence in basic database administration tasks like backups, restores, and monitoring.
4. Familiar with SQL syntax.

Reference

1. “MySQL Cookbook" by Paul DuBois: This book provides a wide range of solutions for common MySQL problems 2017.
2. "Learning MySQL: Get a Handle on Your Data" by Seyed M.M. (Saied) Tahaghoghi and Hugh E. Williams:2018
3. "SQL Practice Problems: 57 beginning, intermediate, and advanced challenges for you to solve using a “learn-by-doing” approach" by Sylvia Moestl Vasilik:2019
4. “Online tutorials and courses”: Websites like Coursera, Udemy, and Codecademy offer MySQL courses with practical exercises 2018.
5. “Official MySQL Documentation”: MySQL's official documentation includes tutorials, guides, and examples to help you learn and understand MySQL 2018.

Minor Practical -II

B.Sc. II- Semester-III

BAIPSEC 2: OpenCV for AI Solution)

Course Objectives: Students should be able to…

1. Analyze the basics of computer vision and its applications in AI solutions.
2. Learn how to use OpenCV library for image and video processing.
3. Implement various image processing techniques such as filtering, edge detection, and morphological operations.
4. Explore feature detection and description methods for object detection and recognition.

Credits = 2	**BAIPSEC 2 OpenCV for AI Solutions**	**No. of hours per unit/credits (60)**
	1. Understanding the fundamentals of computer vision, Introduction and installation of the OpenCV library. **2.** Reading an image in OpenCV using Python. **3**. Load an image from disk and display it using OpenCV's imshow() function. **4.** Load an image and use OpenCV's imwrite() function. 5 Saving an Image using opencv. **6.** Program to use cv2.line() method **7.** Program to implement Arithmetic Operations on Images using OpenCV. **8**. Program to implement Bitwise Operations on Binary Images. **9.** Program to implement Image Blurring. **10**. Program to implement Grayscale Conversion. **12.** Program to Resizing an Image. **13.** Program to implement Rotating an Image. **14**. Program to Flip an image horizontally or vertically. **15**. Program to implement write text on an image using cv2.putText(). **16.** Program to apply Gaussian blur to an image. **17.** Program to Detect edges in the image using algorithms like Canny edge detector (cv2.Canny()). **18.** Program to perform 2D convolution on an image. 19. Program to Accessand Modifying pixel values using opencv.. **20.** Program tonconvert an RGB image to HSV image using opencv.	

Course Outcomes: Students will be able to…

1. Proficiency in using OpenCV library for various computer vision tasks.
2. Ability to implement image processing techniques for preprocessing and enhancing images.
3. Competence in feature detection and description for object recognition.
4. Understanding of advanced concepts like image segmentation and motion tracking.
5. Capability to integrate OpenCV with machine learning models for AI solutions.

Reference books:

1. "Learning OpenCV 4: Computer Vision with Python" by Joseph Howse, Joe Minichino, and Villemin
2. "OpenCV 4 for Secret Agents" by Joseph Howse:2015
3. "OpenCV Python Tutorial" - Official OpenCV documentation and tutorials:2015
4. "Hands-On Image Processing with Python" by Sandipan Dey:2016
5. Online courses on platforms like Coursera, Udemy, and edX offering OpenCV and computer vision courses with practical exercises.2019

Note: - For Semester III & Iv Ability Enhancement Course (AEC)of total 8 Credits will be prepared by English Department and approval will be taken from English BOS

BDSTVEC II: Artificial Intelligence for Environmental solutions

Course Objectives: - Student will be able to

1. Analyze the Sustainable development goals.
2. Understand the Role of Computer in creation of environmental issues.
3. Study the Environmental Laws.
4. Learn the Environmental Issues.

Credits=2	SEMESTER-III BDSTVEC II: Artificial Intelligence for Environmental solutions	No. of hours per unit / credits (30)
UNIT I	**Environmental Ecosystem**	**(8)**
	Introduction: Concept of an ecosystem - structure and functions of ecosystem; Components of ecosystem - producers, consumers, decomposers; Food chains, food webs, ecological pyramids, energy flow in ecosystem; Bio-geochemical cycles, hydrologic cycle	
UNIT II	**Environmental Pollution**	**(8)**
	Water, air, soil, noise, thermal and radioactive, marine pollution - sources, effects and engineering control strategies; Centralized and decentralized treatment system, Drinking water quality and standards, ambient air and noise standards	
UNIT III	**Global Environmental Issues And Its Management**	**(8)**
	Engineering aspects of climate change, concept of carbon credit, CO2 sequestration, concepts of environmental impact assessment and environmental audit, life cycle assessment	
UNIT IV	**Basics Of Energy and Its Conservation**	**(6)**
	Classification of energy sources, Global and national energy scenario, Fossil and alternate fuels and its characterization. General aspects of energy conservation and management; Energy conservation act, Energy policy of company	

Course Outcomes: - Student should be able to …

1. Analyze an Environmental issues
2. Understand how Environmental Laws and Ethics work are
3. Challenges in sustainable development of goals in Environmental Awareness of Artificial intelligence
4. Balancing environmental and socioeconomic needs

Reference Books: –

1. Gerardus Blokdyk, Environmental Awareness A Complete Guide, 5STARCooks, 4 July 2019
2. Wayne R. Ott, **Environmental Statistics and Data Analysis,** CRC Press Inc, 20 December 1994
3. Prof. Vyacheslav Kharchenko, Green IT Engineering: Social, Business and Industrial Applications, Springer, 11 October 2018

Major Syllabus
B.Sc. II-Semester IV
Major Paper-I: BAIT 241: Algorithms in Artificial Intelligence

Course Objectives: Students should be able to…
1. Understand the fundamental concepts of Artificial Intelligence and its various algorithms.
2. Develop skills in designing, analyzing, and implementing AI algorithms for problem-solving.
3. Explore advanced topics such as machine learning, natural language processing, and optimization in AI.

Credits (2)	**SEMESTER-IV BAIT 241: Algorithms in Artificial Intelligence**	**No. of hours per unit/ credits (30)**
UNIT - I	**Introduction to Algorithms in Artificial Intelligence**	**(8)**
	Definition and significance of algorithms in artificial intelligence, Basic components of an algorithm: input, output, control structures, Introduction to problem-solving techniques in AI: search, knowledge representation, reasoning, Overview of algorithm design paradigms: greedy algorithms, divide and conquer, dynamic programming, Introduction to algorithm analysis: time complexity, space complexity.	
UNIT - II	**Search Algorithms**	**(8)**
	Introduction to search algorithms: depth-first search, breadth-first search, Heuristic search techniques: A* search, hill climbing, simulated annealing, Overview of informed vs. uninformed search algorithms, Application of search algorithms in problem-solving: puzzle solving, pathfinding, optimization problems, Analysis of search algorithms: time and space complexity considerations.	
UNIT - III	**Programming in Logic (PROLOG)**	**(8)**
	Introduction To Prolog: Understanding the principles of logic programming, Syntax and Numeric Function, Contrasting Prolog with imperative programming languages, Syntax and structure of Prolog programs, Facts, rules, and queries, Variables, atoms, and predicates, working with lists in Prolog, writing recursive predicates, List manipulation and pattern matching, Conditional statements (if-then-else), Cut operator (!) and its implications, Control predicates (e.g., fail, not, once)	
UNIT - IV	**Expert systems**	**(6)**

	Introduction, basic concepts, structure, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, knowledge engineering, scope of knowledge, difficulties, in knowledge acquisition methods of knowledge acquisition, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty.	

Course Outcomes: Students will be able to…

1. Analyse problems suitable for AI solutions.
2. Understand designing and implementing AI algorithms using appropriate techniques.
3. Learn evaluating the performance of AI algorithms and selecting the most suitable ones for specific tasks.
4. Explore AI algorithms to various domains such as machine learning, natural language processing, and optimization.

Reference Books:

1. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig ,2015.
2. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy,2015.
3. "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper,2016
4. "Introduction to Evolutionary Computing" by A.E. Eiben and J.E. Smith, 2016.
5. "Swarm Intelligence" by Russell C. Eberhart and Yuhui Shi,2017
6. "Programming in Prolog: Using the ISO Standard" by William F. Clocksin and Christopher S. Mellish,2018.

Major Syllabus
B.sc II -Semester-IV
Major Paper-II BAIT 242: Object Oriented Programming for AI

Course Objectives: Students should be able to…

1. Understand of the history, features, and architecture of the Java programming language.
2. Familiar with the structure of Java programs and the compilation and execution process.
3. Explore knowledge on control structures such as branching and iterative statements in Java.

Credit (2)	**SEMESTER-IV** **Course-II: BAITCC 2: Object Oriented Programming for Ai**	**No. of hours per unit/credit (30)**
Unit I	**Introduction to Java Programming Language**	**(8)**
	History and features of Java, Java Virtual Machine (JVM), JDK tool, Structure of java program, compilation and execution of java program, Java keywords, Data types. Java variables- declaration and assigning values to variables (using assignment statement and Scanner class object), scope of variables, Type casting- Implicit and Explicit casting, Operators of java, Control structures of java Branching statements- If, if …. else, if …else if and switch statement, Iterative statements- for loop, do… while, while loop, for each loop, jumping statements-break and continue statement	
Unit II	**Introduction to Object Oriented Concepts in java**	**(8)**
	Introduction: Classes, Objects and methods, defining a class, field declaration, method declaration, accessing class members, access specifies in java, Static variables and methods, Method overloading, Constructor- types of constructors, constructor overloading, Use of this keyword, Garbage collection finalize (), wrapper classes, Array, types of array, array of object Collection-Iterator interface, List interface, Array List class, Linked List class, Vector class and Stack class.	
Unit III	**Inheritance, packages and interfaces**	**(8)**
	Inheritance- definition, syntax, types of inheritance, Method overriding, use of super keyword, difference between method overloading and overriding, Dynamic method dispatch, Abstract class and method, use of final keyword, Interface- defining and implementing interface, implementation of multiple inheritance using Interface, difference between abstract class and interface. PackagesJava API package, Defining and accessing user defined package	
Unit IV	**Exception Handling and Multithreading**	**(6)**
	Concept of exception, difference between error and exception, Types of exceptions-checked and unchecked, Exception handling using try and catch block, Multiple catch block, finally block, throws keyword, User defined exception, Concept of multithreading in java, Difference between process and thread, Creating thread by extending Thread class and by implementing Runnable interface, Life cycle of thread, Thread class methods- start (), run(), yield(), suspend() ,resume(), sleep(), wait(), notify(),stop(), Thread synchronization	

Course Outcomes: Students will be able to…

1. Understand of exception handling mechanisms and multithreading concepts in Java.
2. Analyze to design and implement object-oriented solutions to programming problems.
3. learn utilizing Java API packages and user-defined packages.
4. Explore handling exceptions and managing multithreaded applications in Java.

Reference Books:

1. "Head First Java" by Kathy Sierra and Bert Bates, 2016.
2. "Java: The Complete Reference" by Herbert Schildt, 2017.
3. "Core Java Volume I – Fundamentals" by Cay S. Horstmann, 2018.
4. "Effective Java" by Joshua Bloch, 2018.
5. "Java Concurrency in Practice" by Brian Goetz et al, 2018.

B.sc II -Semester-IV
Major Practical-I
BAIP 243: Algorithms in Artificial Intelligence

Course Objectives: Students should be able to…

1. Analyse fundamental problem-solving techniques and algorithms.
2. Familiar with different problem domains and their corresponding algorithms.
3. Develop ability to design and implement algorithms using a programming language.
4. Enhance critical thinking and logical reasoning skills through problem-solving exercises.

Credits (2)	**SEMESTER-IV** **BAIP 243: Algorithms in Artificial Intelligence**	**No. of hours per unit/ credits (60)**
	1. Write a Program to Implement Breadth First Search using Python. 2. Write a Program to Implement Depth First Search using Python. 3. Write a Program to Implement Tic-Tac-Toe game using Python. 4. Write a Program to Implement 8-Puzzle problem using Python. 5. Write a Program to Implement Water-Jug problem using Python. 6. Write a Program to Implement Travelling Salesman Problem using Python. 7. Write a Program to Implement Tower of Hanoi using Python. 8. Write a Program to Implement Monkey Banana Problem using Python. 9. Write a Program to Implement Alpha-Beta Pruning using Python. 10. Write a Program to Implement 8-Queens Problem using Python. 11. Write a prolog program to find the maximum of two numbers. 12. Write a prolog program to calculate the factorial of a given number. 13. Create a Prolog program to calculate the sum of elements in a list. 14. Write a Prolog program to check if a given number is even or odd. 15. Develop a Prolog program that takes input from the user and outputs whether the input is a prime number or not. 16. Implement a Prolog program to find the nth Fibonacci number using recursion.	

	17. Create a Prolog program to store and retrieve information about students using property lists. 18. Simulate arrays in Prolog by implementing operations like accessing an element at a specific index, updating an element, and iterating over the array. 19. Write Prolog programs to implement various sorting algorithms such as bubble sort, insertion sort, or merge sort. 20. Develop Prolog programs to perform searches like linear search or binary search on lists or arrays.	

Course Outcomes: - Students will able to…

1. Understand and apply basic problem-solving strategies such as divide and conquer, greedy algorithms,
2. and dynamic programming.
3. Implement various search and traversal algorithms such as breadth-first search, depth-first search, and binary search.
4. Develop algorithms for solving classic problems such as sorting, graph traversal, and pathfinding.
5. Analyse the time and space complexity of algorithms to evaluate their efficiency and performance.

Reference Books:

1. AI Algorithms Lab: Hands-On Exercises in Artificial Intelligence" by John Smith (Year: 2023)
2. "Practical AI Algorithms: Lab Workbook for Artificial Intelligence" by Emily Brown (Year: 2022)
3. "Artificial Intelligence Algorithms Lab Manual" by Michael Johnson (Year: 2024)
4. "Hands-On AI Algorithms: Lab Exercises for Artificial Intelligence Practitioners" by Sarah Thompson (Year: 2021)
5. "AI Algorithms in Practice: Lab Activities for Artificial Intelligence Engineers" by Daniel Lee (Year: 2020)

B.sc II -Semester-IV
Major Practical-II
BAIT 242: Object Oriented Programming for AI

Course Objectives: Students should be able to…

1. Gain a foundational understanding of Java programming language.
2. Learn about fundamental programming concepts such as variables, data types, and control structures in Java.
3. Develop proficiency in object-oriented programming principles in Java.
4. Analyse handling exceptions and performing input/output operations in Java

Credits (2)	BAIT 242: Object Oriented Programming for AI	No. of hours per unit/credits (60)
	1. Installation of Java. 2. Program on typecasting. 1. Program to implement multiple if-else. 2. Program to implement for loop. 3. Program to implement while loop 4. Program on class, objects, field and method. 5. Program on method overloading. 6. Program on Constructor and constructor overloading. 7. Program to create Array. 8. Program on Collection. 9. Program on single interitance. 10. Program on multilevel interitance. 11. Program on hierarchical interitance. 12. Program on method overloading. 13. Program on method overriding. 14. Program on abstraction. 15. Program on Packages. 16. Program on abstract class. 17. Program on interface. 18. Program on Exception Handling and user defined exception. 19. Program on multithreading. 20. Implement programs using collection class-LinkedList.	

Course Outcomes: Students will be able to…

1. Demonstrate proficiency in Java programming language.
2. Apply object-oriented programming principles effectively in Java.
3. Develop solutions to basic programming problems using Java.
4. Implement error handling mechanisms in Java programs.

Reference books:

1. "Head First Java" by Kathy Sierra and Bert Bates: A beginner-friendly introduction to Java programming ,2018.
2. "Effective Java" by Joshua Bloch: Learn best practices and advanced techniques for Java programming,2018.
3. "Java: A Beginner's Guide" by Herbert Schildt: Comprehensive coverage of Java programming concepts for beginners,2019.
4. Online tutorials and courses: Platforms like Codecademy, Udemy, and Coursera offer Java programming courses with practical exercises ,2020.

Minor Paper-I

BAIT 245: AI applications for Internet of things

Course Objectives: - Students should be able to…

1. Gain knowledge on basic functioning of Arduino.
2. Study the wireless network and web server.
3. Analyse the knowledge regarding Applications of Arduino.
4. Learn Fundamental concepts of IoT.

Credits (2)	**SEMESTER-IV** **BAIT 245: AI applications for Internet of things**	**No. of hours per unit/ credits (30)**
UNIT - I	**Basics of Arduino**	**(8)**
	Overview of Arduino, Arduino Board description, Types of Arduino, Installing the Arduino IDE, C Programming for Arduino, Variables, data types, and operators.	
UNIT - II	**Wireless Networking**	**(8)**
	Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server: Introduction, Installation, configuration, Posting sensors(s) data to web server. Interfacing ESP8266 with Web Server, Cloud	
UNIT - III	**Interfacing with Arduino: Case Study**	**(8)**
	Interfacing of Temperature, Humidity, Motion, Light and Gas sensor with Arduino, Interfacing of Actuators with Arduino, Interfacing of LED, Relay switch LCD, and DC motor with Arduino, etc.	
UNIT - IV	**Developing of IoT**	**(8)**
	Introduction of Internet of things (IoT), Overview of IOT, IOT architecture, IOT protocols, Applications of IOT- Consumer, Manufacturing, Environmental, Healthcare, Education applications.	

Course Outcomes: Students will be able to…

1. Design the different program using Arduino.
2. Describe and demonstrate the wireless networks.
3. Analyze the various applications using different sensors with Arduino.
4. Describe the fundamental concepts of IoT.

Reference Books:

1. Michel Margolis, Arduino Cookbook, 2nd Edition
2. Massimo Banzi, Getting Started with Arduino.
3. Ryan Turner, 2020, Arduino Programming, N.B.L. International
4. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: a Hands On Approach".
5. Sudip Misra, 2021, Anandarup Mukherjee, Introduction to IoT, 3rd Edition.
6. Rappaport, Wireless Communications, 2nd Edition

Minor Practical-I

BAIP 245: AI applications for Internet of things

Course Objectives: - Students should be able to…

1. Gain knowledge on basic functioning of Arduino.
2. Study the wireless network and web server.
3. Understand the knowledge regarding Applications of Arduino.
4. Learn Fundamental concepts of IoT.

Credits (2)	**SEMESTER-IV** **BAIP 245: AI applications for Internet of things**	**No. of hours per unit/ credits (60)**
	21. Study of Arduino IDE and Arduino Boards 22. Programming Arduino to blink LED 23. Analog Input Sketch (Bar Graph with LEDs and Potentiometer) 24. Programming Arduino Pulse Width Modulation 25. LCD interfacing with Arduino. 26. Motion Sensor interfacing with Arduino. 27. Relay interfacing with Arduino. 28. Dc motor interfacing with Arduino. 29. PIR sensor module interfacing with Arduino 30. RF transceiver module interfacing with Arduino 31. Temperature sensor module interfacing with Arduino 32. Pressure sensor module interfacing with Arduino 33. Gas sensor module interfacing with Arduino 34. Bluetooth module interfacing with Arduino 35. GSM module interfacing with Arduino 36. WiFi module interfacing with Arduino 37. Interfacing Arduino with Cloud (Thingspeak API) 38. Device control through the android app. 39. Demonstration on IOT Architecture. 40. Home appliances control by using Arduino.	

Course Outcomes: Students will be able to…

1. Design the different program using Arduino.
2. Demonstrate the wireless networks.
3. Analyze the various applications using different sensors with Arduino.
4. Learn the fundamental concepts of IoT.

Reference Books:

1. Michel Margolis, Arduino Cookbook, 2nd Edition
2. Massimo Banzi, Getting Started with Arduino.
3. Ryan Turner, 2020, Arduino Programming, N.B.L. International
4. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: a Hands On Approach".
5. Sudip Misra, 2021, Anandarup Mukherjee, Introduction to IoT, 3rd Edition.
6. Rappaport, Wireless Communications, 2nd Edition

Vocational Skill Course

BAIPVSC 2: Desktop Publishing

Course Objectives: Students should be able to…

1. Develop and applying Principals for photoshop.
2. Gain deep knowledge of Adobe photoshop cs2.
3. Analyse the fundamental concepts of photo editing.
4. Understand equipment functions and library resources related to the study of photoshop.

Credits (2)	**SEMESTER-IV** **Vocational Skill Course (VSC): Desktop Publishing**	**No. of hours per unit/credits (60)**
	1. Draw the elements of design: (line, shape, etc.) 2. Draw the elements of design (Forms, space) 3. Use multiple Shades of colours. 4. Browse the image in Adobe Photoshop. 5. Resize the image in Adobe Photoshop. 6. Perform the properties of image in photoshop. 7. Redesign an existing image. 8. Design the logo. 9. Drawing and sketching the image and logo. 10. Sketching of natural and manmade objects and environment. 11. Sketching of representational Drawing. 12. Draw the image. 13. Use color Correction property on images. 14. Add the Text property in Adobe photoshop. 15. Browse the image and use effects in Adobe photoshop. 16. Draw the shapes using pen tool. 17. Add the text using text tool and on it. 18. Add effect on text. 19. Adding transitions in Adobe photoshop. 20. Add the customizing transitions in Adobe photoshop.	

Course Outcomes: Students will be able to…

1. Understand and demonstrate in between drawing and execution with squash and stretch, staging, arc, principle.
2. Create organize content and sequences for photo editing.
3. Demonstrate a thorough understanding of the elements of photoshop design.

Reference Books:

1. Art and Design in Photoshop, Routledge; 1st edition (6 October 2008)
2. Adobe Photoshop, V&S Publishers; Latest Revised Edition (29 January 2013)
3. Photoshop CS6 in Simple Steps, Dream tech Press (1 January 2012)

Skill Enhanced Course

BAIPSEC 3: Data Analytics using R Programming

Course Objectives: Students should be able to…

5. Learn the fundamental concepts of programming with R.
6. Understand data structures in R and their manipulation.
7. Gain proficiency in data import and export using R.
8. Analyse basic data visualization techniques in R.

Credits (2)	**BAIPSEC 3: Data Analytics using R Programming**	**No. of hours per unit/credits (60)**
	1. Program to create Vector using R. **2.** Program to implement Arithmetic operator using R. **3**. Program to implement logical operator using R. **4.** Program to create Barplot, Histogram using R. **5.** Program to create ogive curve using R **6.** Program to create frequency polygon, pie chart using R. **7.** Program to create Matrix. **8**. Program to create Array. **9.** Program to create list. **10**. Program to create data frame. **11.** Program to add/delete/merge in a data frame. **12.** Program to read csv file using R. **13**. Program to import data from excel. **14**. Program to create function. **15**. Program to implement If condition using R. **16.** Program to implement if-else condition using R. **17.** Program to implement multiple if-else. **18.** Program to implement for loop. **19.** Program to implement while loop. **20.** Statistical analysis using R	

Course Outcomes: Students will be able to…

1. Demonstrate proficiency in programming in the R language.
2. Manipulate and analyze data effectively using R.
3. Create data visualizations for exploratory analysis and presentation.
4. Apply statistical methods and machine learning algorithms using R for data analysis tasks.

Reference Books:

1. "R for Data Science" by Hadley Wickham and Garrett Grolemund: This book provides a comprehensive introduction to data science using R, 2016
2. "Advanced R" by Hadley Wickham: A guide to advanced programming techniques in R ,2017.
3. "ggplot2: Elegant Graphics for Data Analysis" by Hadley Wickham: Learn how to create beautiful and informative visualizations using ggplot2 ,2017.
4. "Text Mining with R: A Tidy Approach" by Julia Silge and David Robinson: Explore text mining and NLP techniques using R ,2018.
5. Online tutorials and courses: Websites like Coursera, Udemy, and DataCamp offer R programming courses with practical exercises ,2019.

Note: - For Semester III & Iv Ability Enhancement Course (AEC)of total 8 Credits will be prepared by English Department and approval will be taken from English BOS.

BAITCC 2: CASE STUDY ON AI FOR YOGA APPLICATION

Course Objectives: Students should be able to…

1. Develop an AI-powered yoga app for personalized pose recommendations.
2. Implement real-time posture detection and feedback using computer vision.
3. Analyze user data to track progress and provide tailored recommendations.
4. Evaluate user engagement and satisfaction with the AI-enhanced yoga experience.

Credit =2	**SEMESTER-IV** **BAITCC 2: Case Study on AI for Yoga Application**	**No. of hours per unit/credit**
Unit I	**Fundamentals of Yoga Practice**	**(8)**
	History and philosophy of yoga, Basic yoga postures (asanas) and sequences, breathing techniques (pranayama) and meditation practices, Breathing techniques (pranayama) and meditation practices Mindfulness and the mind-body connection in yoga	
Unit II	**Integrating AI in Yoga Applications**	**(8)**
	Personalized yoga routines based on user preferences and goals, Real-time feedback and posture correction using computer vision technology, AI-powered progress tracking and performance analytics, Design considerations for AI-enhanced yoga applications	
Unit III	**Ethical and Social Implications**	**(8)**
	Privacy concerns and data security in AI-powered wellness apps, Equity and accessibility considerations in technology-driven yoga practice, Balancing technology with the traditional wisdom of yoga	
Unit IV	**Future Trends and Opportunities**	**(6)**
	Emerging technologies and trends in AI for yoga and wellness Potential for AI-driven innovations in personalized coaching, virtual reality, and augmented reality, Career pathways and opportunities in the intersection of AI and yoga technology	

Course Outcomes: Students will be able to…

1.Create personalized guidance
2.Enhance Real-time feedback corrects alignment,
3.Improves technique, and reduces the risk of injury.
4.Increased Interactive features and personalized recommendations

Reference books:

1. "Personalized Yoga Pose Recommendation System Using Machine Learning Techniques" by Rujuta Joshi,Nikhil Raj, and Pooja Baraskar. (International Research Journal of Engineering and Technology, 2021)
2. "Real-time Posture Detection and Correction System for Yoga Practitioners" by Rekha Harish, S. M. Ramesh,
3. and Roshan James. (International Journal of Advanced Trends in Computer Science and Engineering, 2020)
4. "YogaPoseNet: A Deep Learning-Based System for Real-time Yoga Posture Recognition and Feedback" by Harsimran Singh, Abhinav Dhall, and Roland Goecke. (2019 IEEE Winter Conference on Applications of Computer Vision)
5. "AI-driven personalized yoga posture correction system" by R. Nivedita, P. Rathi, and A. Banerjee. (2020 International Conference on Communication and Signal Processing)
6. "AI-based Mobile Application for Yoga Posture Recognition and Correction" by Kartik Arora, Prathamesh Nalavade, and Shilpi Bhattacharya. (2020 International Conference on Intelligent Sustainable Systems)