Skill Enhancement Course: SEC for B.Sc. & other Subject Students`

Semester: III/IV

Course Title: **Artificial Intelligence**	Course Credits: 2
Total Contact Hours: 13 hours of theory and 26 hours ofpractical	Duration of ESA: 01 Hour
Formative Assessment Marks: 2**0 marks**	Summative Assessment Marks: 30 marks

Course Outcomes (COs):

At the end of the course, students will be able to:

- Write basic Python programs: Utilize essential syntax, data types, control flow, and functions to process information.
- Work with Sanskrit text: Encode, normalize, and tokenize Sanskrit data for analysis.
- Analyze and manipulate data: Use NumPy and Pandas to perform basic statistical calculations and data visualization for Sanskrit projects.
- Explain the concept of AI and its different branches: Differentiate between Machine Learning, Deep Learning, and Natural Language Processing and their potential applications in Sanskrit studies.
- Analyze existing AI projects for Sanskrit: Identify and discuss case studies of AI tools used for sentiment analysis, topic modeling, or machine translation in Sanskrit.
- Utilize AI libraries for Sanskrit tasks: Apply Python libraries like Scikit-learn or spaCy to perform basic machine learning or NLP tasks on Sanskrit data.
- Implement AI models for real-world Sanskrit applications: Design and build a basic AI project focused on a specific task like text summarization, authorship attribution, or named entity recognition in Sanskrit texts.
- Evaluate and document AI projects: Analyze the performance of your project, identify potential limitations, and present your work effectively.
- Identify ongoing research initiatives in AI for Sanskrit: Discuss the challenges and future directions of this field, including knowledge base generation and computational Sanskrit linguistics.

- Develop research questions and approaches: Formulate research questions related to AI and Sanskrit and propose methodologies for addressing them.
- Enhanced problem-solving skills: Apply logical thinking and analytical skills to solve complex problems using Python and AI techniques.
- Improved critical thinking: Evaluate and interpret the results of AI models critically and draw informed conclusions.
- Strengthened communication skills: Present your AI project findings and research ideas effectively to both technical and non-technical audiences.
- Developed awareness of ethical considerations: Understand the ethical implications of using AI in the context of Sanskrit studies and cultural heritage preservation.

Course Content (Artificial Intelligence for Sanskrit)

	Details of topic	**Duration**
Course – 1 – Introduction to Python and AI for Sanskrit	**Module 1: Python Basics for Sanskrit Analysis (2 Theory Hours, 6 Practical Hours)** • Setting up Python environment and basic syntax • Data types, variables, and operators • Control flow statements and functions • Working with Sanskrit text: encoding, normalization, tokenization • Introduction to Jupyter notebooks for interactive coding **Module 2: AI for Sanskrit Studies: Concepts and Applications (2 Theory Hours, 4 Practical Hours)** • Definition of AI and its different branches (Machine Learning, Deep Learning, Natural Language Processing) • Potential applications of AI in Sanskrit research and analysis • Case studies of existing AI projects for Sanskrit (e.g., sentiment analysis, topic modeling, machine translation) • Introduction to Python libraries for AI (NumPy, Pandas, Scikit-learn) **Module 3: Python for Data Analysis and Manipulation (1 Theory Hour, 3 Practical Hours)** • Working with lists, dictionaries, and sets • Data preprocessing and cleaning techniques • Descriptive statistics and data visualization • Introduction to NumPy and Pandas for efficient data handling.	05 hours – Theory 13 hours – Practical

Course – 2 - AI Applications for Sanskrit Studies	**Module 4: Machine Learning for Sanskrit Analysis (2 Theory Hours, 5 Practical Hours)** • Supervised learning: classification algorithms like Naive Bayes and Support Vector Machines for Sanskrit text analysis (e.g., authorship attribution, genre classification) • Unsupervised learning: clustering techniques like k-means and topic modeling (e.g., identifying themes and motifs in Sanskrit texts) • Introduction to neural networks and their potential for Sanskrit analysis. • Convolutional Neural Networks (CNNs) for image recognition: applications in analyzing Devanagari script variations, handwritten Sanskrit text. • Recurrent Neural Networks (RNNs) for sequence modeling: applications in Sanskrit text generation, poetry analysis, machine translation. **Module 5: Natural Language Processing for Sanskrit (2 Theory Hours, 4 Practical Hours)** • NLP basics: tokenization, stemming, lemmatization, part-of-speech tagging • Word embeddings and semantic similarity • Named entity recognition and relationship extraction • Applications of NLP in Sanskrit: machine translation, question answering, chatbots **Module 6: AI Project for Sanskrit Application (2 Theory Hours, 4 Practical Hours)** • Students choose a project topic based on their interests and skills (e.g., Sanskrit sentiment analysis tool, summarization of Vedic texts, AI-powered Sanskrit chatbot) • Project planning, data collection and preparation, model selection and implementation • Project evaluation, documentation, and presentation **Module 7: Research Frontiers in AI for Sanskrit (2 Theory Hours, 0 Practical Hours)** • Introduction to ongoing research initiatives in AI for Sanskrit (e.g., Sanskrit knowledge base generation, computational Sanskrit linguistics) • Discussion of research challenges and future directions • Guidance on how to identify and pursue research problems in AI for Sanskrit	08 hours – Theory 13 hours – Practical

References to learning resources:

1. **Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig**
2. **Deep Learning From Scratch: Building with Python from First Principles by Seth Weidman published by O`Reilley**
3. **Artificial Intelligence with Python by Alberto Artasanchez and Prateek Joshi**

Pedagogy

Flipped classroom pedagogy is recommended for the delivery of this course.For every class:

1. All the faculty who takes this class should go for a Faculty Development Program on these before starting the session.
2. Faculty needs to introduce this course to the students then students need to start learning from Future Skills PRIME platform.
3. Faculty also needs to explain the course outcomes and needs of the course and why tis needed for the students.
4. Then students need to start learning online after registering on the platform.
5. Classroom activities are designed around the topic of the session towards developing better understanding, clearing doubts and discussions of high order thinking skills like application, analysis, evaluation, and design.
6. Every theory class ends with announcement of exercise for practical activity of the week.

- **Probable Teaching Pedagogy Interventions:**
- **Active Learning:**
    - Interactive coding with Jupyter notebooks: Encourage students to experiment and explore concepts through hands-on practice.
    - Mini-challenges and puzzles: Present small coding exercises within modules to solidify understanding and reinforce key principles.
    - Team coding activities: Divide students into small groups to work on collaborative coding tasks involving Sanskrit text analysis.
- **Visual Learning:**
    - Visualization of data using libraries like Matplotlib and Seaborn: Enhance comprehension of data analysis outcomes through visual representations.
    - Infographics and diagrams to illustrate AI concepts: Break down complex ideas into easily digestible diagrams and visuals.

- Interactive simulations of AI algorithms: Create simulations that students can manipulate to observe the workings of different algorithms.

- **Project-Based Learning:**
  - Introduce mini-projects throughout the course: Assign small projects focusing on specific skills like data cleaning or basic AI model implementation.
  - Final project with real-world Sanskrit application: Allow students to choose and develop a project that applies their newly gained skills to a relevant problem in Sanskrit studies.
- **Flipped Classroom:**
  - Provide pre-recorded video lectures or reading materials for students to learn theory concepts at their own pace.
  - Use classroom time for interactive activities, coding exercises, and project discussions.
- **Experiential Learning:**
  - Pose open-ended questions and problems related to Sanskrit analysis using AI.
  - Guide students through the process of formulating research questions, exploring datasets, and selecting appropriate AI techniques.
  - Encourage collaboration and peer feedback during project development.
  - Case Studies and Real-World Examples: Analyze existing AI projects for Sanskrit to showcase the practical applications of these techniques. Invite guest speakers from research labs or industry working on AI and Sanskrit to share their experiences.
  - Gamification: Develop points systems or leaderboards for completing coding challenges or achieving project milestones. Design interactive quizzes or games to test understanding of AI concepts and their application to Sanskrit.
- **Mentored Learning:**
  - Assign faculty mentors or teaching assistants to provide personalized guidance and support throughout the project development process.
  - Organize workshops or office hours dedicated to addressing student questions and challenges related to AI and Sanskrit tasks.

Exercises:

Practical Exercises	Weightage in marks
After each chapter students' needs to complete exercises based on the learning in google colab environment.	No Weightage (But students need to complete it to move to next chapter) .

Assessment:

Assessment Occasion	Weightage in Marks
➢ Formative Assessment: Student has to complete the assignments given by the faculty. ➢ Summative Assessment: After completion of both the courses, the student can optionally give Assessment for each of the courses on Future Skills Prime platform. Students will have two attempts and those who score at least 50% marks per course will get certificate from NASSCOM-MeitY.	This assessment may be given 50% weight in computing the final grade of the students.