Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
(An Autonomous Institute)

Board of Studies: Artificial Intelligence and Data Science

Syllabus: Final Year (B. Tech) Artificial Intelligence and Data Science 2023 Pattern w.e.f 2026-2027
(As per NEP 2020)

Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
Board of Studies: Artificial Intelligence and Data Science
Syllabus: Final Year (B. Tech) Artificial Intelligence and Data Science 2023 Pattern w.e.f 2026-2027

SEMESTER-VII																
Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
PCC	AI23401PR	Internship/On job Training	-	24	-	100	-	-	100	-	150	350	-	12	-	12
HSS	HS23401TH	Software Project Management	3	-	-	30	-	70	-	-	-	100	3	-	-	4
HSS	HS23401TUT	Software Project Management	-	-	1	-	-	-	-	-	30	30	-	-	1	
PCC	AI23402 TH	Research Methodology and IPR	3	-	-	30	-	70	-	-	-	100	3	-	-	4
PCC	AI23402 TUT	Research Methodology and IPR	-	-	1	-	-	-	-	-	30	30	-	-	1	
HSS	HS23404TH	Public Speaking and Aptitude	1	-	-	40	-	-	-	-	-	40	1	-	-	2
HSS	HS23404TUT	Public Speaking and Aptitude	-	-	1	-	-	-	-	-	30	30	-	-	1	
	Total		7	24	3	200	-	140	100	-	240	680	7	12	3	22

28/03/2026

Mr.P.N. Shendage
Academic Coordinator

Dr.C.S. Kulkarni
Head of Department

Dr.S.M. Bhosale
Dean Academics

Dr.A.H. Kolekar
Controller of Examination

Dr. S. B. Lande
Principal

VPKBIET BARAMATI
Affiliated to S.P.P.U: Pune Id No./PU/PN/Engg./152/2000
PUNE (MS.)

SEMESTER-VIII																
Course Type	Course Code	Course Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	CAA	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
PCC	AI 23411TH	Deep Learning	3	-	-	10	30	60	-	-	-	100	3	-	-	4
PCC	AI 23411PR	Deep Learning	-	2	-	-	-	-	-	30	-	30	-	1	-	
PEC-IV	AI23412XTH	Programme Elective IV Course	3	-	-	10	30	60	-	-	-	100	3	-	-	4
PEC-IV	AI23412XPR	Programme Elective IV Course	-	2	-	-	-	-	-	-	30	30	-	1	-	
PEC-V	AI23413XTH	Programme Elective V Course	2	-	-	10	-	60	-	-	-	70	2	-	-	3
PEC-V	AI23413XPR	Programme Elective V Course	-	2	-	-	-	-	-	-	30	30	-	1	-	
PROJ	AI23414PR	Project	-	8	-	-	-	-	80	-	50	130	-	4	-	4
MDM	MD23XXXTH	Multi-disciplinary minor	2	-	-	20	20	50	-	-	-	90	2	-	-	3
MDM	MD23XXXPR	Multi-disciplinary minor	-	2	-	-	-	-	20	-	-	20	-	1	-	
OE	OE230XXTH	Open Electives	2	-	-	-	-	50	-	-	-	50	2	-	-	2
	Total		12	16	-	50	80	280	100	30	110	650	12	8	-	20

Programme Elective List:

Programme Elective IV Course		Programme Elective V Course	
AI23412A	Predictive Analytics using Big Data	AI 23413A	Agentic AI
AI 23412B	Intelligent Web Accessibility	AI 23413B	AI for Software Prototyping
AI 23412C	Smart Social Media Analytics	AI 23413C	Applied AI for Industry 4.0

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PUNE (M.S.)

SEMSTER -VII

Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
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AI23401- INTERNSHIP

Teaching Scheme:	Credits: 12	Examination Scheme:
Practical: 24 Hours/Week	**Practical : 12**	**CAA:**100 **TW :**100 **OR:** 150 Marks

Prerequisites: Students should have successfully completed **Semester VI** of the Engineering program.

Course Objectives:

- To learn and practice hands-on technical skills.
- To provide opportunities for acquiring, comprehending, and refining practical technical proficiencies.
- To gain exposure to professional industrial practices and environments.
- To understand how real-world factors like cost, society, and management affect a company.
- To cultivate ethical principles aligned with professional and societal standards.

Course Outcomes:

CO 1. Understand how people in the industry approach and solve problems. CO
2. Learn how to write clear and effective technical reports.
CO 3. Work effectively and professionally as part of a team.
CO 4. Learn to pick the right tools and technology to solve a given problem. CO
CO 5. Demonstrate abilities of a responsible professional and use ethical practices in day-to-day life.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or Entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry.

Internship work identification process should be initiated in the VI semester in coordination with training and placement cell/ industry institute cell. This will help students to start their internship work on time.

Student can take internship work in the form of the following but not limited to:

1. Working for consultancy/ research project,
2. Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
3. Learning at Departmental Lab/ Institutional workshop,
4. Development of new product/ Business Plan/ registration of start-up,
5. Industry / Government Organization Internship,
6. Internship through Internshala,
7. In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
8. Research internship under professors, IISC, IIT's, Research organizations,
9. NGOs or Social Internships, rural internship,
10. Participate in open source development.

Duration:
Internship is to be completed after semester 6 and before commencement of semester 8 of at least 14 to 20 weeks; and it is to be assessed and evaluated in semester 7.

Guidelines for students

1. All B.Tech students are required to undergo an internship for a minimum duration of **14–16 weeks**. Students must **obtain a Final Year - Bonafide Certificate through the college office**, which is **mandatory** for commencing the internship.
2. Student must submit application form with all documents and Undertaking forms to department IIIC Coordinator through mentor
3. Students can take mini projects, assignments, case studies by discussing it with concerned authority from industry and can work on it during internship.
4. All students should compulsorily follow the rules and regulations as laid by industry.
5. Every student should take prior permissions from concerned industrial authority if they want to use any drawings, photographs or any other document from industry.
6. Student should follow all ethical practices and SOP of industry.
7. Students have to take necessary health and safety precautions as laid by the industry.
8. Student should contact his /her academic guide from college on weekly basis to communicate the progress.
9. Each student has to prepare internship report in consultation with the academic guide.

Internship Diary / Internship Workbook

1. Students must maintain a daily diary **in the format prescribed by the college**, documenting observations, tasks performed, information gathered, and any suggestions.
2. The diary should include relevant sketches, drawings, or diagrams based on daily observations.
3. The industry supervisor or section in-charge must **verify and sign the diary every week**.
4. Students must present the diary to the **Faculty Mentor during each industry visit** for verification and ratification.
5. Upon completion of the internship, students must submit the following to the Institute:
    - Student's Daily Diary (as per college format)
    - Internship Report
    - Attendance Record
    - Evaluation Sheet duly signed and stamped by the industry
6. The diary will be evaluated based on **regularity of entries, completeness, and adherence to the prescribed format**.

Internship Report

1. Students must prepare a **comprehensive internship report** in the **format prescribed by the department**, covering observations, tasks performed, and key learning outcomes.
2. Students may consult the **Industry Supervisor** and **Faculty Mentor** to obtain specific topics or problem statements to be included in the report.
3. Students should use the **daily diary** as a reference while preparing the report, as it already contains detailed information recorded during the internship.
4. The completed report must be **signed by the Industry Supervisor and Faculty Mentor** before submission to the department.

5. The internship report will be evaluated based on the following criteria:
    - Originality of content
    - Adequacy and purposefulness of the write-up
    - Organization, formatting, quality of sketches/drawings, writing style, and language
    - Variety and relevance of the learning experiences documented
    - Linkage of practical applications with theoretical concepts learned in coursework

Evaluation Guidelines:

Every student is required to prepare and maintain documentary proofs of the activities done by him/her as internship diary or as workbook. The evaluation of these activities will be done by Department IIIC Coordinator / faculty mentor or Industry Supervisor/Appointed External Examiner based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities. Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.)

Component	Marks
A. Continuous Assessment Activity	100
B. Term-Work (Internship Report)	100
C. Oral Examination / Viva	150
TOTAL	350

1. **Continuous Assessment (100 Marks):** Evaluation includes attendance, discipline, workplace behavior, and the quality of the learning diary or logbook. Mid-semester progress presentations and structured industry supervisor feedback form an integral part of the continuous review process.
2. **Term-Work (150 Marks):** Assessment covers the structure and completeness of the internship report, technical depth, problem-solving ability, and reflection on skills developed. Supporting evidence—drawings, screenshots, certificates, and attendance records—is verified, along with a plagiarism check to ensure originality.
3. **Oral Examination / Viva (150 Marks):** Evaluation focuses on understanding of tasks performed, application of engineering concepts, clarity of communication, industry relevance, and the ability to respond logically during interaction with examiners. Joint assessment by internal and external examiners ensures transparency and fairness.

Internship Evaluation Scheme (Total: 350 Marks)

Component	Marks	Evaluation Basis	Mode of Assessment / Evaluator
A. Continuous Assessment (50 Marks)			
Attendance, Discipline & Professionalism	20	Regularity, punctuality, adherence to workplace culture	Attendance record + Industry Supervisor note
Diary / Logbook	20	Weekly reflection of tasks, learning outcomes, challenges	Logbook review by Faculty Mentor
Mid-Semester Progress Presentation	20	Presentation on tasks performed, tools/technologies learned, contributions	Faculty review (in consultation with Industry Supervisor)
Industry Supervisor Feedback	40	Attitude, initiative, teamwork, professional conduct	Structured feedback form
Subtotal (A)	**100**		
B. Term-Work (Internship Report)- (100 Marks)			
Internship Report (Structure & Completeness)	20	Cover page, acknowledgement, organization profile, objectives, methodology, tasks, outcomes, conclusion	Faculty Panel Evaluation
Technical Content & Problem Solving	30	Depth of technical work, relevance to discipline, engineering application	Faculty Panel
Skill Development Reflection	20	Technical/professional skills, tools learned, employability skills (NEP focus)	Faculty Panel
Evidence & Annexures	15	Screenshots, codes, drawings, certificates, datasheets, attendance logs	Faculty Panel
Plagiarism / Originality	15	Minimum 80% originality; no copy-paste	Plagiarism check + Faculty review
Subtotal (B)	**100**		
C. Presentation & Oral Examination / Viva (100 Marks)			
Understanding of Work Done	30	Explanation of tasks performed, process understanding, technical depth	Internal + External Examiners
Application of Knowledge	30	Linkage with curriculum, application of engineering concepts	Viva Panel
Soft Skills & Communication	30	Presentation skills, clarity, professional conduct	Viva Panel
Industry Relevance & Employability	30	Awareness of industry practices, teamwork, adaptability	Viva Panel (Industry input)
Q&A Interaction	30	Logical reasoning and accuracy of responses	Viva Panel
Subtotal (C)	**150**		
Total A+B+C	**350**		

Feedback from internship supervisor

Post internship, faculty coordinator/Mentor should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership

References:

1. https://internship.aicte-india.org/
2. Circular No. 29-2024 Internship Cell- BOD Link_15022024.pdf
3. https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

Vidya Pratishthan's
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HS23401 : Software Project Management

Teaching Scheme:	**Credit: 04**	**Examination Scheme:**
TH: 03 Hours/Week	TH Credit :03	CAA:30 Marks
TUT:01 Hour/Week	Oral Credit :01	ESE:70 Marks
		OR :30 Marks

Prerequisite: Students are expected to have a good understanding of Software Engineering

Course Objective:

- To understand the fundamentals of Software Project Management
- To investigate software project planning and management tools
- To learn software project scheduling and tracking
- To discuss about the agile project management
- To know people management in software project

Course Outcomes:

1. Comprehend Project Management Concepts
2. Use various tools of Software Project Management
3. Schedule various activities in software projects
4. Track a project and manage changes
5. Apply Agile Project Management
6. Analyse staffing process for team building and decision making in Software Projects and Management

Course Activity:

The course coordinator should identify relative and innovative activities for course activity. Below are some suggested course activity for course coordinator

1. Mini Project
2. Survey on uses of software project management with emerging technology presentation
3. Industry Visit
4. Seminar
5. Research Paper in software project management

Course Contents

Mapping of Course Outcomes for Unit I	**CO1**	
UNIT I	**Introduction to Software Project Management**	**07 Hours**

Project Definition, Project versus Flow type work, Project Lifecycle, Processes and Knowledge Areas in Project Management (PM), Build or Buy decision, Work Breakdown Structure (WBS) and its types, Introduction to PMBOK, Program and Portfolio Management. Case Studies: Analysis of a project using project management concepts

Mapping of Course Outcomes for Unit II	**CO2**	
UNIT II	**Project Planning and Project Management Tools**	**07 Hours**

Project Planning: Steps for Project Planning, PERT and Gantt Charts, Gantt Project, Microsoft Project and Primavera Project Management Software, Objectives of Activity planning, Project Schedules, Activities,

Sequencing and Scheduling, Network Planning Models, Formulating Network Model. Case Studies: Create software project plan using any tool.

Mapping of Course Outcomes for Unit III	CO3

UNIT III	Activity Based Scheduling	07 Hours

Introduction, Objectives of Activity Planning, Project Schedules: Activities: Sequencing and Scheduling, Network Planning Models, Formulating Network Model, Activity relationships (FS, SF, SS, FF), Forward Pass and Backward Pass techniques, Critical Path concept and remedies. Case Studies: Apply the critical path technique to the project

Mapping of Course Outcomes for Unit IV	CO4

UNIT IV	Software Project Monitoring and Control	07Hours

Introduction, Collection of Project data, visualizing progress, Cost monitoring, Earned Value Analysis, Project tracking, Change Control, Software Configuration Management, Managing contracts, Contract Management. Case
Studies: Analyze the effect of a major requirement change on the schedule.

Mapping of Course Outcomes for Unit V	CO5

UNIT V	Agile Project Management	07 Hours

Predictive versus Empirical Management, Comparison between Non-Agile and Agile Project, three stages of Agile Project, Estimation, Scope Management, Roles and Responsibilities, Scheduling and Tracking.
Case Studies: Analyze the same project using Agile. Create the three stages of the project.

Mapping of Course Outcomes for Unit VI	CO6

UNIT VI	Staffing in Software Projects	07 Hours

Managing People, Organizational behavior, Best methods of Staff Selection, Motivation, The Oldham, Hackman job characteristic Model, Stress, Health and Safety, Ethical and Professional concerns, working in Teams, Decision Making, Organizational structures, Dispersed and Virtual Teams, Communications Genres, Communication Plans. Case Studies: Analyze a case study for a distributed team and comment.

Books and Other Resources

Text Books:

1. Bob Hughes, Mike Cotterell and Rajib Mall, Software Project Management, Sixth Edition, Tata McGraw Hill, New Delhi, 2017
2. Robert K. Wysocki, Effective Software Project Management, Wiley Publication, 2011

Reference Books:

1. Ken Schwaber, Agile Project Management, Microsoft Press, 2004
2. Walker Royce, Software Project Management, Addison-Wesley, 1998
3. Jalote Pankaj, Software Project Management in Practice, Addison-Wesley Professional, 2002
4. PMBOK Guide

E Books:

1. https://www.konve-online.net/ITIL/McgrawHill.Software_Project_Management_2nd_Edition.pdf
2. http://library.lo/main/B96E3B1223262FBD62C6FDB35A5E978422

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AI23402: Research Methodology and IPR

Credits:04(03 (Theory) and 01 (Tutorial))

Teaching Scheme:	**Examination Scheme:**
	CAA : 30 Marks
Theory: 03 Hours /week	ISE : -----
Tutorial: 01 Hours /week	ESE : 70 Marks
	OR : 30 Marks

Prerequisites: Project based learning of all subjects, Fundamental laws and principles of all subjects, Soft and communication skills.

Course Objectives:

1. The course has been developed with orientation towards research related activities and recognizing the ensuing knowledge as property.
2. It will create consciousness for Intellectual Property Rights and its constituents.
3. Learners will be able to perform documentation and administrative procedures relating to IPR in India as well as abroad.

Course Outcomes:

On completion of the course, the students will be able to:
1. Formulate a research problem for engineering and technology domain.
2. Analyze the available literature for given research problem and understand different techniques of data collection.
3. Investigate the statistical and reliability methods of preliminary data analysis and present the results in graphical form.
4. Understand the importance of technical writing and presentation skills.
5. Comprehend the various forms of the intellectual property, its relevance and business impact in the changing global business environment.
6. Realize the importance of patents, trademark and copyright and follow research ethics.

Course Contents

Unit 1: Introduction

Introduction, Meaning of research, Objectives of research, Types of research, Research approaches, Significance of research, Research methods versus methodology, Research and scientific method, Research process, Criteria of good research, Problems encountered in India for good research, Formulation of research hypotheses, Search for causation, Format for research proposal, Funding for the proposal, Different funding agencies, Framework for the planning.

Unit 2: Literature Review

Definition of literature and literature survey, Significance of literature survey, Sources of literature, Elements and objectives of literature survey, Styles of literature survey, Strategies of literature survey, Searching the existing literature, Reviewing the selected literature, Writing about the literature reviewed and gap identified, literature analysis, data collection, and interpretation.

Unit 3: Preliminary Data Analysis

Testing of hypothesis- concepts and testing, Review of theory of reliability, Hazard models, System reliability. Data presentation skills, Features of statistical analysis, Histogram, bar charts, Pie charts, 2D & 3D plots, Interpolation & extrapolation techniques, Curve fitting.

Unit 4 Technical Writing and Presentation

Effective technical writing, thesis writing, research proposal writing, research paper writing. Significance of report writing, Different steps in writing report, Layout of the research report, Types of reports, Mechanics of writing a research report, Precautions for writing research reports, Presentation skills, tools for technical writing and presentation. Plagiarism, avoiding plagiarism, Research ethics, Tools for plagiarism checking, technical writing and presentation.

Unit 5: Intellectual Property Rights

Introduction and significance of intellectual property rights, Types of Intellectual Property Rights, Copyright and its significance, Introduction to patents and its filing, Introduction to patent drafting, Best practices in national and international patent filing, Copyrightable work examples**.**

Unit 6: Patent Rights

Patents and its basics, Patentable items, Designs, Process of filing patent at national and international level, Process of patenting and development, Technological research and patents, innovation, Patent and copyright international intellectual property, Procedure for grants of patents, Need of specifications, Types of patent applications, Provisional and complete specification, Patent specifications and its contents, Trade and copyright

Books

Text books:

1. Ranjit Kumar (2005), 2nd edition, Research Methodology: A Step by Step Guide for beginners (Pearson Education).
2. C. K. Kothari (2004), 2nd edition, Research Methodology Methods & Techniques (New Age International, New Delhi).
3. T. Ramappa (2016), 2nd edition, Intellectual Property Rights-Law in India (Asia Law House, Hyderbad).

Reference Books:

1. Louis Cohen, Manion, Morrison and Routledge (2017), 8th edition, Research Methods in Education (Taylor & Francis Group- Cambridge University Press India Pvt. Ltd.).
2. John Best and James Kahn (1998), 8th edition, Research in Education (Prentice Hall of India Pvt. Ltd.).
3. Stuart Melville and Wayne Goddard (2001), Research Methodology: An Introduction for Science and Engineering Students. (Juta & Co Ltd.).
4. Benjamine Niebel and Alan Draper (1974), Product Design and Process Engineering, (McGraw Hill International Publishers).
5. Halbert D. J. (2007), 2nd edition, Resisting Intellectual Property (Taylor and Francis Ltd.).
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley (2016), Intellectual Property in New Technological Age (Stanford Public Law Working Paper No. 2780190, Elsevier Publishers).

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AI23402: Research Methodology and IPR

Credits: 01 (Tutorial)

Teaching Scheme:	**Examination Scheme:**
Tutorial: 01 hrs. /week	OR: 30 Marks

Project work Stage – I is an integral part of the Project work. In this, the student shall complete the partial work of the Project which will consist of problem statement, literature review, SRS, Model and Design. The student is expected to complete the project at least up to the design phase. As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic. The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute. The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.

The term work should consists of following and the oral examination is conducted based on following assignments.

1. **Literature Review:** Collect the existing literatures on any research idea in engineering/technology and find out the research gap**. (Performed in a group of students of not more than three).**
2. **Report and Seminar Presentation:** Prepare the research proposal based on the earlier identified research gap (Report should check in plagiarism and grammarly) and present the idea. **(Performed in a group of students of not more than three).**
3. **Blank format of research proposal:** Identify the national and international funding agencies and prepare/print the blank format of research proposal of any one funding agency. **(Performed in a group of students of not more than three).**
4. Write a report on different citation style and reference style adopted by different publishers.
5. Write a report on case study of any existing patent/copy right/trademark.
6. Collect the information of any one referred peer reviewed journal and write a report based on Abstracting and indexing, H Index, SJR rating, Impact factor, Aims and Scope of the Journal, Guidelines for paper submission etc.

CAA: Project Topic Topic Identification and Literature review of B.Tech project is expected to be done during the VIIth semester.

1) Project Selection:

- The project topic should be relevant to the Artificial Intelligence & Data Science branch.
- It should aim to solve a real-life problem or improve an existing system.
- Prefer innovative, industry-relevant or research-oriented topics.
- Avoid projects that are purely theoretical or copied from previous work.
- The project should be feasible within the available time, resources, and budget.
- Students must consult the guide regularly and report progress.
- The guide will approve the topic, methodology, and progress of the project

2) Project Planning Students should follow a structured project plan, including:

- Problem identification
- Literature review
- Objective formulation
- Methodology or design approach
- Experimentation / simulation / fabrication
- Data collection and analysis
- Result interpretation A timeline or Gantt chart should be prepared for proper planning.

3) Literature Review:

- Students are expected to study research papers, journals, patents, and books related to the topic.
- Identify research gaps or improvement areas.
- Use authentic/credible sources such as journals, conference papers, and technical reports.

4) Presentation of Project Work:

- Project Topic Identification Presentation
- Project Progress Presentation-I Online Project Topic Identification Presentation (if students are not present in the department due to internship) & Project Progress Presentation-I is to be taken in VIIth semester, in which student groups will present their problem statement along with literature review related to the topic.
- Students can prepare and submit a review paper to a reputed journal/conference based on the literature review completed.
- Project activities in VIIth semester are to be executed in conjunction with the other courses such as Research Methodology (Termwork) and Internship.

Participation Activities: Students are expected to submit a review/research paper to a reputed journal/conference, and are encouraged to file a Patent or Copyright based on their research.

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HS23404:Public Speaking and Aptitude

Teaching Scheme		**Examination Scheme**
Theory: 1 Hour/ Week Tutorial: 1 Hour/ Week	**Credits: 02**	CAA: 40 Marks OR : 30 Marks

Course Objectives:

1. To develop effective public speaking styles through conversational and communication skills and also enhance speaking skills by focusing on body language and understanding the situational requirements for effective public speaking
2. To develop students' quantitative, logical and analytical abilities required to solve aptitude-based problems commonly encountered in competitive examinations and also enhance their problem-solving speed, decision-making ability and logical reasoning skills

Course Outcomes: On the completion of the course, students will be able to:

1. Communicate effectively in various public speaking situations and deliver organised and engaging speeches with appropriate body language, voice modulation and confident speech techniques
2. Apply appropriate quantitative, logical, and reasoning strategies to efficiently solve numerical aptitude, data interpretation, and logical reasoning problems with improved speed and accuracy in placement and competitive examination contexts and apply rapid analytical, logical and decision-making strategies to solve time-bound problems with improved accuracy and efficiency

Course Contents:

Unit 1: Essentials and Art of Public Speaking (6 Hours)

Sentence Mastery (Sentence Structure + Subject–Verb Agreement), Verb Tense Control (Past / Present / Future Tenses), Functional Usage (Prepositions + Common Errors & Correct Usage), Verbal & Non-Verbal Communication, Active Listening Skills, Public Speaking & Presentation Skills, Confidence Building, Interpersonal Skills & Relationship Building, Teamwork & Collaboration, Body Language & First Impression, Professional Email, Message & Business Writing, Time Management & Prioritization, Interview Skills & Group Discussion, Workplace Etiquette & Professional Behavior, Emotional Intelligence & Anxiety Control, Stress Management & Work-Life Balance, LinkedIn Profile & Resume Writing, Mock Interviews & Feedback

Unit 2: Quantitative Aptitude (6 Hrs)

Number System, Percentages, Ratio & Proportion, Profit, Loss & Discount, Averages, Time, Speed & Distance, Time & Work + Pipes, Simple & Compound Interest (Basic), Data Interpretation (DI), Data Sufficiency, Seating Arrangement (Linear & Circular), Blood Relations, Coding–Decoding, Syllogisms, Statement–Assumption / Argument

Textbooks & Other Resources:

1. King, Dale. Effective Communication Skills: The Nine-Keys Guidebook for Developing the Art of Persuasion through Public Speaking, Social Intelligence, Verbal Dexterity, Charisma, and Eloquence, Hamatea Publishing Studio, 2020
2. King, Patrick. How to Speak Effectively: Master Communication Skills, Public Speaking and Influence | Improve Conversations, Confidence, and Social and Professional Presentations, and Making an Impact on People, Penguin, 2024
3. Tuhovsky, Tuhovsky. *Communication Skills: A Practical Guide to Improving Your Social Intelligence, Presentation, Persuasion and Public Speaking: 9 (Positive Psychology Coaching),* Createspace Independent Publishing, 2015
4. Aggarwal. R.S., Quantitative Aptitude for Competitive Examinations, S Chand and Company Ltd. 2025

SEMSTER -VIII

Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
(Autonomous Institute)

AI23411- Deep Learning

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hour/Week**	**Credits** **04**	**Examination Scheme:** **CAA:10 Marks** **ISE: 30 Marks** **ESE: 60 Marks** **PR: 30 Marks**

Prerequisites: Neural Network, Machine Learning

Course Objectives:

- Understand fundamentals of deep learning, hyperparameters, and optimization techniques.
- Learn the structure of deep neural networks, activation functions, and loss functions.
- Study convolutional neural networks and transfer learning techniques.
- Understand RNNs, LSTM, GRU, attention mechanisms, and transformer models.
- Learn generative models such as autoencoders and GANs.
- Explore real-world applications of deep learning models.

Course Outcomes (COs): The students will be able to:

CO1: Explain fundamental concepts and optimization methods in deep learning.
CO2: Apply deep neural networks with suitable activation and loss functions.
CO3: Implement CNN models and transfer learning for image-based tasks.
CO4: Apply RNN, LSTM, GRU, and transformer models for sequence data.
CO5: Analyze generative models such as autoencoders and GANs.
CO6: Apply deep learning techniques to real-world applications.

Course Contents

Unit I: Fundamentals of Deep Learning (06 Hours)
Definition, history of deep learning, advantages and challenges, difference between machine learning and deep learning, working of deep learning, applications of deep learning. **Hyperparameters:** manual Search (Trial and Error), grid search, regularization, cost functions, error back propagation, Random Search, Bayesian Optimization, Hyperband, Population based training (PBT), Optimization **algorithms:** gradient descent, SGD (Stochastic Gradient Descent), mini batch SGD, SGD with momentum, AdaGrad, RMSProp, Adam Optimizer.

Unit II: Deep Neural Networks (DNNs) (06 Hours)
Concept of neural networks, biological vs artificial neurons, **Activation functions:** Sigmoid, Tanh, ReLU, Leaky ReLU, Parametric ReLU, Soft plus GELU, Swish, Mish, Softmax, **Loss functions:** loss function notation, loss functions for regression, classification, and reconstruction.

Unit III: Convolution Neural Network (CNN) (07 Hours)
Introduction, convolution operation, padding and stride, pooling layers, architecture, challenges, applications, **CNN Architectures:** Inception, ResNet, EfficientNet, MobileNet, YOLO, U-Net. **Transfer Learning:** Introduction, Types of Transfer Learning.

Unit IV: Advanced Recurrent Neural Networks and Attention-Based Models (07 Hours)
Recurrent Neural Networks (RNNs): Unfolding graphs, backpropagation through time (BPTT), vanishing/exploding gradients. **Advanced RNNs:** Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), bidirectional RNNs. **Modern Architectures:** attention mechanisms, transformer models (BERT, GPT basics).

Unit V: Generative Models and Advanced Deep Learning Techniques (07 Hours)
Autoencoders: Basic architecture of auto encoders, encoder–decoder structure, reconstruction loss denoising autoencoders, Sparse autoencoders, under complete autoencoders, applications in feature learning and dimensionality reduction. **Generative Adversarial Networks (GANs):** Introduction, architecture, discriminator network, generator network, types of GAN, DCGAN, VAEs (Variational Autoencoders). **Advanced Techniques:** Self-supervised learning, Reinforcement Learning basics, Deep Belief Networks.

Unit VI: Case Studies and Real-World Applications of Deep Learning (07 Hours)

Convolutional Neural Networks (CNN) for image classification, facial recognition, and medical image analysis; **Long Short-Term Memory (LSTM)** and **Gated Recurrent Units (GRU)** for speech recognition, language modeling, and sentiment analysis tasks, Transformer-based architectures, machine translation, intelligent chatbots, and conversational AI systems, **Generative Adversarial Networks (GANs)** for image generation, deepfake detection, data augmentation, and creative AI applications, **Real-time industry applications**: autonomous driving systems, recommendation systems, healthcare diagnosis using medical imaging, financial fraud detection, and smart surveillance systems.

Text Books:

1. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, 2016.
2. Deep Learning with Python, François Chollet, Manning Publications, 2018.
3. Hands-On Machine Learning with Scikit-Learn Keras and TensorFlow, Aurélien Géron, O'Reilly Media, 2019.
4. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer, 2018.

Reference Books:

1. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, 2016.
2. Deep Learning with Python, François Chollet, Manning Publications, 2018.
3. Hands-On Machine Learning with Scikit-Learn Keras and TensorFlow, Aurélien Géron, O'Reilly Media, 2019.
4. Deep Learning for Computer Vision, Adrian Rosebrock, PyImageSearch Publications, 2020.
5. Natural Language Processing with Transformers, Lewis Tunstall, Leandro von Werra, and Thomas Wolf, O'Reilly Media, 2022.

E-Resources:

1. http://csis.pace.edu/ctappert/cs855-18fall/DeepLearningPractitionersApproach.pdf
2. https://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-1col-dkrieselcom.pdf

MOOCs:

1. Deep Learning- Part 1, IIT Madras: https://nptel.ac.in/courses/106106184
2. Deep Learning Specialization: https://www.coursera.org/specializations/deep-learning

List of Assignments (Perform any 10 Assignments)

1. Develop a Deep Neural Network (DNN) to classify daily physical activities using wearable sensor data. Compare model performance with different activation functions and optimizers. Dataset:HAR70+ Dataset :- https://archive.ics.uci.edu/dataset/780/har70
2. Design a 1D CNN model to detect abnormal heart rhythms from ECG signals. Dataset (UCI): Arrhythmia Dataset : https://archive.ics.uci.edu/ml/datasets/Arrhythmia
3. Build a Multiclass classifier using the CNN model. Use MNIST or any other suitable dataset. a. Perform Data Pre-processing b. Define Model and perform training c. Evaluate Results using confusion matrix.
4. Design and implement a CNN for Image Classification a) Select a suitable image classification dataset (medical imaging, agricultural, etc.). b) Optimized with different hyper-parameters including learning rate, filter size, no. of layers, optimizers, dropouts, etc.
5. Design and implement a Recurrent Neural Network (RNN) model to predict future values in a time-series dataset by learning temporal patterns from historical data. Dataset: Daily Minimum Temperatures Dataset: UCI /Kaggle.
6. Build an LSTM-based model to predict future human activity from sequential sensor signals. Dataset: HARTH Dataset https://archive.ics.uci.edu/dataset/779/harth
7. Design and implement a Long Short-Term Memory (LSTM) based deep learning model to generate meaningful text sequences by learning patterns from a large collection of text documents. Train the model on a text corpus and generate new sentences based on the learned language structure. Dataset: WikiText Language Modeling Dataset https://paperswithcode.com/dataset/wikitext-2
8. Implement a GRU-based deep learning model to classify sequential movement patterns and compare its performance with LSTM. Dataset: Human Activity Recognition Using

Smartphones:https://archive.ics.uci.edu/ml/datasets/Human+Activity+Recognition+Using+Smart phones

9. Design a Transformer model for time-series classification to identify physical activities from wearable sensor data and compare with RNN-based models. Dataset: HARTH Dataset https://archive.ics.uci.edu/dataset/779/harth
10. Develop a Generative Adversarial Network (GAN) to generate realistic synthetic sensor signals to augment training datasets.Dataset:HAR70+ Dataset https://archive.ics.uci.edu/dataset/780/har70
11. Design and implement Deep Convolutional GAN to generate images of faces and a set of given images. Dataset: MNIST Handwritten Digits : https://yann.lecun.com/exdb/mnist/
12. Design a CNN-LSTM model to detect fall events from wearable accelerometer data for elderly healthcare monitoring. Dataset: HAR70+ Dataset https://archive.ics.uci.edu/dataset/780/har70

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Elective – IV :AI23412A- Predictive Big Data Analytics

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hours/Week**	**Credits** **04**	**Examination Scheme:** **CAA:10 Marks** **ISE: 30 Marks** **ESE: 60 Marks** **OR: 30 Marks**

Prerequisites: • Basics of Data Science, Python Programming, Probability and Statistics ,Introduction to Machine Learning

Course Objectives:

- To understand the fundamentals of big data and predictive analytics.
- To learn various predictive modeling techniques.
- To implement scalable machine learning algorithms using big data frameworks.
- To analyze and visualize big data using suitable tools and technologies.
- To learn Model Evaluation, Tuning, Robustness, Deployment
- To analyze real-world predictive analytics problems

Course Outcomes (COs): The students will be able to:

CO1: Understand and apply key concepts of big data and predictive analytics.
CO2: Use machine learning techniques for prediction on large datasets.
CO3: Apply big data frameworks (like Hadoop, Spark) for predictive modeling.
CO4: Evaluate and optimize predictive models.
CO5: Visualize data and results using appropriate tools.
CO6: Solve real-world predictive analytics problems.

Course Contents

Unit I: Foundations of Predictive Analytics & Big Data (06 Hours)

Overview: predictive vs descriptive vs prescriptive analytics, Architectural patterns: Lambda, Kappa, batch vs streaming,Data pipelines, ingestion, storage , Review of statistical foundations (distributions, estimators, bias-variance trade -off, hypothesis testing).

Unit II: Data Preprocessing, Feature Engineering & Representation (06 Hours)

Big Data preprocessing,Data cleaning at large scale,Handling Missing Data (Distributed Systems) ,Handling Imbalanced Big Data,Feature, Extraction in Big Data Context Feature selection, dimensionality reduction in Big Data, Feature interaction, polynomial features, Regularization in Big Data Models, Representational learning for big data (word2vec, graph embeddings)

Unit III: Predictive Data Analytics Models (06 Hour)

Types of Predictive Analytical Models,Additive Models, Predictive Algorithms, Trees, and Boosting: Generalized additive models, graph model in predictive data analytics,Big Data Graph Processing Frameworks,Numerical Optimization Examples (Spam data, California housing, New Zealand fish, Demographic data).

Unit IV: Big Data Frameworks & Distributed Machine Learning (06 Hour)

Apache Mahout Mahout Architecture,Machine Learning Algorithms in Mahout,MLlib, Distributed optimization: SGD, mini-batch, parameter server, ADMM, Spark pipelines, MLlib extensions, other frameworks: Flink, Beam, Dask, Real-time / streaming predictive analytics (Spark Streaming, Structured Streaming, Kafka integration), GPU / cluster acceleration (TensorFlow on clusters, distributed deep learning).

Unit V: Model Evaluation, Tuning, Robustness, Deployment (06 Hours)

Hyperparameter optimization: grid search, random search, Bayesian optimization, bandit strategies, Model interpretability & explainability (SHAP, LIME, partial dependence), Adversarial robustness, drift detection, monitoring, Model deployment: APIs, microservices, containers, deployment

orchestration, MLOps concepts: versioning, pipelines, monitoring, retraining.

Unit VI: Advanced Topics, Case Studies & Research Frontiers (06 Hours)

Applications: Precision in medicine with the scope of big data analytics, financial risk, recommender systems, big data approaches in manufacturing , (BDPA) and Artificial Intelligence (AI) are transforming Supply Chain Risk Management (SCRM), Privacy, fairness, ethics in predictive systems, Recent research directions: AutoML, meta-learning, federated learning, continual learning.

Text Books:

1. Siegel, Eric. *Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die*. 2nd ed. Hoboken, NJ: Wiley, 2016

2. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The elements of statistical learning: Data mining, inference, and prediction* (2nd ed.). Springer.

3. Damji, J. S., Wenig, B., Das, T., & Lee, D. (2020). *Learning Spark: Lightning-fast data analytics* (2nd ed.). O'Reilly Media.

4.BIG DATA ANALYTICS: Introduction to Hadoop, Spark, and Machine-Learning,Raj Kamal,Preeti Saxena McGraw-Hill Education, 2019 ISBN 9353164974, 9789353164973

Reference Books:

1. EMC Education Services, "Data Science and Big Data Analytics - Discovering, analyzing, visualizing and Presenting Data" 1st Edition Phil Hanna, JSP : Complete Reference, TATA McGraw-Hill Company
2. DT Editorial Services, "Big Data, Black Book", DT Editorial Services, ISBN: 9789351197577, 2016 Edition.
3. Géron, A. (2022). *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems* (3rd ed.). O'Reilly MediaWes

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ma46/preview
2. https://nptel.ac.in/courses/106104189
3. https://onlinecourses.nptel.ac.in/noc26_cs09/preview

List of Assignments (Any 10)

1. Design a distributed preprocessing pipeline to clean and transform large-scale telecom or transactional datasets for predictive modeling.
Tasks:
a. Data Loading using Spark
b. Data Preprocessing
c. Feature Engineering
d. Model Building
e. Performance Evaluation (RMSE / Accuracy / F1-score)
f. Scalability Analysis
Dataset Links:
https://archive.ics.uci.edu/ml/datasets/Individual+household+electric+power+consumption

2. Build a Scalable Predictive Maintenance System for Smart Agriculture using Big Data Analytics

3.Consider finance application The raw dataset contains customer demographics, financial history, and loan information. Effective feature engineering is required to improve model performance.

4. Build a classification model to predict disease presence.

Example datasets:Diabetes dataset, Heart disease dataset

5.A telecom company experiences customer churn when users switch to competitors. Predicting which customers are likely to churn helps the company retain them.

a Train a Random Forest classifier.

b.Train a Gradient Boosting model.

c. Implement XGBoost.

d. Compare prediction accuracy

6. Scalable Traffic Pattern Analysis and Anomaly Detection in Web Server Logs using Apache Mahout

7. A financial institution processes thousands of transactions per second. Real-time analytics is required to detect potentially fraudulent transactions Apache Mahout.

8. An online retailer wants to recommend products to customers. Multiple predictive models are tested, and the best model must be selected through proper evaluation and tuning.

9. A manufacturing company wants to reduce machine downtime by predicting equipment failures using sensor data.

a. Analyze sensor dataset.

b. Perform feature engineering.

c. Train predictive models to detect failures.

d. Visualize results and evaluate performance.

10. A predictive analytics project must determine whether automated machine learning can outperform manually designed models

a.Train models manually using Scikit-learn.

b Apply AutoML on the same dataset.

c.Compare performance metrics.

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Elective – IV : AI23412B– Intelligent Web Accessibility

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hours/Week**	**Credits 04**	**Examination Scheme:** **CAA:10 Marks** **ISE: 30 Marks** **ESE: 60 Marks** **OR: 30 Marks**

Prerequisites: Introduction to Web Development with AI

Course Objectives:

- Explain the fundamental concepts, principles, and standards (WCAG) of web accessibility.
- Analyze the role of AI techniques in improving web accessibility and inclusive design.
- Apply AI-powered tools to identify and resolve accessibility issues in web applications.
- Design and develop accessible web components compatible with assistive technologies.
- Implement and integrate accessibility testing within the web development lifecycle.
- Evaluate real-world web applications through accessibility audits and case studies.

Course Outcomes (COs): The students will be able to:

CO1: Analyze web accessibility requirements based on WCAG principles and user needs.
CO2: Use AI-based tools to identify and fix accessibility issues in web interfaces.
CO3: Apply accessibility principles in designing accessible web pages.
CO4: Analyze visual design issues related to contrast, typography, and layout in web interfaces.
CO5: Design UI components compatible with assistive technologies.
CO6: Evaluate and conduct accessibility audits of web applications using AI-assisted and manual testing methods.

Course Contents

Unit I: Introduction to Web Accessibility (6 Hours)

Web accessibility: Introduction, Types of disabilities and how users interact with the web, Introduction to WCAG principles (POUR: Perceivable, Operable, Understandable, Robust),Accessibility tree, Introduction to inclusive design principles,Accessibility Fundamentals -HTML, ARIA, UX basics, Overview of assistive technologies (screen readers, keyboard navigation, voice input)**Introduction to AI applications in accessibility**: AI in web development, , AI in content adaptation (e.g., auto-captions, alt text generation),Ethics and limitations of AI in accessibility

Unit II: Exploring AI-Powered Accessibility Tools (6 Hours)

Overview of popular AI accessibility tools: **Design and Prototyping Tools**:Importance of accessibility in UI/UX design,Inclusive design principles- Stark (Figma), Able; **Code-Level Accessibility Tools:**Writing accessible code,Introduction to accessibility linting tools- eslint-plugin-jsx-a11y. ;**Automated Accessibility Testing Tools**:Introduction to automated accessibility testing**.** axe DevTools, Lighthouse, WAVE, Accessibility Insights; **AI overlays:** Concept of AI-based accessibility overlays-to EqualWeb, UserWay, Benefits and limitations of AI overlay tools.Continuous accessibility testing,Accessibility in CI/CD pipelines

Unit III: Designing with Accessibility (6 Hours)

Accessibility in design: Introduction Accessibility vs. usability vs. inclusive design; Principles of Accessible Design,Introduction to semantic HTML and ARIA roles,Designing for keyboard navigation, screen readers, and color contrast, Role of AI tools in real-time during design,Best practices for images, videos, and forms ;JavaScript accessibility: modals, focus management, dynamic content, Accessibility in frameworks (React, Vue, plain HTML/JS),) Accessible Navigation, Accessible Forms, ARIA landmarks,Focus indicators

Unit IV: Visual Design and Contrast with AI Feedback(6 Hours)

Importance of Visual Accessibility in Web Design,, Types of Visual Impairments,Auto-generated accessibility insights during design, Designing for visual impairments (color blindness, low vision),Color contrast ratios and typography best practices,Visual Hierarchy and Accessibility,AI tools for real-time feedback on contrast Responsive and Adaptive Visual DesignMetrics for Visual Accessibility, **AI tools :** Figma plugins (e.g., Able, Stark, A11y Annotation Kit), Color contrast analyzers with AI hints.

Unit V: Designing for Assistive Technologies (6 Hours)

Role of Assistive Technologies (AT) in Inclusive Design,Assistive Technologies (AT):Introduction,Types of AT:Screen readers (e.g., NVDA, VoiceOver),Screen magnifiers,Alternative input (switch devices, eye-tracking, voice input),Speech-to-text and text-to-speech,Overview of WCAG & POUR principles in the context of AT,Cognitive accessibility Accessible multimedia design.

Unit VI: Accessibility Testing: Automated + Manual 6 Hours

WCAG Conformance Levels in Testing,Types of Accessibility Testing Accessibility Testing in Software Development Life Cycle (SDLC)Limits of automated tools, Complementing AI with manual testing, Accessibility scoring and reporting, Manual vs automated testing: pros, limits, when to use both,Automated Accessibility Testing Tools, Role of ARIA in Testing, Metrics for Accessibility Evaluation,Limitations of Accessibility Scores

Text Books:

1. AI Web Development: Smart Website Creation Guide | Build 8 AI-Powered Websites | Including Recommendation Systems by Emily Dawson-2025
2. Artificial Intelligence for Web Development: Enhance Websites with AI Features and Automation by Francis McCaffery -2025
3. AI-assisted Programming for Web and Machine Learning: Leveraging AI for smarter coding practices and development environments-Dr Muralidhar Kurni , Ramesh Krishnamaneni , Dr Srinivasa K G-2025

Reference Book:

1. Generative AI for Web Development: Building Web Applications Powered by OpenAI APIs and Next.js, Paperback 2024 by Emma Saroyan , Tom Auger
2. AI-Powered Web Development: Integrate Machine Learning Features into Your Websites Paperback – 2025 by Booker Blunt

Web Link:

https://www.w3.org/WAI/standards-guidelines/wcag/

Recommended Tools:

Browser Extensions: axe DevTools, WAVE, Accessibility Insights
Websites for testing: WebAIM, WCAG Quick Reference
Free AI tools: UserWay widget, Google Lighthouse, Microsoft tools
Optional: Screen reader simulation (NVDA, VoiceOver demo)
AI Testing Tools: axe DevTools, Microsoft Accessibility Insights, Google Lighthouse, WAVE,
Libraries: axe-core (JS), react-aria, react-a11y, eslint-plugin-jsx-a11y
IDE Extensions: VS Code Accessibility Checker
CI Tools: Lighthouse CI, GitHub Actions, axe CLI, pa11y-ci
AI Accessibility Plugins: Stark, Able, A11y Color Contrast Checker, Figma-Lint
Audit Tools: axe DevTools, Microsoft Accessibility Insights, Google Lighthouse
Reference Tools: WCAG Color Contrast Checker, WebAIM Contrast Checker

List of Assignments (Any 10)

1. Identify at least **5 accessibility issues** using Lighthouse and Identify at least **5 accessibility violations** using axe DevTools.

2. Create a web page with low-contrast text and background combinations. Detect low-contrast color pairs using an algorithm or AI-assisted method, suggest alternative accessible color combinations and Apply the recommended colors to the webpage.
3. Web images without proper alternative text reduce accessibility for visually impaired users. Develop a solution that identifies such images, generates descriptive alt text using a pretrained AI model, and evaluates the effectiveness of these improvements using accessibility testing tools. (Hint:AI Model: BLIP / CLIP / any image captioning API)
4. Given a web page with poor keyboard accessibility, Test keyboard navigation, identify issues such as improper focus order, keyboard traps, and unreachable elements, use a script to detect accessibility issues, Apply AI-based heuristics to suggest improved focus order.
5.
6. Given an interactive web form with accessibility issues, run axe-core to identify errors, analyze accessibility violations, Fix issues in the form, Re-run axe-core to verify fixes, Use AI tools to suggest improvements (e.g., labels, error messages, ARIA attributes).

7. Create a custom UI component (dropdown / modal / slider), Implement accessibility features: (Keyboard navigation, Focus management, ARIA roles and attributes), Test the component using axe-core / Lighthouse, Use AI tools to analyze and suggest improvements, Fix identified issues and Re-test and validate accessibility.

8. Multimedia content without proper support can be difficult to understand for users with cognitive and learning disabilities. Enhance a given video or multimedia content by adding captions, transcripts, and simplified summaries. Evaluate how these improvements increase comprehension and accessibility.

9. Design a UI screen or mini-journey for a real-world scenario (e.g., booking, learning, sign-up Use AI tools to audit, fix, and document accessibility considerations
10. .
11. Evaluate a real website (e.g., college/public site): Perform AI + manual audit, identify issues, Suggest improvements and Document findings.

12. Create or use a demo web project, Set up Lighthouse CI for automated accessibility audits,
13. Configure axe-linter for code-level checks, Integrate the project with GitHub Actions / Travis CI, run automated audits on every commit and Analyze reports and identify accessibility issues.

14. **Mini Project:** Design and develop a simple web page from scratch using **inclusive design principles**, ensuring it is accessible to all users. Use **AI-powered tools** to suggest accessibility improvements, generate alt text, and interpret audit reports. Test the page with **automated and manual methods**, fix identified issues, and submit the final page along with an accessibility audit and brief documentation.

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Elective – IV : AI 23412C - Smart Social Media Analytics

Teaching Scheme: **Theory: 3 Hours/Week** **Practical: 2 Hours/Week**	**Credits** **04**	**Examination Scheme:** **CAA:10 Marks** **ISE: 30 Marks** **ESE: 60 Marks** **OR : 30 Marks**

Prerequisites: Digital marketing concepts, social media platforms, and key performance indicators (KPIs).

- **Course Objectives:**
- To understand the fundamentals of social media analytics, including the analytics life cycle and the seven-layer framework for extracting business insights.
- To apply Social Network Analysis (SNA) and graph mining techniques to identify influencers, communities, and network structures in social media data.
- To design and implement scalable data collection and preprocessing systems using APIs, web scraping, and big data technologies.
- To develop advanced NLP and Deep Learning models for sentiment analysis, opinion mining, and trend discovery from social media content.
- To analyze social media data using predictive and action analytics for engagement measurement, trend forecasting, and competitor benchmarking.
- To evaluate ethical, privacy, and legal aspects, including GDPR and algorithmic bias, in social media analytics and AI-driven systems.

Course Outcomes (COs): The students will be able to learn:

CO1: Identify social media data using the seven-layer framework and explain the complete analytics life cycle for business insights.

CO2: Apply Social Network Analysis (SNA) and graph mining techniques to identify influencers, communities, and network patterns.

CO3: Design and implement scalable data collection, preprocessing, and storage systems using APIs, web scraping, and big data tools.

CO4: Develop and evaluate NLP and Deep Learning models for sentiment analysis, topic modeling, and multimodal content analysis.

CO5: Apply predictive and action analytics techniques to measure engagement, forecast trends, and perform competitor benchmarking.

CO6: Assess ethical issues, privacy regulations (e.g., GDPR), and algorithmic bias in social media analytics and recommendation systems.

Course Contents

Unit I: Fundamentals of Smart Analytics (06 Hours)

The Landscape: Evolution from Web 2.0 to Social Web 3.0; Types of Social Media (Social graphs vs. Interest graphs). The Seven Layers of SMA: Text, Network, Action, Mobile, and Hyperlink, Location, and Search analytics. Strategy: Defining Business KPIs, Social Media ROI, and the Analytics Maturity Model.

Unit II: Social Network Analysis (SNA) & Graph Mining (6 Hours)

Graph Theory: Nodes, Edges, Degree, Density, and Diameter of a network. Centrality Measures: Identifying influencers using Degree, Betweenness, Closeness, and Eigenvector Centrality. Community Detection: Finding sub-groups using Louvain, Walk trap, and Girvan-Newman algorithms. Practical Use-case: Identifying "Brand Advocates" vs. "Detractors" in a network.

Unit III: Smart Data Collection & Big Data Ingestion (6 Hours)

API Ecosystem: Working with X (Twitter) API v2, Facebook Graph API, and LinkedIn API.Scalable Scraping: Dynamic scraping using Selenium and Scrapy for non-API sources. Data Cleaning: Handling "Noisy" social data—Noise removal, emoji-to-text conversion, and slang normalization. Big Data Integration: Introduction to streaming social data into HDFS or NoSQL databases (MongoDB/Cassandra).

Unit IV: NLP, Sentiment & Opinion Mining (6 Hours)

Text Processing: Advanced Tokenization, Lemmatization, and Named Entity Recognition (NER) for

brands/people. Sentiment Analysis: Lexicon-based (VADER) vs. Transformer-based (BERT/RoBERTa) models. Topic Modeling: Using Latent Dirichlet Allocation (LDA) and BERTopic to find trending conversations. Visual Analytics: Basic Image/Video analytics—OCR on memes and logo detection in social images.

Unit V: Predictive Analytics & Action Analytics (6 Hours)

Trend Prediction: Using Time-Series analysis to predict "Virality" or volume of mentions. Action Analytics: Analyzing "Actions" (Likes, Shares, Shares-per-post) to measure engagement depth. Competitor Benchmarking: Using Share of Voice (SoV) and Sentiment Gap analysis against competitors.

Unit VI: AI Ethics, Privacy & Future Trends (6 Hours)

Privacy Laws: Impact of GDPR and CCPA on data scraping and user profiling. Algorithmic Bias: Understanding "Echo Chambers" and "Filter Bubbles" created by recommendation AI. Generative AI: The role of LLMs (ChatGPT/Llama) in automated content creation and "Smart" social bots.

Text Books:

1. Ganis, M., & Kohirkar, A. (2016**)." Social media analytics: Techniques and insights for extracting business value out of social media"**. IBM Press, First Edition, ISBN :9789332578463
2. Deepa Gupta, Mukul Gupta, and Parth Mukul Gupta (2015**)." Social media and web analytics: Turning insights into action in a digital world"**. PHI Learning, ISBN: 978-9354439605.
3. Khan, G. F. (2015). "**Seven layers of social media analytics: Mining business insights from social media text, actions, networks, hyperlinks, apps, search engine, and location data "** Create Space Independent Publishing Platform , ISBN : 1507823207 **.**
4. Lipschultz, J. H. (2025)**." Social media measurement and management: Entrepreneurial digital analytics "**(2nd ed.). Routledge. ISBN: 9781032252100

Reference Books:

1. Freberg, K. (2021)," ***Social media marketing*** "(3rd ed.). SAGE Publications, ISBN: 1506387101
2. Kaushik, A. (2007)." ***Web analytics: An hour a day",*** Wiley Publishing, ISBN: 8126513284
3. Munzert, S., Rubba, C., Meißner, P., & Nyhuis, D. (2015). "***Automated data collection with R: A practical guide to web scraping and text mining*** **(related to social media analytics with R".** Packt Publishing, ISBN: 8126570423
4. Fuchs, C. (2021)," ***Social media: A critical introduction*** **(3rd ed.)",** SAGE Publications, ISBN : *1529752744*

E-Resources:

1. **E-Books & Academic Materials**
   Seven Layers of Social Media Analytics (official resource website)
   https://7layersanalytics.com/
2. **Online Courses & Tools**
   Google Digital Garage – Fundamentals of Digital Marketing / Social Media Analytics
   https://learndigital.withgoogle.com/digitalgarage/course/digital-marketing
3. **Case Studies & Research Papers**
   IJERT – Social Media Analytics using Machine Learning
   https://www.ijert.org/social-media-analytics-using-machine-learning

MOOCs: (Massive Open Online Courses)

1. **Social Network Analysis**
   https://nptel.ac.in/courses/106106169
2. **Coursera – Social Media Data Analytics**
   https://www.coursera.org
3. **edX – Data Analytics for Social Media**
   https://www.edx.org
4. **Udemy – Social Media Analytics and Data Science**
   https://www.udemy.com

Smart Social Media Analytics Lab

List of Assignments

1. Study of Social Media Ecosystem
   Study various:
   i) Social media platforms and their features.

ii) Social media analytics tools used for monitoring and measuring performance.
iii) Social media analytics techniques and engagement metrics at different levels (page level, post level, and user/member level).
iv) Applications of social media analytics in business decision-making.
Dataset URL : https://github.com/topics/social-media-dataset

2. Select a social media platform of your choice and collect social media data related to a business or brand using appropriate data collection techniques such as scraping, crawling, or APIs.
   Dataset URL : https://www.kaggle.com/datasets
3. Design data preprocessing pipelines to clean and transform social media data by removing noise, filtering irrelevant information, and storing it in suitable databases or storage systems.
   Dataset URL : https://www.kaggle.com/datasets/kazanova/sentiment140
4. Perform exploratory data analysis (EDA) on social media datasets and visualize key insights using suitable data visualization techniques.
   Dataset URL : https://www.kaggle.com/datasets/ramjasmaurya/social-media-engagement-data
5. Develop a model for analyzing different types of social media content such as text, emoticons, images, audio, and video to extract meaningful insights for business applications.
   Dataset URL : https://www.kaggle.com/datasets/abhishek/celeba-dataset
6. Develop text analytics models to analyze customer reviews or comments in order to improve existing products or services.
   Dataset URL : https://www.kaggle.com/datasets/lakshmi25npathi/imdb-dataset-of-50k-movie-reviews
7. Design and develop a dashboard for monitoring and reporting social media analytics results using real-time or collected social media data.
   Dataset URL : https://developer.twitter.com/en/docs/twitter-api
8. Design creative content strategies for promoting a business or product on social media platforms.
   Dataset URL : https://www.kaggle.com/datasets/paramaggarwal/fashion-product-images-small
9. Apply competitor activities and performance using social media data and derive insights for strategic decision-making.
   Dataset URL : https://www.kaggle.com/datasets/crowdflower/twitter-airline-sentiment
10. Apply social media analytics techniques to analyze user feedback and recommend improvements for existing products or services.
    Dataset URL : https://www.kaggle.com/datasets/datafiniti/consumer-reviews-of-amazon-products

Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
(Autonomous Institute)

Elective-V:AI 23413A-Agentic AI

Teaching Scheme: **Theory: 2 Hours/Week** **Practical: 2 Hours/Week**	**Credits** **03**	**Examination Scheme:** **CAA:10 Marks** **ESE: 60 Marks** **OR: 30 Marks**

Prerequisites: Artificial Intelligence

Course Objectives:

- To introduce the fundamental concepts of Artificial Intelligence, intelligent agents, and their architectures.
- To understand decision-making, search, and planning techniques used in intelligent agent systems.
- To explore Generative Artificial Intelligence, Large Language Models, and modern agent development frameworks.
- To develop simple AI agents using modern tools and APIs and understand the ethical and societal implications of Agentic AI systems.

Course Outcomes (COs): The students will be able to learn:

CO1: Explain the fundamental concepts of Artificial Intelligence, Generative AI, and intelligent agents.
CO2: Analyze different types of agent architectures and apply search and decision-making techniques in intelligent systems.
CO3: Use modern frameworks to develop simple AI agents.
CO4: Evaluate the ethical, societal, and responsible use of Agentic AI systems in real-world applications

Course Contents

Unit I: Foundations of Artificial Intelligence and Intelligent Agents (07 Hours)

Introduction to Agentic Artificial Intelligence and comparison with traditional AI systems. Overview of Generative AI and Large Language Models. Architecture of LLM-based systems. Components of intelligent agents including goal, memory, reasoning, planning, action, and tool usage. Agent loop and autonomous decision cycle. Prompt engineering techniques including zero-shot, few-shot, role prompting, and chain-of-thought reasoning. Re Act pattern and tool calling. System prompts, user prompts, and structured prompts. Prompt safety, prompt injection, and secure prompt design. Development of simple LLM-based agents using APIs.

Unit II: Agent Architectures, Design Patterns and Frameworks (06 Hours)

Principles of autonomous agents including reactivity, proactiveness, planning, and collaboration. Agent architectures and design patterns such as Reflection, Re Act, Planning, Tool-use, and Multi-agent collaboration. Memory systems and context management in agentic applications. Vector embedding and semantic search basics. Introduction to modern agent frameworks including Lang Chain, Lang Graph, and Llama Index. Tool integration, memory integration, and reasoning pipelines. Design of modular and reusable agent workflows.

Unit III: Agentic RAG and Multi-Agent Systems (07 Hour)

Retrieval Augmented Generation and Agentic RAG architecture. Document loaders, embedding, vector databases, and retrievers. Knowledge-enabled agents using external data sources. Planning agents and task decomposition. Multi-agent collaboration and communication. Supervisor–worker and planner–executor models. Introduction to Auto Gen, Crew AI, and collaborative agent frameworks. Designing multi-agent workflows for solving complex tasks.

Unit IV: Agent Orchestration, Deployment and Responsible AI (06 Hour)

End-to-end agent pipelines and orchestration. Integration of agents with APIs, databases, and external tools. Workflow automation using agent pipelines. Event-driven execution, triggers, and web hooks. Error handling, retry mechanisms, and fallback agents. Monitoring, logging, and evaluation of agents. Guardrails, hallucination control, and prompt versioning. Responsible AI principles including transparency, explain ability, privacy, and security. Ethical issues and real-world deployment of

autonomous agents.

Text Books:

1. Stuart Russell, Peter Norvig – "*Artificial Intelligence: A Modern Approach*" – Pearson – 4th Edition – ISBN: 978-0134610993

2. David L. Poole, Alan K. Mackworth – "*Artificial Intelligence: Foundations of Computational Agents*" – Cambridge University Press – 2nd Edition – ISBN: 978-1107180657

3. Sebastian Raschka, Vahid Mirjalili – " *Python Machine Learning*" – Packt – 3rd Edition – ISBN: 978-1800567708

4. Aurélien Géron – "*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*" – O'Reilly – 2nd Edition – ISBN: 978-1492032649

Reference Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville – "*Deep Learning*" – MIT Press – 1st Edition – ISBN: 978-0262035613

2. Valentino Zocca, Ram Sriharsha – "*Building LLM Powered Applications*" – O'Reilly – 1st Edition – ISBN: 978-1098106625

3. Joseph Babcock, Raghav Bali – "*Generative AI with Python and PyTorch*" – Packt – 1st Edition – ISBN: 978-1803245174

E-Resources:

1. https://nptel.ac.in/courses/106106226
2. https://nptel.ac.in/courses/106105158

List of Assignments(Any 08)

1. Develop a simple LLM-based AI agent using Python API to generate responses for user queries.

2. Design prompt engineering examples demonstrating zero-shot, few-shot, and chain-of-thought prompting techniques using an LLM.

3. Develop a Re Act-based AI agent using Lang Chain to solve multi-step reasoning queries.

4. Design and develop an AI agent with conversation memory using Lang Chain memory modules.

5. Develop a Retrieval Augmented Generation (RAG) system using text documents and vector embedding.

6. Design and develop an Agentic RAG system with tool usage and reasoning capability using Lang Chain.

7. Develop an agent workflow using Lang Graph with planner and worker agent.

8. Design and develop a multi-agent collaboration system using Crew AI framework.

9. Develop an API-enabled AI agent that uses external tools such as search, calculator, or weather API

10. Design and implement guardrails and safety checks to control hallucination and unsafe responses in an AI agent.

Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
(Autonomous Institute)

Elective- V:AI 23413B- AI for Software Prototyping

Teaching Scheme: **Theory: 2 Hours/Week** **Practical: 2 Hours/Week**	**Credits** **03**	**Examination Scheme:** **CAA:10 Marks** **ESE: 60 Marks** **OR: 30 Marks**

Prerequisites: Programming Fundamentals, Software Engineering Basics, Problem Solving & Logical Thinking

Course Objectives:

- To apply AI-assisted methods for transforming user needs into functional software requirements.
- To design executable software prototypes using AI-powered coding and design tools.
- To evaluate AI-generated prototypes using usability, performance, and ethical metrics.
- To analyze human-AI collaboration patterns in software design workflows.

Course Outcomes (COs): The students will be able to learn:

CO1: Interpret user problems and outline their representation in AI-supported software design specifications.
CO2: Build functional software prototypes using AI coding assistants.
CO3: Design intuitive user interfaces using AI-driven UX tools.
CO4: Assess prototypes for bias, usability, security, and compliance.

Course Contents

Unit I: AI-Driven Requirement Analysis and Feature Definition (6 Hours)

Understanding user centric software requirements, AI assisted requirement elicitation, User stories and acceptance criteria generation, AI-based stakeholder analysis, Constraint discovery and refinement, translating problem statements into prototype specifications, Traceability using AI tools.

Unit II: Generative Code Prototyping and System Scaffolding (6 Hours)

AI assisted coding paradigms, Prompt based code generation, Rapid backend and frontend scaffolding, API generation using AI, Debugging and refactoring with AI assistants, Integrating AI generated components, Version control and reproducibility considerations.

Unit III: AI-Powered UX and Interface Prototyping (6 Hours)

UX fundamentals for AI systems, Text to UI generation, Wireframing with AI tools, Conversational interface prototyping, Multimodal design synthesis, Accessibility-aware design using AI, Iterative UX refinement with user feedback loops.

Unit IV: Prototype Evaluation, Ethics, and Quality Assurance (6 Hours)

Prototype validation strategies, Usability testing frameworks, A/B testing with AI-generated variants, Bias detection and mitigation, Explainability in AI prototypes, Privacy and security concerns, Ethical frameworks for responsible AI prototyping.

Text Books:

1. Foster, D. (2019). Generative deep learning: Teaching machines to paint, write, compose, and play. Sebastopol, CA: O'Reilly Media. ISBN: 978-1492041948.
2. Lewrick, M., Link, P., & Leifer, L. (2020). The design thinking toolbox: A guide to mastering the most popular and valuable innovation methods. Hoboken, NJ: Wiley. ISBN: 978-1-119-62919-1.
3. Taulli, T. (2019). Artificial intelligence basics: A non-technical introduction. Berkeley, CA: Apress. ISBN: 978-1484250273.

Reference Books:

1. Unger, R., & Chandler, C. (2023). A project guide to UX design: For user experience designers in the field or in the making (3rd ed.). New Riders / Pearson. ISBN: 9780138188221.
2. Brown, T. (2019). Change by design: How design thinking transforms organizations and inspires innovation (Revised and updated ed.). Harper Business. ISBN: 9780062856623
3. IDEO. (2015). The field guide to human-centered design: Design kit (1st ed.). IDEO Press. ISBN: 9780991406319
4. Ulrich, K. T. (2011). Design: Creation of artifacts in society. University of Pennsylvania. ISBN: 9780983648703.

E-Resources:

1. AI Prototyping – IDEO U
   https://www.ideou.com/products/ai-prototyping
2. AI Prototyping Certification – Product School
   https://productschool.com/certifications/ai-prototyping
3. AI Prototyping Course – Go Practice
   https://gopractice.io/course/aiprototyping/
4. AI Prototyping for Product Managers – Maven
   https://www.maven.com/tech-for-product/ai-prototyping-for-product-managers
5. Certificate in AI for Prototyping – UX Design Institute
   https://www.uxdesigninstitute.com/blog/certificate-in-ai-for-prototyping/
6. Generative AI for Software Development – DeepLearning.AI
   https://www.deeplearning.ai/courses/generative-ai-for-software-development/

MOOCs:

1. Programming with Generative AI – NPTEL:
   https://onlinecourses.nptel.ac.in/noc25_cs137/preview
2. Artificial Intelligence: Search Methods for Problem Solving – NPTEL:
   https://onlinecourses.nptel.ac.in/noc21_cs63/preview
3. Ethical AI and Responsible Innovation – NPTEL:
   https://onlinecourses.nptel.ac.in/noc22_hs134/preview
4. Generative AI for Software Development – DeepLearning.AI:
   https://www.deeplearning.ai/courses/generative-ai-for-software-development/

AI for Software Prototyping Lab

List of Assignments

1. Apply prompt engineering techniques to generate and refine innovative software product ideas using generative AI tools.
2. Use AI tools to generate a requirement specification and validate user stories with acceptance criteria for a selected software problem.
3. Apply AI-assisted analysis techniques to prioritize software features based on impact, feasibility, and user value.
4. Develop a rapid backend prototype for a selected application using AI-based coding assistants or automated code generation tools.
5. Use text-to-design AI tools to create an interactive frontend UI prototype for a proposed software system.
6. Develop a conversational interface prototype using LLM APIs for user interaction in a selected application scenario.
7. Apply usability testing methods and analyze user feedback to improve AI-generated software prototypes.
8. Develop a bias and ethical risk assessment report by evaluating fairness, privacy, and responsible AI aspects of a prototype.
9. Deploy an AI-assisted software prototype on a cloud or local development environment using appropriate deployment tools.

10. Develop an end-to-end AI-enabled software prototype by applying AI tools for ideation, design, development, evaluation, and deployment.

Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
(Autonomous Institute)

Elective – V :AI 23413C- Applied AI for Industry 4.0

Teaching Scheme: **Theory: 2 Hours/Week** **Practical: 2 Hours/Week**	**Credits** **03**	**Examination Scheme:** **CAA:10 Marks** **ESE: 60 Marks** **OR: 30 Marks**

Prerequisites: Networks of Things, Python Programming, Probability and Statistics ,Introduction to Machine Learning.

Course Objectives:

- Introduce the concepts, architecture, and technologies of Industry 4.0, IIoT, and Cyber-Physical Systems.
- Apply machine learning and deep learning techniques for predictive maintenance and anomaly detection.
- Design AI-based computer vision and robotics solutions for industrial inspection and automation.
- Deploy, monitor, and interpret industrial AI models while ensuring security, reliability, and ethical compliance.

Course Outcomes (COs): The students will be able to:

CO1: Explain Industry 4.0 concepts, architectures (RAMI 4.0, IIRA), and industrial communication protocols.

CO2: Develop and evaluate predictive maintenance and anomaly detection models using appropriate ML/DL techniques.

CO3: Build computer vision systems for defect detection and integrate AI with robotic or automated systems.

CO4: Deploy AI models in industrial environments and analyze model reliability, interpretability, safety, and ethical implications.

Course Contents

Unit I: Foundations: Industry 4.0, IIoT & CPS (06 Hours)

Evolution: Industry 1.0 to 4.0, Key pillars: CPS, IoT, Cloud, Edge, Digital Twin, Big Data, AI, Reference architectures (RAMI 4.0, IIRA, IEC 62443), Sensors, actuators, networks, communication protocols (MQTT, OPC UA, 5G)

Unit II: Predictive Maintenance & Anomaly Detection (06 Hour)

Condition monitoring, health index, degradation modeling approaches: regression, survival analysis, time series forecasting, Anomaly detection: unsupervised methods (isolation forest, autoencoders), Evaluation metrics, thresholding, false alarm tradeoffs

Unit III: Computer Vision, Robotics & Quality Inspection (06 Hour)

Vision systems in manufacturing: defect detection, visual inspection, Deep learning(CNNs, segmentation, object detection) in industrial setups, Robot vision, pick & place, robot guidance using AI, Human robot collaboration, safety.

Unit IV: Deployment, Interpretability, Resilience & Ethics 06 Hours)

Model deployment: on-edge, fog, cloud; model serving frameworks (TensorFlow Serving, ONNX, Flask etc.), Model monitoring, drift detection, retraining pipelines, Interpretability (SHAP, LIME) and reliability in industrial settings, Safety, redundancy, fault tolerance, security in industrial AI, Ethical and social aspects: job impact, bias, accountability

Text Books:

1. A. Neustein, P. N. Mahalle, P. Joshi, et al.,AI, IoT, Big Data and Cloud Computing for Industry 4.0,Boca Raton, FL, USA: CRC Press, 2021. ISBN: 978-0367697681.
2. D. Jose, P. Nanjundan, S. Paul, and S. N. Mohanty,AI-Driven IoT Systems for Industry 4.0,Cham,

Switzerland: Springer, 2022.ISBN: 978-9811670478.
3. R. Anandan, S. Gopalakrishnan, Suseendran, S. Pal, and N. Zaman, Eds.,Industrial Internet of Things (IIoT),Cham, Switzerland: Springer, 2020. ISBN: 978-3030497397.
4. G. R. Kanagachidambaresan, R. Anand, E. Balasubramanian, and V. Mahima,Internet of Things for Industry 4.0: Design, Challenges and Solutions,Hoboken, NJ, USA: Wiley, 2020.ISBN: 978-1119768871.

Reference Books:

1. J. Lin, L. Zhang, and H. Shao, Eds., Industrial AI,Singapore: Springer, 2020.ISBN: 978-9811524832
2. T. Singh, V. Patidar, A. Panwar, and U. Sugandh, Eds.,Data Analytics and Artificial Intelligence for Predictive Maintenance in Industry 4.0,Hoboken, NJ, USA: Wiley, 2021.ISBN: 978-1119769236.
3. K. P. Tran, Ed.,Artificial Intelligence for Smart Manufacturing,Cham, Switzerland: Springer, 2022.ISBN: 978-3031045177.
4. M. M. Islam, M. L. Baptista, and F. Tariq, Eds.Artificial Intelligence for Smart Manufacturing and Industry X.0,Boca Raton, FL, USA: CRC Press, 2023. ISBN: 978-1032330728.
5. S. Russell and P. Norvig,Artificial Intelligence: A Modern Approach, 4th ed.,Hoboken, NJ, USA: Pearson, 2021.ISBN: 978-0134610993.

E-Resources:

3. https://nptel.ac.in/courses/106105195
4. https://onlinecourses.nptel.ac.in/noc26_ge04/preview

List of Assignments

1. A manufacturing plant wants to monitor machine temperature and vibration in real-time to reduce unexpected downtime. Design and implement a basic IIoT system that collects sensor data and transmits it to a centralized server using MQTT protocol. The system should log and visualize the data.
2. Implement a secure data transmission mechanism using MQTT with TLS or OPC-UA security features for automotive component manufacturing units. Analyze the security improvements compared to unsecured communication and document performance impact.
3. A vibration sensor attached to an industrial motor generates noisy data. Develop a system on Raspberry Pi or simulated edge device to collect sensor data, apply filtering techniques (moving average / low-pass filter), and extract statistical features for further analysis.
4. Collect time-series data and implement feature extraction (RMS, variance, kurtosis) on an edge platform (Raspberry Pi / simulated edge). Compare processing time between edge and cloud-based execution.
5. A factory experiences rare but critical machine failures. Implement an unsupervised anomaly detection method (Isolation Forest / Autoencoder) on sensor data. Evaluate detection performance and analyze false positives and missed detections.
6. A PCB manufacturing company wants to automate defect detection. Using an image dataset of PCBs (defective and non-defective), build and train a CNN-based classification model. Evaluate accuracy and deploy the model using a simple web interface
https://www.kaggle.com/datasets/norbertelter/pcb-defect-dataset
7. Design a real-time object detection system using YOLO or OpenCV to identify different components on a conveyor belt. Simulate or integrate with a small actuator/servo to sort objects based on classification
8. A manufacturing facility has multiple machines and multiple jobs with different processing times. Implement a job-shop scheduling model using OR-Tools or Genetic Algorithm to minimize total completion time (makespan).
9. Given historical demand data for a product, develop a forecasting model (ARIMA / LSTM). Use the forecasted demand to optimize inventory using EOQ or safety stock models. Analyze cost reduction achieved.
https://www.kaggle.com/code/simontagbor/demand-forecasting-and-inventory-optimisation
10. Deploy a trained ML model (predictive maintenance or defect detection) using Flask or Docker. Implement basic monitoring to track prediction accuracy over time and simulate data drift.

Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
(Autonomous Institute)

AI23414- Project

Teaching Scheme:	Credits	Examination Scheme:
Practical: 8 Hours/Week	**04**	**TW: 80 Marks** **OR: 50 Marks**

Course Objectives:

- To Apply the knowledge for solving realistic problem
- To develop problem solving ability by considering relevant social, ethical and legal issues
- To Organize, sustain and report on a substantial piece of team work over a period of several months
- To Evaluate alternative approaches, and justify the use of selected tools and methods
- To find information for yourself from appropriate sources such as manuals, books, research journals and from other sources, and in turn increase analytical skills
- To Work in team and learn professionalism
- To follow SDLC meticulously and meet the objectives of proposed work
- To test and validate rigorously before deployment of system
- To consolidate the work as furnished report

Course Outcomes (COs): The students will be able to:

CO1: Solve real life problems by applying knowledge
CO2: Analyze/Link techniques and results from literature as well as actual research and future research lines with the research for feasible solution
CO3: Participate effectively in multi-disciplinary and heterogeneous teams exhibiting team work
CO4: Critically analyze the results and their interpretation
CO5: Inter-personal relationships, conflict management and leadership quality
CO6: Writing precise report and present the original results in an orderly way, placing the open questions in the right perspective

Guidelines

Project can be application oriented and/or will be based on some innovative work in recent technologies like Artificial Intelligence / Machine Learning, Computer Vision, Cyber security, IoT / Embedded Systems, Cloud Computing, Web / Mobile Applications, Data Science, Blockchain, Networking, Healthcare /Agriculture / Smart Systems, Natural Language Processing, Theoretical Computer Science fundamentals.

The student will undertake a project which will involve the analysis, design of a system or sub system in the area identified earlier in the field of Information Technology and Computer Science and Engineering. The project will be undertaken preferably by a group of 3-4 students who will jointly work and implement the project. The group will select a project based on their internship or Guide can suggest based on recent technologies / Industrial Applications. The student shall complete the remaining project work which consists of Selection of Technology and Tools, Installations, UML implementations, testing, Results, performance discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems and comparative analysis and validation of results and conclusions. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is the duly certified by the concerned guide and head of the Department/Institute**.**

Guidelines to Faculty and Students:

1) The Head of the department / Project coordinator shall constitute a review committee for the project group; project guide would be one member of that committee by default.
2) For sponsored projects, an employee of the sponsoring organization may be one of the members of the review committee.
3) There shall be two reviews in a semester.
4) The Project Review committee will be responsible for evaluating the timely progress of the projects.

5) Students should identify projects of enough complexity, which has at least 4-5 major functionalities.
6) Student should adopt skills learned in Software Engineering / Software Architecture to identify stakeholders, actors, Architectural Styles etc. and write detail problem statement for the system
7) The review committee should finalize the scope of the project.
8) Every student of the project group shall make presentation on the progress made by them before the committee during each review. Each student/group is required to give a presentation as part of review followed by a detailed discussion and query session.
9) Students need to note down the queries raised during review(s) and comply with the same in the next review session.
10) The record of the remarks/suggestions of the review committee (project dairy) should be properly maintained and should be made available at the time of examination.
11) The project group needs to present / publish a papers in a reputed international journal/Conference/ file IPR. Paper must be checked for Plagiarism by any open software.
12) The project report must also be checked for plagiarism.
13) The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers, and report

Evaluation Criteria:

Following criteria is suggested for evaluation of Project Term Work.

Objectives & Architectural Design	15 Marks
Mathematical Model / Mathematical Implications for the solution proposed	10 Marks
Implementation	20 Marks
Testing, Validation & Result Analysis	10 Marks
Documentation Quality	10 Marks
Publications: IPR/Journal/Conferences	10 Marks
Innovation / Industrial Relevance	05 Marks
Total	80 Marks

Project report contains the details as Follows:

1. Certificate from the institute.
2. Certificate sponsoring organization (If any).
3. Acknowledgement.
4. Abstract.
5. List of Abbreviations (As applicable).
6. List of Figures (As applicable).
7. List of Graphs (As applicable).
8. List of Tables (As applicable).

1) Introduction, aim/motivation and objectives.

2) Literature Survey (with proper citation).
3) Problem Statement/definition.
4) Software Requirement Specification (In SRS Documentation only).
5) Flowchart
6) Project Requirement specification.
7) Proposed system Architecture.
8) High level design of the project (DFD , UML , ER Diagrams).
9) System implementation-code documentation: Algorithm style, Description of detailed methodologies, protocols used etc..as applicable.
10) Test cases.
11) GUI/Working modules and Experimental Results in suitable format.
12) Project Plan.
13) Analysis and Conclusions with future work.
14) Bibliography in IEEE format.

Appendices

1) Plagiarism Report of Paper and Project report from any open source tool.
2) Base Paper(s) [If any].
3) Tools used / Hardware Components specifications [If any].
4) Published Papers and Certificates (Both Papers).

Use appropriate plagiarism tools, reference managers, Latex for efficient and effective project writing.