SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

QUESTION BANK

V SEMESTER
PAD102–FUNDAMENTALS OF TEXT & SPEECH ANALYSIS

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SUBJECT: PAD102–FUNDAMENTALS OF TEXT & SPEECH ANALYSIS

SEM / YEAR : V / III

UNIT I – NATURAL LANGUAGE BASICS

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stopwords – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model.

PART-A (2 - MARKS)

Q. No	QUESTIONS	Competence	BT Level
1.	What is syntax in natural language processing?	Remember	BTL-1
2.	List the types of stemming.	Remember	BTL-1
3.	What is a phrase in the context of sentence structure?	Understand	BTL-2
4.	Define a parse tree.	Remember	BTL-1
5.	Point out some Text Wrangling Techniques.	Understand	BTL-2
6.	What is text preprocessing.	Understand	BTL-2
7.	Define tokenization with an example.	Understand	BTL-2
8.	What is the difference between sentence tokenization and word tokenization?	Understand	BTL-2
9.	Draw NLP pipeline.	Remember	BTL-1
10.	LIst three tasks are commonly applied as part of any normalization process.	Understand	BTL-2
11.	Show the purpose of removing stopwords in NLP?	Understand	BTL-2
12.	List different parsing technique.	Remember	BTL-1
13.	Define word tokenization.	Remember	BTL-1
14.	What is lemmatization and give an example.	Remember	BTL-1
15.	Define Penn Treebank tokenization.	Remember	BTL-1
16.	Define stemming? Provide an example.	Remember	BTL-1
17.	Write the Porter stemmer with example.	Understand	BTL-2
18.	How does stemming differ from lemmatization?	Understand	BTL-2
19.	What is the Bag of Words (BoW) model?	Understand	BTL-2
20.	Define an N-gram with an example.	Remember	BTL-1
21.	Compare constituency parsing and dependency parsing.	Understand	BTL-2
22.	Define TF-IDF.	Remember	BTL-1
23.	How does TF-IDF improve upon the Bag of Words model?	Understand	BTL-2
24.	Write formula for TF-IDF Model.	Understand	BTL-2

PART-B (16- MARKS)

1	Explain the phases of Natural Language Processing in detail.	(16)	Remember	BTL-1
2	Summarize in detail on Language syntax and structure.	(16)	Evaluate	BTL-5
3	What is a parse tree? Explain with examples how parse trees are constructed and used.	(16)	Analyze	BTL-4
4	Discuss the complete pipeline for text preprocessing.	(16)	Remember	BTL-1
5	Explain text preprocessing and wrangling in Natural Language Processing.	(16)	Analyze	BTL-4

6	Discuss the significance of part-of-speech (POS) tagging in lemmatization. How does POS information improve the accuracy of lemmatization?	(16)	Understand	BTL-2
7	Discuss the different types of tokenization with example.	(16)	Understand	BTL-2
8	Analyse and write detailed notes on types of stemming and its applications.	(16)	Analyze	BTL-4
9	Compare and contrast stemming and lemmatization. Illustrate the difference with examples, and explain when each should be used.	(16)	Analyze	BTL-4
10	What are stopwords? Why are they removed in NLP tasks? Discuss scenarios where removing stopwords may not be appropriate.	(16)	Understand	BTL-2
11	List and explain different types of parsing techniques with examples.	(16)	Remember	BTL-1
12	What are different methods for extracting features from the text. Explain statistical method in detail.	(16)	Evaluate	BTL-5
13	Explain the process of converting raw text into a numerical feature vector using TF-IDF. Illustrate with an example.	(16)	Evaluate	BTL-5
14	What is TF-IDF? Derive the formula and explain its components. Discuss how TF-IDF differs from raw frequency counts.	(16)	Apply	BTL-3
15	Explain the role of stopword removal in text analysis. Discuss its effect on feature extraction and model performance.	(16)	Understand	BTL-2
16	Demonstrate about the Bag of Words (BoW) model in detail. Discuss its working, advantages, limitations, and applications.	(16)	Apply	BTL-3
17	Discuss the N-Gram model. How does it improve upon the Bag of Words model? Give examples of unigram, bigram, and trigram.	(16)	Apply	BTL-3

UNIT II TEXT CLASSIFICATION

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Text summarization and Topic Models.

PART – A

Q. No	QUESTIONS	Competence	BT Level
1.	What is vector semantics?	Understanding	BTL-2
2.	Define word embeddings.	Remembering	BTL-1
3.	What is Lemmas and Senses.	Understanding	BTL-2
4.	What is the use of vector space in NLP?	Understanding	BTL-2
5.	Give the cosine similarity in word vectors.	Understanding	BTL-2
6.	List the semantic similarity.	Remembering	BTL-1
7.	Compare Word2Vec and GloVe.	Understanding	BTL-2
8.	How does context affect word embeddings?	Understanding	BTL-2
9.	What are the two main architectures of Word2Vec?	Remembering	BTL-1
10.	Define Connotation.	Understanding	BTL-2
11.	Define Skip-Gram model.	Understanding	BTL-2
12.	What Semantic Frames and Roles?	Remembering	BTL-1
13.	Show type of neural network is used in Word2Vec?	Remembering	BTL-1
14.	Give limitation of Word2Vec.	Understanding	BTL-2

15.	What is Vectors and documents?		Remembering	BTL-1
16.	Define GloVe in NLP.		Remembering	BTL-1
17.	Define FastText.		Remembering	BTL-1
18.	What is the advantage of using subword information in FastText?		Remembering	BTL-1
19.	What is text summarization?		Remembering	BTL-1
20.	Can FastText generate embeddings for out-of-vocabulary (OOV) words? Why?		Remembering	BTL-1
21.	Name one library or tool used for text summarization.		Understanding	BTL-2
22.	Compare extractive vs abstractive summarization.		Understanding	BTL-2
23.	How does FastText represent words?		Remembering	BTL-1
24.	State the Mention one use case of text summarization.		Understanding	BTL-2
	PART-B (16- MARKS)			
1.	Write and analyze the concept of vector semantics in NLP. How does it help in understanding word relationships?	16	Analyzing	BTL-4
2.	Assess in detail the need and advantages of using word embeddings over one-hot encoding.	16	Evaluating	BTL-5
3.	Analyze with examples how cosine similarity is used to measure similarity between word vectors.	16	Analyzing	BTL-4
4.	Explain the architecture of the Word2Vec model. Compare and contrast CBOW and Skip-Gram with suitable diagrams and examples.	16	Analying	BTL-4
5.	Describe the process of learning word embeddings and their importance in NLP tasks.	16	Applying	BTL-3
6.	Illustrate the mathematical foundation behind the Skip-Gram model of Word2Vec.	16	Remembering	BTL-3
7.	Explain the working of the GloVe (Global Vectors) model. How does it differ from Word2Vec in terms of methodology?	16	Creating	BTL-6
8.	Analyze and Discuss the co-occurrence matrix and its role in the GloVe algorithm. Provide a numerical example.	16	Analyzing	BTL-4
9.	Generalize on text summarization. Differentiate between extractive and abstractive summarization with real-world examples.	16	Creating	BTL-6
10.	Compare Word2Vec and GloVe based on architecture, performance, and training data.	16	Evaluating	BTL-5
11.	Generalize and Discuss any two methods used for extractive text summarization. Compare their effectiveness.	16	Creating	BTL-6
12.	Explain the architecture and working of the FastText model. Assess on how does it improve upon Word2Vec?	16	Evaluating	BTL-5
13.	Explain the concept of subword embeddings in FastText. How does it handle out-of-vocabulary words?	16	Understanding	BTL-2
14.	Discuss applications and advantages of FastText in real-world NLP problems.	16	Applying	BTL-3
15.	Write and Explain the concept of topic modeling. How does it help in understanding large corpora of text?	16	Evaluating	BTL-5
16.	Apply and describe the working of the Latent Dirichlet Allocation (LDA) algorithm in detail. Illustrate with an example of topic discovery.	16	Applying	BTL-3
17.	Describe the steps and techniques involved in performing automatic text summarization.	16	Evaluating	BTL-5

UNIT III TEXT CLASSIFICATION USING DEEP LEARNING

Overview of Deep Learning models – RNN - LSTM – Transformers – BERT – Evaluation Metrics.

PART A				
Q. No	**QUESTIONS**	**Competence**		**BT Level**
1.	Give the backpropagation through time (BPTT)?	Understanding		BTL-2
2.	What problem does LSTM solve in standard RNNs?	Remembering		BTL-1
3.	Give the hidden state in an RNN.	Remembering		BTL-1
4.	Point out one major limitation of vanilla RNNs.	Understanding		BTL-2
5.	State in what type of NLP task are RNNs commonly used?	Remembering		BTL-1
6.	What is an RNN?	Remembering		BTL-1
7.	Define LSTM.	Remembering		BTL-1
8.	What is the purpose of the forget gate in LSTM?	Remembering		BTL-1
9.	What problem does the LSTM architecture solve?	Understanding		BTL-2
10.	Tell how is LSTM better than RNN in learning long-term dependencies?	Remembering		BTL-1
11.	List any two gates used in an LSTM cell.	Remembering		BTL-1
12.	Give the advantages of LSTM.	Understanding		BTL-2
13.	What is a Transformer in NLP?	Remembering		BTL-1
14.	What is the difference between encoder and decoder in a Transformer?	Understanding		BTL-2
15.	Write the difference between RNN and LSTM.	Remembering		BTL-1
16.	Name the two main components of a Transformer architecture.	Remembering		BTL-1
17.	Give the purpose of the [CLS] token in BERT?	Understanding		BTL-2
18.	What is self-attention?	Remembering		BTL-1
19.	Define BERT.	Remembering		BTL-1
20.	Define accuracy in classification tasks.	Remembering		BTL-1
21.	List out one limitation of using BERT for real-time applications.	Remembering		BTL-1
22.	Write the formula for F1-score and when is it preferred?	Remembering		BTL-1
23.	Define recall with a formula.	Understanding		BTL-2
24.	Name one evaluation metric suitable for imbalanced datasets.	Understanding		BTL-2
	PART-B (16- MARKS)			
1.	**Analyze** the architecture and working of Recurrent Neural Networks (RNNs) with suitable diagrams and mathematical formulations.	16	Analyzing	BTL-4
2.	Illustrate about Autoregressive generation with an RNN-based neural language model and Part-of-speech tagging as sequence labeling	16	Applying	BTL-3
3.	Summarize on the process of Bidirectional RNNs.	16	Applying	BTL-3
4.	Explain the architecture of Long Short-Term Memory (LSTM) networks. Describe the function of its gates	16	Analyzing	BTL-4
5.	Compare RNN and LSTM architectures with reference to memory handling, vanishing gradient, and sequence learning.	16	Analyzing	BTL-4

6.	Analyze how LSTMs are used in language modeling or machine translation with examples.	16	Analyzing	BTL-4
7.	Explain the Transformer architecture in detail. Describe the roles of encoder, decoder, self-attention, and positional encoding.	16	Creating	BTL-6
8.	Generalize the importance of the self-attention mechanism in the Transformer model. Provide examples with attention scores.	16	Creating	BTL-6
9.	Compare the Transformer model with LSTM-based sequence models in terms of performance, scalability, and parallelism.	16	Evaluating	BTL-5
10.	Analyze about the architecture of a Information flow in a causal (or masked) self-attention model with relevant formulas and diagrams.	16	Analyzing	BTL-4
11.	**Analyze** how is BERT fine-tuned for downstream NLP tasks like Question Answering or Named Entity Recognition?	16	Analyzing	BTL-4
12.	Explain the architecture of BERT. What makes BERT bidirectional, and why is it important?	16	Remembering	BTL-1
13.	In a multi-class text classification problem, how would you evaluate model performance? Explain macro, micro, and weighted averaging.	16	Creating	BTL-6
14.	How do deep learning models (RNN, LSTM, Transformer, BERT) handle context differently in language modeling tasks?	16	Understanding	BTL-2
15.	Explain in detail the evaluation metrics used for NLP classification tasks: Accuracy, Precision, Recall, F1-Score, and Confusion Matrix.	16	Remembering	BTL-1
16.	Compare BERT with traditional word embeddings (like Word2Vec) and contextual models like GPT.	16	Evaluating	BTL-5
17.	Explain in detail about simplified view of a feedforward neural language model moving through a text.	16	Understanding	BTL-2

UNIT IV QUESTION ANSWERING AND DIALOGUE SYSTEMS

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems.

PART-A

	Questions	Competence	BT Level
1.	Define Information Retrieval (IR).	Remembering	BTL-1
2.	What is document and query in the context of IR?	Understanding	BTL-2
3.	Give the purpose of a ranking function in IR?	Understanding	BTL-2
4.	Differentiate between precision and recall in IR.	Understanding	BTL-2
5.	State the evaluation metric used in IR systems.	Remembering	BTL-1
6.	List the key limitation of IR-based QA systems.	Understanding	BTL-2
7.	Define IR-based Question Answering.	Remembering	BTL-1
8.	What is a knowledge base in QA systems?	Remembering	BTL-1
9.	Define answer span in QA systems.	Remembering	BTL-1
10.	List the. role of SPARQL in knowledge-based QA.	Remembering	BTL-1
11.	Express about the knowledge graph.	Understanding	BTL-2
12.	Compare classic QA models.	Understanding	BTL-2

13.	How are pretrained language models used for QA?		Understanding	BTL-2
14.	What is the TREC QA track?		Remembering	BTL-1
15.	Compare extractive and generative QA.		Understanding	BTL-2
16.	What is meant by Information Retrival?		Remembering	BTL-1
17.	Name the three basic components of a QA pipeline.		Remembering	BTL-1
18.	How is passage scoring done in traditional QA models?		Understanding	BTL-2
19.	What is a chatbot?		Remembering	BTL-1
20.	State a rule-based chatbot.		Understanding	BTL-2
21.	Differentiate between knowledge base in QA systems and and IR-based QA systems.		Understanding	BTL-2
22.	State one real-world application of chatbots.		Understanding	BTL-2
23.	What is the role of intent recognition in chatbots?		Remembering	BTL-1
24.	State the goal of IR-based QA.		Understanding	BTL-2
	PART-B (16- MARKS)			
1.	Explain in detail about the IR-based question answering pipeline.How does it retrieve relevant answers from large corpora?	16	Applying	BTL-3
2.	Describe in detail about Information Retrieval process.with a neat architecture diagram.	16	Understanding	BTL-2
3.	Explain in detail about the architecture of an ad hoc IR system with neat diagram.	16	Creating	BTL-6
4.	Assess and explain about IR-based QA: Reader (Answer Span Extraction) with diagram.	16	Evaluating	BTL-5
5.	(i) Evaluate about Knowledge-Based QA from RDF triple stores. (ii) Explain QA by Semantic Parsing.	8 8	Evaluating	BTL-5
6.	Explain with a neat sketch about the inference process in the ELQ algorithm for entity linking in questions.	16	Evaluate	BTL-5
7.	Explain how transformer-based language models (like BERT) are used in extractive QA tasks. Include diagrammatic flow.	16	Analyzing	BTL-4
8.	Generalize on the 4 broad stages of Watson QA: (i)Question Processing and Candidate Answer Generation, (ii)Candidate Answer Scoring and Answer Merging and Confidence Scoring.	8 8	Creating	BTL-6
9.	Explain the T5 system is an encoder-decoder architecture.	16	Evaluate	BTL-5
10.	Summarize, and explain the architecture and components of a rule-based chatbot.	16	Understanding	BTL-2
11.	Assess and write a simplified sketch of the ELIZA algorithm.	16	Evaluate	BTL-5
12.	Summarize in detail about Corpus-based chatbots.	16	Evaluate	BTL-5
13.	Design a simple architecture for slot filling in Dialogue-State system.	16	Evaluate	BTL-5
14.	Draw the the two architectures for generating responses for a neural chatbot and give a fleshed-out example.	16	Creating	BTL-6
15.	Analyze and explain architecture of a dialogue-state system for task-oriented dialogue.	16	Analyzing	BTL-4
16.	Analyze and explain the ACUTE-EVAL method in evaluating Chatbots.	16	Analyzing	BTL-4

17.	Explain in detail about the Dialogue acts used by the HIS restaurant recommendation system.	16	Creating	BTL-6

UNIT V TEXT-TO-SPEECH SYNTHESIS

Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems.

PART-A

	Questions	Competence	BTL
1.	Define prosody in speech synthesis.	Remembering	BTL-1
2.	List out Major English places of articulation.	Understanding	BTL-2
3.	What is text normalization in speech synthesis?	Remembering	BTL-1
4.	Give an example of a normalization task in TTS systems.	Remembering	BTL-1
5.	What is Mean Opinion Score (MOS)?	Understanding	BTL-2
6.	What is the letter-to-sound conversion task?	Remembering	BTL-1
7.	State one subjective and one objective evaluation method for TTS.	Understanding	BTL-2
8.	Differentiate Pitch and Loudness.	Understanding	BTL-2
9.	What is a pronunciation lexicon?	Remembering	BTL-1
10.	List out any two components of prosody.	Understanding	BTL-2
11.	What are the three main components of voice application?	Remembering	BTL-1
12.	State statistical parametric speech synthesis system.	Understanding	BTL-2
13.	List Some types of non-standard words in text normalization.	Understanding	BTL-2
14.	Define TTS Preprocessing.	Remembering	BTL-1
15.	Tell about Speech SoundWaves.	Remembering	BTL-1
16.	What is WaveNet?	Remembering	BTL-1
17.	Give speech recognition architecture.	Understanding	BTL-2
18.	State the key components of a parametric TTS pipeline.	Understanding	BTL-2
19.	Define statistical parametric speech synthesis system.	Remembering	BTL-1
20.	State the modern task of speech synthesis.	Understanding	BTL-2
21.	Define Spectrogram prediction.	Remembering	BTL-1
22.	What is the role of vocoders in deep learning-based TTS?	Understanding	BTL-2
23.	What is concatenative?	Understanding	BTL-2
24.	Give the various parametric approaches.	Understanding	BTL-2

PART-B

1.	Explain the process of text normalization in speech synthesis with examples. Why is it critical for high-quality TTS output?	16	Analyzing	BTL-4
2.	Discuss the various challenges involved in normalizing non-standard words (e.g., numbers, dates, acronyms) in TTS system	16	Understanding	BTL-2
3.	Explain the architecture and approaches for letter-to-sound conversion in TTS systems. Compare rule-based and data-driven methods.	16	Evaluate	BTL-5
4.	Analyze how are pronunciation dictionaries used in TTS systems? Explain with examples of L2S ambiguities.	16	Analyzing	BTL-4

5.	Discuss the role of phonological rules in grapheme-to-phoneme conversion and how deep learning models improve accuracy.	16	Analyzing	BTL-4
6.	Define prosody and explain its components: pitch, duration, intensity, and phrasing. Why is prosody essential in speech synthesis?	16	Analyzing	BTL-4
7.	Describe techniques used for prosody modeling in TTS systems. How does prosody affect intelligibility and naturalness?	16	Evaluate	BTL-5
8.	Explain text normalization in detail.	16	Applying	BTL-3
9.	Compare subjective and objective methods of evaluating TTS systems. What are the strengths and limitations of each?	16	Analyzing	BTL-4
10.	Explain concatenative speech synthesis. Describe unit selection and diphone concatenation methods with advantages and limitations.	16	Evaluate	BTL-5
11.	What is parametric TTS? Explain the statistical modeling process and its components (acoustic models, vocoders, etc.).	16	Understanding	BTL-2
12.	Compare the quality and flexibility of concatenative vs. parametric TTS systems using real-world use cases.	16	Evaluate	BTL-5
13.	Describe the architecture of WaveNet. How does it differ from traditional vocoders?	16	Evaluate	BTL-5
14.	Discuss Tacotron 2 architectures for TTS. What are their contributions to end-to-end speech synthesis?	16	Evaluate	BTL-5
15.	Compare WaveNet with other deep learning-based TTS models like FastSpeech and Glow-TTS.	16	Analyzing	BTL-4
16.	Generalize in detail about TTS Preprocessing and Spectrogram prediction.	16	Creating	BTL-6
17.	Assess and explain about the current challenges and future directions in deep learning-based TTS systems?	16	Evaluate	BTL-5