SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE of B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning)) VII & VIII Semester

[Draft Syllabus Subjected to approval]

Effective for the students admitted in year 2021-22 and onwards
Approved by ……. academic council meeting held on …….

Teaching & Examination Scheme
B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning))
4rd Year – VII Semester
(Effective for the students admitted in year 2021-22 and onward)

S. No.	Category	Course Code	Course Title	Hours			Exam Hours	Marks			Credit
				L	T	P		IA	ETE	Total	
	THEORY										
1	DC	7CM4-01	Natural Language Processing	3	-	-	3	30	70	100	**3**
2	UE	**University Elective subject** ***Course code and title to be selected from the university elective pool of subjects***		3	-	-	3	30	70	100	**3**
3	DE	7CM5-11	Mobile Computing	2	-	-	3	30	70	100	**2**
		7CM5-12	Soft Computing and Evolutionary Algorithms								
		7CM5-13	Generative AI								
Sub Total				**8**	**00**	**00**	**-**	**90**	**210**	**300**	**8**
PRACTICAL & SESSIONAL											
4	DC	7CM4-21	Natural Language Processing Lab	-	-	2	-	60	40	100	**1**
5	UI	7CM7-30	Industrial Training	-	-	1	-	60	40	100	**3**
	UI	7CM7-50	B.Tech. Project - I	-	-	3	-	60	40	100	**2**
6	CCA	7CM8-00	SODECA / Co-Curricular Activity	-	-	-	-	-	100	100	**1**
Sub Total				**00**	**00**	**06**	**-**	**180**	**220**	**400**	**7**
Total				**8**	**00**	**06**	**-**	**270**	**430**	**700**	**15**

L = Lecture, **T** = Tutorial, **P** = Practical, **IA**=Internal Assessment**, ETE**=End TermExam,**Cr**=Credits

Teaching & Examination Scheme
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S. No.	Category	Course Code	Course Title	Hours			Exam Hours	Marks			Credit
				L	T	P		IA	ETE	Total	
	THEORY										
1	UE		**University Elective subject** *Course code and title to be selected from the university elective pool of subjects*	3	-	-	3	30	70	100	**3**
Sub Total				**3**	**00**	**00**		**30**	**70**	**100**	**3**
	PRACTICAL & SESSIONAL										
10	UI	8 CM 7-40	Seminar	-	-	2	-	60	40	100	**2**
	UI	8 CM 7-50	B.Tech. Project - II	-	-	3	-	60	40	100	**4**
12	CCA	8 CM 8-00	SODECA / Co-Curricular Activity	-	-	-	-	-	100	100	**2**
Sub Total				**00**	**00**	**05**	**-**	**120**	**180**	**300**	**8**
Total				**03**	**00**	**05**	-	**150**	**250**	**400**	**11**

L = Lecture, **T** = Tutorial, = Practical, **IA**=Internal Assessment**, ETE**=End Term Exam,**Cr**=Credits

VII Semester B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning))	
7CM4-01: Natural Language Processing	
Credit: 3	**Max. Marks: 100 (IA:30, ETE:70)**
3L+0T+ 0P	**End Term Exams: 3 Hours**

Course Objectives: As a result of successfully completing this course, students will:

- Able to study language and the tools that are available to efficiently study
- Analyze large collections of text and should learn about the effects of electronic communication on our language.

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

CO-1: Learn about major NLP issues and solutions
CO-2: Become agile with NLP programming.
CO-3: Be able to asses NLP problems
CO-4: Understand Natural language understanding, processing, generation

S. No.	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction:** Introduction to NLP - Various stages of NLP, A computational framework for natural language, description of English or an Indian language in the frame work, lexicon, algorithms and data structures for implementation of the framework, Finite state automata. Applications like machine translations.	**7**
3	**Word Level and Syntactic Analysis:** Introduction to Corpora Analysis, Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing Probabilistic Parsing. Machine-readable dictionaries and lexical databases, RTN, ATN.	**8**
4	**Semantic Analysis:** Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.	**8**
5	**Natural Language Generation:** NL interfaces, Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages	**8**
6	**Information Retrieval and Lexical Resources**: Recent trends in NLP, Information Retrieval: Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net,Frame Net, Stemmers, POS Tagger.	**8**
	Total	**40**

Suggested Books:

1 Natural Language understanding by James Allen, Pearson Education 2008
2. NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall
3. Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press
4. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education
5. Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley

VII Semester B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning))	
7CM5-11: Mobile Computing	
Credit: 2	**Max. Marks: 100 (IA:30, ETE:70)**
2L+0T+ 0P	**End Term Exams: 3 Hours**

Course Objectives:

As a result of successfully completing this course, students will:

- To make the student understand the concept of the mobile computing paradigm, its novel applications, and limitations.
- To understand the typical mobile networking infrastructure through a popular GSM protocol
- Understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer
- To understand the database issues in mobile environments & data delivery models.
- Understand the ad hoc networks and related concepts.
- To understand the platforms and protocols used in the mobile environment.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO-1: Think and develop a new mobile application.

CO-2: Take any new technical issue related to this new paradigm and come up with a solution(s).

CO-3: Develop new ad hoc network applications and/or algorithms/protocols.

CO-4: Understand & develop any existing or new protocol related to the mobile environment

S. No.	Contents	Hours
1	**Introduction:** Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS	**5**
2	**(Wireless) Medium Access Control (MAC):** Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)	**6**
3	**Mobile Network Layer:** IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP	**6**
4	**Mobile Transport Layer:** Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing	**6**
5	**Data Dissemination and Synchronization:** Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols.	**5**
	Total	**28**

Suggested Books:

1. Jochen Schiller, “Mobile Communications”, Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007, ISBN: 0195686772
3. ASOKE K TALUKDER, HASAN AHMED, ROOPA R YAVAGAL, “Mobile Computing, Technology Applications and Service Creation” Second Edition, Mc Graw Hill.
4. UWE Hansmann, Lother Merk, Martin S. Nicklaus, Thomas Stober, “Principles of Mobile Computing,” Second Edition, Springer.
5. “GENESIS : Personal Communication Device”. GENESIS 191A321 Document, 1993.
6. “Intelligent Vehicle Highway Systems Projects”. Department of Transportation, Minnesota Document, March 1994.

VII Semester B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning))	
7CM5-12: Soft Computing and Evolutionary Algorithms	
Credit: 2	**Max. Marks: 100 (IA:30, ETE:70)**
2L+0T+ 0P	**End Term Exams: 3 Hours**

Course Objectives:

As a result of successfully completing this course, students will:

- Able to understand basics of Fuzzy Set
- Able to understand the concepts of the genetic algorithms.
- Able to understand the idea of the evolutionary algorithms.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO-1: Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.

CO-2: Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic

CO-3: Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self learning situations.

CO-4: Develop some familiarity with current research problems and research methods in Soft Computing Techniques

S. No.	Contents	Hours
1	**Introduction to Soft Computing:** Aims of Soft Computing-Foundations of Fuzzy Sets Theory-Basic Concepts and Properties of Fuzzy Sets- Elements of Fuzzy Mathematics-Fuzzy Relations-Fuzzy Logic	**5**
2	**Application of Fuzzy Sets**: Applications of Fuzzy Sets-Fuzzy Modeling – Fuzzy Decision Making-Pattern Analysis and Classification-Fuzzy Control Systems-Fuzzy Information Processing- Fuzzy Robotics.	**6**
3	**Genetic Algorithms**: Main Operators- Genetic Algorithm Based Optimization-Principle of Genetic Algorithm- Genetic Algorithm with Directed Mutation- Comparison of Conventional and Genetic Search Algorithms Issues of GA in practical implementation. Introduction to Particle swarm optimization-PSO operators-GA and PSO in engineering applications	**6**
4	**Neuro-Fuzzy Technology:** Fuzzy Neural Networks and their learning-Architecture of Neuro-Fuzzy Systems- Generation of Fuzzy Rules and membership functions - Fuzzification and Defuzzyfication in Neuro-Fuzzy Systems- Neuro-Fuzzy Identification - Neuro Fuzzy Control-Combination of Genetic Algorithm with Neural Networks- Combination of Genetic Algorithms and Fuzzy Logic-Neuro-Fuzzy and Genetic Approach in engineering applications.	**6**
5	**Basic Evolutionary Processes, EV:** A Simple Evolutionary System, Evolutionary Systems as Problem Solvers, A Historical Perspective, Canonical Evolutionary Algorithms - Evolutionary Programming, Evolution Strategies, A Unified View of Simple EAs- A Common Framework, Population Size	**5**
	Total	**28**

Suggested Books:

1. An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)
2. Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition), Collelo, Lament, Veldhnizer (Springer)
3. Fuzzy Logic with Engineering Applications Timothy J. Ross (Wiley)
4. Sivanandam, Deepa, " Principles of Soft Computing", Wiley
5. Jang J.S.R, Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall
6. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill

VII Semester B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning))	
7CM5-13: Generative AI	
Credit: 2	**Max. Marks: 100 (IA:30, ETE:70)**
2L+0T+ 0P	**End Term Exams: 3 Hours**

Course Objectives:

As a result of successfully completing this course, students will be:

- Understand the fundamentals of generative AI and its applications in computer vision and natural language processing.
- Develop skills in designing and implementing generative models using deep learning frameworks.
- Analyze and evaluate the performance of generative models in various applications.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO-1: Design and implement generative models for image and text generation, and other applications.

CO-2: Understand the strengths and limitations of various generative models and be able to select appropriate models for specific tasks.

CO-3: Develop problem-solving skills using generative AI and be able to apply them to real-world problems.

CO-4: Critically evaluate the performance of generative models and develop strategies for improvement.

S. No.	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course	**1**
2	**Overview of Generative AI**: Types of Generative Models (VAE, GAN, RNN, etc.), Applications of Generative AI (Image Generation, Text Generation, etc.)	**6**
3	**Generative Models for Computer Vision** : Convolutional Neural Networks (CNNs) for image processing, Generative Adversarial Networks (GANs) for image generation, Variational Autoencoders (VAEs) for image compression and generation, Case studies: Image generation, Image-to-image translation, etc.	**7**
4	**Generative Models for Natural Language Processing:** Recurrent Neural Networks (RNNs) for text processing, Transformers for text generation and language modeling, Generative models for text summarization, chatbots, and language translation	**7**
5	**Advanced Generative AI Topics:** Generative models for multimodal data (images, text, audio, etc.), Generative models for sequential data (time series, videos, etc.), Advanced techniques: Style transfer, CycleGAN	**7**
	Total	**28**

Suggested Books:

1. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play by David Foster, O'Reilly Media
2. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
3. Generative Adversarial Networks by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
4. Natural Language Processing (almost) from Scratch" by Collobert et al.
5. Neural Network Methods for Natural Language Processing" by Yoav Goldberg
Deep Learning for Computer Vision with Python" by Adrian Rosebrock

VII Semester B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning))	
7CM4-21: Natural Language Processing Lab	
Credit: 1	**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+ 2P	**End Term Exams: 2 Hours**

Course Objectives:

As a result of successfully completing this course, students will:

- To provide hands-on experience with NLP frameworks and tools
- To understand the applications and limitations of NLP in various domains
- To develop skills in designing, training, and evaluating NLP Model with other models

Course Outcomes:

Upon successful completion of the course, students will be able to

CO-1: Will be able to understand the wide spectrum of problem statements, tasks, and solution approaches within NLP

CO-2: Will be able to implement and evaluate different NLP applications and apply machine learning and deep learning methods for this process.

CO-3: Evaluate various algorithms and approaches for the given task, dataset, and stage of the NLP product.

CO-4: **U**nderstand the working principle of convolution neural networks, LSTM etc

S. No.	List of Experiments
1	Basic Text Processing operation on text document.
2	Implement N-gram Language model
3	Write a program to extract features from text and Implement word embedding using Word2Vec/Glove/fastText.
4	Implement LSA and Topic model.
5	Implementation text classification using Naïve Bayes, SVM.
6	Implementation of K-means Clustering algorithm on text.
7	Implement text processing with neural network.
8	Implement text processing with LSTM
9	Implement HMM/CRF on sequence tagging task
10	Develop any one NLP application Sentiment Analysis - Chatbot - Text Summarization Track - Machine Translation

Suggested Books:

1. Natural Language Processing (almost) from Scratch" by Collobert et al.
2. Neural Network Methods for Natural Language Processing" by Yoav Goldberg
3. D. Jurafsky and J. Martin “Speech and Language Processing: An Introduction to

4. Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition draft C. Manning and H. Schutze, “Foundations of Statistical Natural Language Processing”,MIT Press, 1999

VII Semester B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning))	
7CM7-50 : B.Tech. Project – I	
Credit: 2	**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+3P	**Mode of evaluation: Report and presentation**

Assessment or Evaluation

The evaluation criteria for B. Tech. Project - I

S. No.	Category	Internal Assessment Max Marks in %	End Term Examinations Max Marks in %
1	Project Motivation, Conceptual Design, Innovativeness, and utility in actual life application	10%	10%
2	Project Ideation, Project Formulation, and Design	10%	10%
3	Project Prototyping & Finalization, Project Planning & Timeline (Project Viability for 2 semesters)	10%	10%
4	Technology Used and Method	10%	10%
5	Project Execution, Development, Deployment, Demonstration and Delivery (Working and completeness) required to justify current semester work and presentation	30%	30%
6	Report writing and project documentation (organization of the report, clarity, use of figure/diagram, writing skills, presentation of result, paper publication, patent application, etc.)	20%	20%
7	Professional ethics (teamwork, punctuality, novelty, etc.)	10%	10%
Total		**100%**	**100%**

VIII Semester B. Tech. (Computer Science & Engineering (Artificial Intelligence and Machine Learning))	
8CM7-50 : B.Tech. Project -II	
Credit: 4	**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+3P	**Mode of evaluation: Report and presentation**

Assessment or Evaluation

The evaluation criteria for B. Tech. Project - II

S. No.	Category	Internal Assessment Max Marks in %	End Term Examinations Max Marks in %
1	Project Motivation, Conceptual Design, Innovativeness, and utility in actual life application	10%	10%
2	Project Ideation, Project Formulation, and Design	10%	10%
3	Technology Used and Method	10%	10%
4	Project Execution, Development, Deployment, Demonstration and Delivery (Working and completeness) required to justify current semester work and presentation	30%	30%
5	Report writing and project documentation (organization of the report, clarity, use of figure/diagram, writing skills, presentation of result, paper publication, patent application, etc.)	20%	20%
6	Professional ethics (teamwork, punctuality, novelty, etc.)	10%	10%
7	Paper Published in reputed journals (SCE, SCIE, Scopus, UGC care or any peer-reviewed journal), Paper publications (International or National conferences [IEEE, ACM, Springer, etc]), and presentations at Hackathon (Institute level or SIH) or any institute, state or national level project presentation competitions.	10%	10%
Total		**100%**	**100%**