B. V. V. Sangha's
Basaveshwar Engineering College, Bagalkote
Department of Artificial Intelligence and Machine Learning

7th Semester Scheme and Syllabus

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)= Total Hours /30
				L Hrs/Week (Hrs/Sem.)	T Hrs/Week (Hrs/Sem.)	P Hrs/Week (Hrs/Sem.)	Term Work (TW) & Self Learning (SL), (TW+SL) Hrs/Sem.	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	IPCC	22UAI705C	Advanced AI & ML	2(28)	0	2(26)	28	5	3	90	50	50	100	03
2.	HSSM	22UHS711C	Research Methodology and IPR	3(42)	0	0	42	3	3	90	50	50	100	03
3.	PEC	22UAI702E	Internet of Things	3(42)	0	0	42	3	3	90	50	50	100	03
4.	PEC	22UAI703E	Natural Language Processing	3(42)	0	0	42	3	3	90	50	50	100	03
5.	PROJ	22UAI706P	Major Project	Two contact hours/week for interaction between the faculty and students				3	3	360	50	50	100	12

Course Code		**:**	**22UAI701 C**	**Internet of Things**	**Semester**	**:**	**7**
L:T:P		**:**	**3:0:0**		**Course Type**	**:**	**PEC**
Hours/Sem.	**Teaching**	**:**	**42 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Apply IoT concepts, network architectures, communication technologies, data analytics, security mechanisms, and IoT platforms to design, develop, and deploy smart connected solutions for real-world applications.

Course Outcomes:

After completion of the course, students will be able to:

CO1: Explain the fundamental concepts of Information Technology (IT), Operational Technology (OT), Internet of Things (IoT), and digital transformation.

CO2: Analyze IoT network architectures, communication models, and design principles for connected systems.

CO3: Apply IoT networking concepts, protocols, and engineering principles to establish reliable IoT communication.

CO4: Analyze IoT data acquisition, storage, processing, and analytics techniques for informed decision-making.

CO5: Evaluate the role and functionality of IoT physical devices, sensors, actuators, and endpoints in IoT ecosystems.

CO6: Design IoT-based solutions by selecting appropriate strategies and technologies for real-world applications.

UNIT–I	**10 Hrs.**

Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

UNIT–II	**11 Hrs.**

Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies: Salient features of protocol stacks utilizing IEEE 802.15.4 (Intd.). IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT.

UNIT-III	**11 Hrs.**

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics. Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices

and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR	
UNIT-IV	**10 Hrs.**
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout. Operating Systems on RaspberryPi, Configuring RaspberryPi. Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture.	
Text Books:	
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Pearson Education (Cisco Press Indian Reprint). 3. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.	
Reference Books:	
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. 3. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.	

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK3) (WK4)	-	-	-	2 (WK6)	1 (WK1) (WK5) (WK7)	-	-	-	-	2 (WK6)	3	-	2
CO2	3 (WK1) (WK3) (WK4)	2 (WK2) (WK3) (WK4)	3 (WK3) (WK4) (WK5)	-	2 (WK2) (WK6)	-	-	-	-	-	-	3	2	-
CO3	3 (WK1) (WK2) (WK4)	2 (WK2) (WK4)	3 (WK3) (WK4)	2 (WK2) (WK4) (WK8)	2 (WK2) (WK8)	2 (WK1) (WK5) (WK7)	-	-	-	-	2 (WK6)	3	2	-
CO4	3 (WK3) (WK4)	3 (WK2) (WK3) (WK4)	2 (WK3) (WK4) (WK5)	3 (WK2) (WK4) (WK8)	3 (WK6)	-	-	-	-	-	3 (WK5) (WK6)	3	3	-
CO5	3 (WK1) (WK3)	-	2 (WK3) (WK4)	-	3 (WK6)	2 (WK5)	-	-	-	-	-	3	2	-

	(WK4))		(WK5)			(WK7)								
CO6	3 (WK3) (WK4)	3 (WK2) (WK3) (WK4)	3 (WK3) (WK4) (WK5)	2 (WK2) (WK4) (WK8)	3 (WK6)	3 (WK5) (WK7)	2 (WK5) (WK7	2 (WK7) (WK9)	2 (WK9	2 (WK9)	3 (WK5) (WK6)	3	3	3

Course Code		:	22UHS711C	Research Methodology & IPR	Semester	:	7
L:T:P		:	3: 0:0		Course Type	:	HSSM
Hours/Sem.	Teaching	:	42 Hrs		CIE Marks	:	50
	Learning (TW+SL)	:	42 Hrs		SEE Marks	:	50
	Exam	:	06 Hrs		Total Marks	:	100
	Total Hrs.	:	90 Hrs		Credits	:	03

Professional Competency:

Develop competency in planning and conducting engineering research through systematic research methodologies, ethical practices, literature analysis, and effective utilization of Intellectual Property Rights for protecting and commercializing innovations.

Course Outcomes:

After completion of the course, students will be able to:

CO1: Integrate research methodology in engineering sciences in relevant trades.
CO2: Exhibit reflective thinking in problem solving exercises.
CO3: Identify criteria to fit one's own intellectual work in particular form of IPRs and able to apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
CO4: Develop skill of making search using modern tools and techniques and also student is able to become patent agent by cracking patent agent exam

UNIT-I	10 Hrs.

Introduction to Engineering Research: Fundamentals of Research: Meaning, objectives, and motivation in engineering research. **Types of Engineering Research:** Basic, applied, and translational research; identifying and solving Worthwhile problems. **Research Ethics:** Ethics in engineering research and practice, types of research misconduct, and ethical issues in authorship.

UNIT-II	11 Hrs.

Literature Review and Citations: Technical Reading & Analysis: Methods for reviewing literature, analyzing prior art, and synthesizing new and existing knowledge. **Bibliographic Databases:** Web of Science, Google, Google Scholar; effective search strategies. Conceptualizing Research, Critical and creative reading, taking notes, reading mathematical models, algorithms, and datasheets. **Citations & Acknowledgments:** Attribution, citation styles, impact of keywords, citing

datasets, and knowledge dissemination.

UNIT-III	10 Hrs.

Intellectual Property Rights (IPR) & Patents: Introduction to Intellectual Property: Concepts of property and rights, forms of IPR, role in research and economic development, IP governance, and global innovation indicators. **Patents:** Definition, objectives, criteria for patentability, software/business method patents, infringement, compulsory licensing, and government use of inventions. **Patent Process:** Prior art search strategies, patent databases (free and paid), drafting specifications and claims, filing requirements, jurisdiction, opposition procedures, and renewal. **Filing Requirement of patent**: Patent Application Forms. Work flow chart in obtaining Patents, Jurisdiction of Filing Patent Application. Pre-grant & Post-grant Opposition. Forms to be submitted, filing mechanism through Individual patent office and PCT route. Need for a Patent Attorney/Agent Revocation. Term of Patent, Patent renewal and Fee Structure National Bodies Dealing with Patent Affairs. Utility Models.

UNIT-IV	11 Hrs.

Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement and remedies in case of infringement. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases. **Trademarks**: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Classification of Trademarks. Registration of a Trademark. Process for Trademarks Registration. Prior Art Search. Validity of Trademark. Trademark Registry. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd. **Industrial Designs:** Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India. **Case Studies on Patents.** Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. **IP Organizations In India. Schemes and Programmes**.

Textbooks:

1. Dr. Nejakar Santosh M, Dr. Bendigeri Harish (2023-24) "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4.
2. Thiel David V. "Research Methods for Engineers" Cambridge University Press,
3. Acharya N.K Intellectual Property Rights . 6th Edition, Asia Law House.
4. P. Naryan, (2007). "Intellectual Property Law", 3rd Ed, Eastern Law House,
5. Dr. Myneni S.R.,(2019) "Law of Intellectual Property", 9th edition, Asia law House,.
6. Dr. Reddy G.B, (2020) "Intellectual Property Rights and Law", Reprint edition, Gogia Law Agency. Hydrabad,.
7. N.R. Subbaram. S. Viswanathan, (2008). "Hand book Indian Patent Law and, Practice" Printers and publishers Pvt,Ltd,

8. Cornish, “Intellectual Property Rights”, Universal publications.
9. Dr.B.L.Wadehra,“Law Relating to Intellectual Property” 5th edition,Universal Law publishing Co, Dehli.
10. SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos and other materials / notes

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2)	3 (WK2) (WK3)	2 (WK3)	2 (WK4)	2 (WK5)	–	–	2 (WK8)	–	2 (WK9)	1 (WK11)	3	2	–
CO2	3 (WK2)	3 (WK3)	3 (WK4)	3 (WK4)	2 (WK5)	–	–	2 (WK8)	1 (WK8)	2 (WK9)	2 (WK10)	3	2	–
CO3.	2 (WK1)	3 (WK3)	2 (WK4)	2 (WK4)	2 (WK5)	2 (WK6)	1 (WK7)	3 (WK8)	–	2 (WK9)	2 (WK10)	–	3	2
CO4	3 (WK3) (WK4)	3 (WK4)	3 (WK4)	3 (WK4)	3 (WK5)	2 (WK6)	–	2 (WK8)	1 (WK8)	2 (WK9)	2 (WK10)	2	3	3

Course Code		**:**	**22UAI705C**	**Advanced AI and ML**	**Semester**	**:**	**7**
L:T:P		**:**	**2:0:2**		**Course Type**	**:**	**IPCC**
Hours/Sem.	**Teaching**	**:**	**28+26 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**28 Hrs**		**SEE Mrks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:	
Design, develop, and evaluate deep learning-based intelligent systems using TensorFlow and modern neural network architectures for solving real-world AI applications.	
Course Outcomes:	
CO1: Recognize the characteristics of deep learning models that are useful to solve real-world problems. **CO2**:Remember architectures and optimization methods for deep neural network training **CO3**: Able to design and deploy simple Tensor Flow-based deep learning solutions to classification problems **CO4**: Design the test procedures to assess the efficacy of the developed model.	
UNIT–I	**7 Hrs.**
Fundamentals of deep learning: What is Deep Learning, Applications, Weights and Activation functions, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss, Data Preprocessing, Image augmentation in Open CV. What are convolutional neural network and tensorflow, Convolutional layer, Pooling layer, How to create the layers in Python. **Conv Nets:** Basic concepts of Convolutional Neural Networks starting from filetering. Convolution and pooling operation and arithmatics of these. **Revisiting ConvNet Architectures:** Discussions on famous convnet architectures - AlexNet, ZFNet, VGG, C3D, GoogLeNet, ResNet, MobileNet-v1, MobileNet-v2, EfficientNet, GhostNet	
UNIT–II	**7 Hrs.**
Transfer learning, RCNN (Fast RCNN, Faster RCNN, Mask RCNN), Revisiting Gradient Descent, Momentum Optimizer, RMS Prop, Adam, Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization, Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN. **Representation and Generative Learning:** Autoe ncoder Architecture-Implementing an Auto encoder in Tensor Flow –Denoising Sparsity in Auto encoders Models for Sequence Analysis, Generative adversarial Networks, Simple example with MNIST dataset, Limitation of GAN and Deep Convolutional GANs.	

UNIT-III	7 Hrs.
Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc. Recurrent Architectures, Transformers, Vision Transformers: Introduction to Recurrent Neural Networks (RNNs), The Architecture of a Traditional RNN, How does Recurrent Neural Networks work? Back propagation Through Time (BPTT), issues of Standard RNNs, RNN Applications, Basic Python Implementation (RNN with Keras), Recurrent Neural Networks- Vanishing Gradients, Long Short-Term Memory (LSTM) Units-Tensor Flow Primitives for RNN Models-Augmenting Recurrent Networks with Attention, Applications of LSTM.	
UNIT-IV	**7 Hrs.**
Deep Learning applications of Reinforcement Learning and NLP: Key elements of Reinforcement Learning, What are the types of deep reinforcement learning in NLP? Open AI Gym Toolkit, How is Deep Learning applied to RL, Robotic Manipulation using Deep RL, Application of Deep learning to Natural Language Processing, Automatic Language Translation, Automatic Text Classification, RCNN and YOLO architectures, fully convolutional segmentations, Mask-RCNNs	
Text Books:	
Text Books: 1. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm", O'Reilly, 2017. 2. Ian Good fellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2016.	
Reference Books:	
Reference books: 1. Aurélien Géron, "Hands-On Machine Learning with Scikit- Learn and Tensor Flow", O'Reilly, 2017. 2. Nikhil Ketkar, "Deep Learning with Python: A Hands-on Introduction", Apress, 2017.	

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)	–	–	1 (WK2)	–	–	–	–	–	1 (WK8)	3	2	–
CO2	3 (WK2) (WK3) (WK4)	3 (WK2) (WK3) (WK4)	1 (WK5)	2 (WK8)	2 (WK2) (WK6)	–	–	–	–	–	1 (WK8)	3	3	–
CO3	2 (WK2) (WK3) (WK4)	2 (WK2) (WK3) (WK4)	3 (WK5)	2 (WK8)	3 (WK2) (WK6)	–	–	–	1	–	1 (WK8)	2	3	1

CO4	**2 (WK2) (WK3) (WK4)**	**3 (WK2) (WK3) (WK4)**	**2 (WK5)**	**3 (WK8)**	**3 (WK2) (WK6)**	**1 (WK5) (WK7)**	**–**	**–**	**1**	**–**	**2 (WK8)**	**2**	**3**	2

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List of Assignments

Sl. No	Assignments
1.	**Comparative Study of CNN Architectures for Image Classification** **Objective:** Implement and compare AlexNet, VGG16, ResNet50, MobileNetV2, EfficientNetB0, and GhostNet for image classification. **Dataset:** CIFAR-10 / Intel Image Classification **Expected Outcome:** • Accuracy comparison • Training time comparison • Model size comparison • Confusion Matrix • Precision, Recall and F1-score
2.	**Medical Image Classification using Transfer Learning** **Objective:** Develop a deep learning model using transfer learning for medical image classification. **Dataset:** • Chest X-Ray Pneumonia • Brain MRI • HAM10000 **Tasks** • Fine-tune pretrained model • Compare frozen vs fine-tuned layers • Evaluate performance **Expected Outcome** Medical image classifier with deployment-ready accuracy.
3.	**Object Detection using Faster RCNN and YOLO** **Objective:** Compare Faster RCNN and YOLOv8 for real-time object detection. **Dataset** MS COCO or Pascal VOC **Tasks** • Train object detector • Detect multiple objects • Compare FPS and mAP **Expected Outcome** High-performance object detection system.
4.	**Semantic Segmentation using Mask RCNN** **Objective:** Segment objects at pixel level using Mask RCNN. **Dataset** Oxford-IIIT Pet Dataset or COCO Segmentation **Tasks** • Train segmentation model • Evaluate IoU and Dice Score • Compare with FCN **Expected Outcome** Pixel-level segmentation of multiple objects.

5.	**Image Denoising using Autoencoder** **Objective:** Build a Deep Autoencoder for image denoising. **Dataset** MNIST Fashion-MNIST **Tasks** • Add Gaussian noise • Train Denoising Autoencoder • Compare reconstructed images **Expected Outcome** Noise-free reconstructed images.
6.	**Handwritten Digit Generation using GAN** **Objective:** Develop a Generative Adversarial Network (GAN) to generate handwritten digits. **Dataset** MNIST **Tasks** • Train Generator • Train Discriminator • Visualize generated images • Compare Generator loss and Discriminator loss **Expected Outcome** Synthetic handwritten digit generation.
7.	**Sentiment Analysis using LSTM with Attention** **Objective:** Develop an LSTM-based sentiment classifier enhanced with an Attention mechanism. **Dataset** IMDb Movie Reviews **Tasks** • Text preprocessing • Word Embedding • LSTM implementation • Attention Layer • Performance comparison **Expected Outcome** Binary sentiment classification with improved accuracy.
8.	**Machine Translation using Transformers** **Objective:** Build an English-to-Kannada Neural Machine Translation system. **Dataset** OPUS Corpus or IIT Bombay English-Hindi Dataset **Tasks** • Transformer Encoder-Decoder • Tokenization • Positional Encoding • BLEU Score Evaluation **Expected Outcome** Neural Machine Translation model.

9.	**Vision Transformer (ViT) for Image Classification** **Objective:** Compare Vision Transformer with CNN architectures. **Dataset** CIFAR-100 or Flowers-102 **Tasks** • Train Vision Transformer • Compare with ResNet50 • Compare training time, accuracy and parameters **Expected Outcome** Performance comparison of CNN and Vision Transformer.
10.	**Deep Reinforcement Learning for Autonomous Navigation** **Objective:** Develop an autonomous navigation agent using Deep Q-Network (DQN). **Environment** OpenAI Gym (CartPole, LunarLander or MountainCar) **Tasks** • Implement Deep Q-Network • Train reinforcement learning agent • Reward optimization • Compare learning curves **Expected Outcome** An intelligent agent capable of learning optimal actions through interaction with the environment.

Course Code		**:**	**22UAI703E**	**Natural Language Processing**	**Semester**	**:**	**7**
L:T:P		**:**	**3: 0:0**		**Course Type**	**:**	**PEC**
Hours/Sem.	**Teaching**	**:**	**42 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**03**

Professional Competency:

Develop the ability to analyze, design, and implement Natural Language Processing (NLP) techniques using statistical, probabilistic, and machine learning approaches for understanding, processing, and extracting meaningful information from natural language text to solve real-world AI applications.

Course Outcomes:

After completion of the course, students will be able to:

CO1: Understand the foundational concepts of Natural Language Processing including empirical laws, spelling correction, n-gram models, and morphological analysis.

CO2: Apply probabilistic models like HMM and PCFG for part-of-speech tagging and syntactic parsing of natural language text. Apply statistical and machine learning algorithms to natural language processing

CO3: Analyze and implement semantic models such as word embeddings, topic models, and lexical semantics for meaning representation and disambiguation.

CO4: Design and evaluate NLP applications such as entity linking, text summarization, and sentiment analysis using modern approaches.

UNIT-I	**10 Hrs.**

Introduction to NLP: Empirical Laws, Text Processing. **Spelling Correction**: Edit Distance, Weighted Edit Distance, Other Variations, Noisy Channel Model for Spelling Correction. **N-Gram Language Models:** Evaluation of Language Models, Basic Smoothing. **Computational Morphology**: Finite State Methods for Morphology.

UNIT-II	**11 Hrs.**

Introduction to POS Tagging: Hidden Markov Models for POS Tagging, Viterbi Decoding for HMM, Parameter Learning. **Syntactic Parsing:** Introduction, Parsing, CKY, PCFGs, PCFGs - Inside-Outside Probabilities. **Dependency Grammars and Parsing**: Introduction, Transition Based Parsing: Formulation and learning.

UNIT-III	**10 Hrs.**

Distributional Semantics: Introduction, Distributional Models of Semantics, Applications, Structured Models, Word Embeddings. **Lexical Semantics:** Introduction, Wordnet. Word Sense Disambiguation, Novel Word Sense detection. **Topic Models:** Introduction, Latent Dirichlet Allocation: Formulation, Gibbs Sampling for LDA, Applications.

UNIT-IV	**11 Hrs.**

Entity Linking: Information Extraction, Relation Extraction, Distant Supervision. **Text Summarization:** LEXRANK, Optimization Based Approaches for Summarization, Summarization Evaluation. **Text Classification:** Sentiment Analysis, Affective Lexicons, Learning Affective Lexicons, Computing with Affective Lexicons, Aspect Based Sentiment Analysis.

Textbooks:

1. Dan Jurafsky and James Martin. “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”. Prentice Hall, 2nd Edition, 2009.
2. Chris Manning and Hinrich Schütze. “Foundations of Statistical Natural Language Processing”, MIT Press, Cambridge, May 1999.

Web Links and Video Lectures:

1. **NPTEL Video Link: https://nptel.ac.in/courses/106105158**

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	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3 (WK1) (WK2)	2 (WK2)	1 (WK2)	–	2 (WK5)	–	–	–	–	1 (WK9)	–	3	–	–
CO2	3 (WK2) (WK3)	3 (WK3)	3 (WK3) (WK4)	2 (WK4)	2 (WK5)	–	–	–	–	2 (WK9)	1 (WK11)	3	2	–
CO3	3 (WK3) (WK4)	3 (WK4)	3 (WK4)	3 (WK4)	2 (WK5)	–	–	–	1 (WK8)	2 (WK9)	2 (WK10)	3	2	–
CO4	3 (WK3) (WK4)	3 (WK4)	3 (WK4)	3 (WK4)	3 (WK5)	–	–	–	1 (WK8)	2 (WK9)	2 (WK10)	3	3	2

8th Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching-Learning Scheme				Examination Duration (Hrs/Sem.)		Total Hours	Examination Scheme and Evaluation			Credits (C)=Total Hours/30
				L Hrs/Week (Hrs/Sem.)	T Hrs/Week (Hrs/Sem.)	P Hrs/Week (Hrs/Sem.)	Term Work (TW) & Self Learning (SL), (TW+SL) Hrs/Sem.	CIE	SEE		CIE Marks	SEE Marks	Total Marks	
1.	AEC	22UAI8XXE	AEC only through NPTEL	-	-	-	90	-	-	90	-	100	100	03
2.	OEC	22UAI8XXN	OEC only through NPTEL	-	-	-	90	-	-	90	-	100	100	03
3.	INT	22UAI803I	Internship	Two contact hours/week for interaction between the faculty and students				3	3	300	50	50	100	10