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| IQRA University (IU) | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Artificial Intelligence Department (AI) | | |
| Course Code | Course Name | Credit Hr |
| AIN472 | Natural Language Processing | 0+1 |

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| 1. Basic Information | | | |
| Instructor |  | Designation |  |
| Prerequisite(s) |  | Semester | Spring 2025 |
| Email |  | Phone |  |
| Consulting Hours |  | Office Location |  |

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| 1. **Course Objective(s)** |
| To introduce students to the foundational concepts and algorithms in NLP. To enable students to work with and analyze large text corpora using modern tools. To develop the ability to apply machine learning models for solving NLP tasks such as text classification, machine translation, and sentiment analysis. |

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| 1. **Course Contents** |
| Natural Language Processing (NLP) is a subfield of artificial intelligence (AI) that focuses on enabling computers to understand, interpret, and generate human language. This course covers core concepts and techniques used in NLP, including text processing, syntactic parsing, semantics, machine translation, and language modeling. The course will emphasize practical application using modern NLP frameworks like NLTK, spaCy, and Hugging Face's Transformers. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | **Setup/** the ability to clean, normalize, and represent raw text data for NLP applications. | P3 | GA5 | #4  DS | 4 | 40% |
| CLO2 | Train, and **evaluate** NLP models using libraries like NLTK, spaCy, and Hugging Face, and interpret model performance metrics (accuracy, precision, recall, F1-score). | C5 | GA4 | 20% |
| CLO3 | **Demonstrate** Fine-tune transformer models for specific NLP tasks and deploy NLP solutions for real-world applications using web frameworks or cloud platforms. | A 3 | GA10 | 40% |
| ***Note: On successful completion of course, GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Speech and Language Processing | Jurafsky, Daniel, and James H. Martin | Pearson |
|  | Neural Network Methods for Natural Language Processing | Goldberg, Yoav | Morgan & Claypool |
|  | Artificial Intelligence. A Modern Approach | Russell, S. and Norvig, P | 3rd ed, Prentice Hall, Inc., 2015 |
|  | Paradigms of Artificial Intelligence Programming: Case studies in Common Lisp | Norvig, P. | Morgan Kaufman Publishers, Inc., 1992 |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Quiz #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
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| **Assignments**  **10** | Assignment #1 | *CLO1* | 5 | 50% | 5 | TBD |
| Assignment #2 | *CLO2* | 5 | 50 % | 5 | TBD |
|  |  |  |  |  |  |
|  | **Total Assignments %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO1-3* | **10** | 100% | **10** | TBD |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
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| **Midterm**  **25** | Midterm Q#1 | *CLO1* | **13** | 52% | 13 | TBD |
| Midterm Q#2 | *CLO2* | **12** | 48% | 12 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | *CLO2* | 10 | 25% | 10 |  |
| Final Exam Q#3 | *CLO3* | 20 | 50% | 20 |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lab No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | **Introduction to NLP and libraries** | **1** |  |
| 2 | 2 | **Text Pre-processing**   * Tasks: Tokenization, stop word removal, case folding, stemming, lemmatization * Objective: Prepare raw text data for NLP tasks |  |  |
| 3 | 3 | **Bag of Words and TF-IDF**   * Tasks: Convert text into numerical vectors using BoW and TF-IDF * Objective: Understand frequency-based text representations and their limitations |  |  |
| 4 | 4 | **Language Modeling**   * Tasks: Build unigram, bigram, and trigram models and evaluate using perplexity * Objective: Predict the next word in a sequence |  |  |
| 5 | 5 | **Word Embeddings**   * Tasks: Train Word2Vec and visualize word similarities using t-SNE * Objective: Explore dense representations and word relationships |  |  |
| 6 | 6 | **POS Tagging**   * Tasks: Perform POS tagging using NLTK/spaCy on text data * Objective: Recognize syntactic roles of words in a sentence |  |  |
| 7 | 7 | **Open Ended Lab** |  |  |
| **Mid Examination** | | | | |
| 9 | 9 | **Named Entity Recognition**   * Tasks: Extract named entities using spaCy/Hugging Face models * Objective: Identify entities like names, locations, and dates |  |  |
| 10 | 10 | **Sentiment Analysis**   * Tasks: Build a sentiment classifier for a movie review dataset (e.g., IMDb reviews) * Objective: Classify text as positive, negative, or neutral |  |  |
| 11 | 11 | **Machine Translation**   * Tasks: Use MarianMT or Google Translate API for language translation * Objective: Translate sentences from one language to another |  |  |
| 12 | 12 | **Speech Recognition**   * Tasks: Convert speech to text using Google’s Speech-to-Text API * Objective: Explore basic ASR systems for NLP tasks |  |  |
| 13 | 14 | **Question Answering**   * Tasks: Fine-tune BERT to answer questions based on a given context * Objective: Build a QA system using pre-trained models |  |  |
| 14 | 14 | **Revision** |  |  |
| 15 | 15 | **Assessment of Open-Ended Lab** |  |  |
| **Final Examination** | | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  15  05  25  40 |