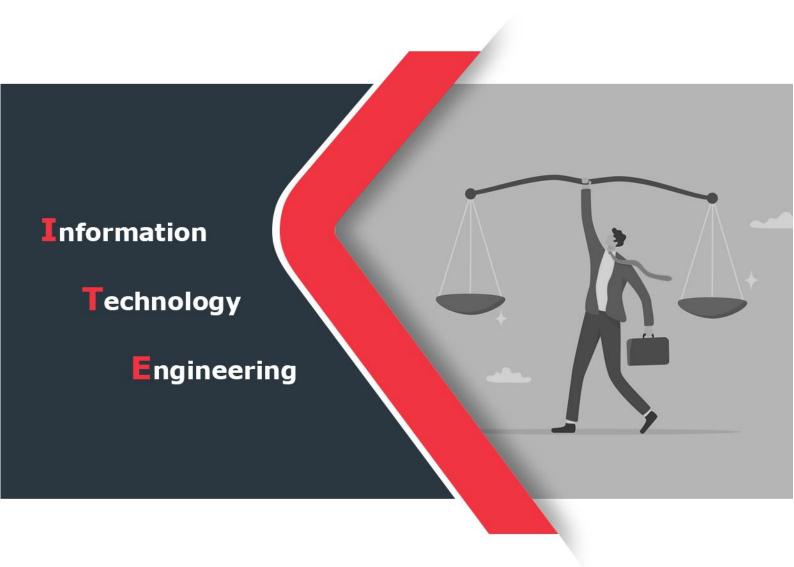


## **Natural Language Processing**

**Course Definition** 







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#### 1. Basic Information:

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Course Name	Natural Language Processing
Course Code	ANL601
Number of Presentational Sessions*	20
Number of Synchronous Sessions**	10
Number of Shorter Tests***	2
Number of Exams***	1
Theoretical Sessions Work Load (hrs.)	60
Practical Sessions Work Load (hrs.)	30
Credit Hours	6

<sup>\*</sup>Each presentational session comprises both recorded lecture (1.5 hrs.) and interactive learning content (1.5 hrs.).

#### N.B.

Generally, each chapter requires two presentational sessions: one for the recorded content and one for the interactive content (unless the chapter is too long, in which case it may require more sessions (. This note applies to synchronous sessions as well, where each chapter requires one synchronous session generally.

<sup>\*\*</sup>Each synchronous session comprises the interactive lecture carried out in real time in a virtual class (1.5 hrs.).

<sup>\*\*\*</sup>Each shorter test is 0.5 hr. long. The final exam is 2 hrs. long.

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### 2. Prerequisites courses:

Course	Code
Artificial Intelligence	BAI501
Neural Networks and Fuzzy Logic	ARB601
Machine Learning	AML601

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#### 3. Course Objectives:

The objective of this course is to familiarize the students with the basic concepts of natural language processing and to introduce the foundations of technologies in NLP and their application to practical problems, providing students with the knowledge and capacity to develop NLP projects that allow users to interact with the computer using a human language. Students will study methodologies used in the recognition of spoken speech, speech synthesis, as well as text processing at different levels: phonetic, morphological, syntactic, and semantic. Students will also explore a range of different applications that fall within this area.

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#### 4. Learning Outcomes (LO):

Upon completion of the course, the student must have:

- Understand the mechanisms of speech production and how to produce speech by computers.
- Build an Arabic text-to-speech system.
- Build a system that recognizes the speech in isolated words or recognizes the speaker.
- Understand different models to represent the language (on different levels: morphological, syntactic, and semantic) and suggest a suitable representation based on the studied problem.
- Understand different approaches to process the language, on the different levels, and suggest a suitable approach to solve the studied problem.
- Design, implement and test natural language processing systems within an interactive application between man and machine.

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#### 5. Assessment Results:

			Assessment Type				
Chapte r Numbe r	Chapter Title	General Objectives	Interacti ve Content & Recorde d Session s	Applied Activities (Synch. Sessions)	Final Exam*/ Shorter Tests**	Presentations and Interviews***	Repo rts**
CH1	Introduction to NLP	Comprehensi on -Analytical Thinking - Tools and Application Hands- On	J	J	J	J	J
CH2	Speech Production, Hearing and Modeling	on -Analytical Thinking - Tools and Application Hands- On	J	J	J	J	J
СНЗ	Speech Signal Characteristics	Comprehen sion	J	J	J	J	J

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	in Time and	-Analytical					
	Frequency	Thinking -					
		Tools and					
		Application					
		Hands- On					
	Text to Speech	Comprehen					
		sion					
		-Analytical					
CH4		Thinking –	J	J	J	J	1
		Tools and					
		Application					
		Hands- On					
	Speech and	Comprehen					
	Speaker	sion					
	Recognition	-Analytical					
CH5		Thinking -	J	J	$\sqrt{}$	J	$\sqrt{}$
		Tools and					
		Application					
		Hands- On					
	Programming	Comprehen					
	using Matlab	sion					
	and Praat	-Analytical					
CH6		Thinking –	J	J	J	J	J
		Tools and					
		Application					
		Hands- On					

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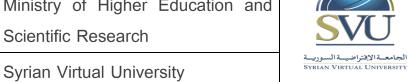


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	Language	Comprehen					
	Models	sion					
		-Analytical					
CH7		Thinking -	J	<b>√</b>	J	<b>√</b>	<b>J</b>
		Tools and					
		Application					
		Hands- On					
	Morphological	Comprehen					
	Processing	sion					
		-Analytical					
CH8		Thinking -	J	J	J	J	J
		Tools and					
		Application					
		Hands- On					
	POS Tagging	Comprehen					
		sion					
		-Analytical					
CH9		Thinking –	J	$\sqrt{}$	J	J	<b>/</b>
		Tools and					
		Application					
		Hands- On					
	Syntactic	Comprehen					
	Processing	sion					
CH10		-Analytical	J	J	J	J	<b>/</b>
		Thinking –					
		Tools and					

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		Application					
		Hands- On					
	Semantic	Comprehen					
	Processing	sion					
		-Analytical					
CH11		Thinking -	J	$\checkmark$	J	J	J
		Tools and					
		Application					
		Hands- On					
	NLP systems:	Comprehen					
	Applications &	sion					
	Approaches	-Analytical					
CH12		Thinking –	J	$\checkmark$	J	J	J
		Tools and					
		Application					
		Hands- On					

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- \*The final exam is two hours long and is given at the end of the course.
- \*\*Shorter tests are about 30 minutes long and are given after three or four lectures throughout the semester during synchronous sessions.
- \*\*\*Presentations, interviews, and reports are submitted once after each three or four lectures throughout the semester during synchronous sessions.

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### 6. Course Syllabus:

Chapter	Subject	Content	Number of Learning Objects	Number of synchronous Learning Objects
	Introduction to	1. Introduction		
	NLP	<ul><li>2. Applications of spoken and written language processing</li><li>3. Levels of natural language</li></ul>		
CH1		processing  4. Ambiguity types in language processing	5	2
		5. Examples on language processing systems		
	Speech	1. Natural speech production.		
	Production,	2. Phonemes in Arabic		
CH2	hearing and	3. Hearing mechanism	4	2
	modeling	4. Speech modeling (source-		
		filter)		
	speech signal	1. Time domain speech signal		
СН3	characteristics in	analysis.	5	2
	time and	2. Fundamental frequency	3	<u> </u>
	frequency	trajectories.		

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		3. Frequency domain speech		
		signal analysis, and		
		sonograms.		
		4. Formants trajectories.		
		5. Linear prediction analysis		
	Text to Speech	1. Text to speech applications.		
	Synthesis	2. Speech synthesis units.		
		3. Speech synthesis techniques		
		4. Synthetic speech prosody		
CH4		5. Demo: Text based speech	7	3
СП4		synthesis	/	
		6. Using statistics averaging in		
		speech synthesis		
		7. Using deep learning in speech		
		synthesis		
	Speech and	1. Speech recognition		
	speaker	applications		
	recognition	2. Speech recognition units		
CH5		3. Speech recognition techniques	6 3	3
CH5		4. Demo	U	3
		5. Speaker recognition		
		6. Deep learning in speech		
		recognition		
	programming	1. Speech signal acquisition		
CH6	using Matlab and	2. Some time and frequency	6	3
	Praat	processing		

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		3. Using praat for signal		
		demonstration		
		4. Time window spectrum		
		amplitude calculation		
		5. Linear prediction coefficients		
		and cepstrum coefficient		
		computation.		
		6. Praat package		
	Language	1. Introduction		
	Models	2. N-gram models		
CH7		3. Language embeddings	5	2
		4. Pretrained language Models		
		5. Conclusion		
	Morphological	1. Text regulating		
	Processing	2. Morphological Processing in		
		English		
CH8		3. Morphological analysis	4	2
		according to linguistic models		
		4. Morphological Processing in		
		Arabic		
	POS tagging	1. Introduction		
CH9		2. English language sets groups	4	2
		3. POS tagging applications	7	2
		4. POS tagging approaches		
01110	Syntactic	1. Introduction	8	4
CH10				

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		3. Ambiguity		
		4. Ambiguity facing research		
		5. Analysis methods using		
		dynamic programming		
		6. Syntactic processing issues		
		7. Partial analysis		
		8. Best tree selection using		
		Probabilistic approach		
	Semantic	1. Meaning representation		
		2. Semantic processing		
		applications		
CH11		3. Semantic analysis based on	4	2
		Syntax		
		4. Word Sense Disambiguation		
		approaches		
	NLP systems:	1. Information Retrieval		
Applications & approaches		2. Machine Translation		
		3. Automatic Summarization	5	2
		4. Question Answering System		
		5. Other applications		

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### 7. Practical Activity:

#### • Tools and Labs:

Tool Name	Description
FARASA	Stemming, POS tagging and
	syntactic analysis
CoreNLP / NLTK NLP Toolkit	Frameworks for NLP
Matlab	Signal Processing Software
Praat	Speech Processing Software

#### • Practical Activities per Chapters:

Chapter	Activities Type	Remarks
	☑ Exercises	
	☑ Homework	
CH1	□ Webinars	
СПІ	□ Project	
	☐ Experiment	
	□ Other	
	☑ Exercises	
	☑ Homework	
CH2	☐ Webinars	
CH2	□ Project	
	☐ Experiment	
	□ Other	

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CH3	☑ Exercises	
	☑ Homework	
	□ Webinars	
0113	□ Project	
	□ Experiment	
	□ Other	
	☑ Exercises	
	☑ Homework	
CH4	□ Webinars	
0114	□ Project	
	□ Experiment	
	□ Other	
	☑ Exercises	
	☑ Homework	
CH <i>5</i>	□ Webinars	
0113	□ Project	
	□ Experiment	
	□ Other	
	☑ Exercises	
	☑ Homework	
CH6	□ Webinars	
CHO	□ Project	
	☐ Experiment	
	□ Other	
CH7	☑ Exercises	
CH7	☐ Homework	



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	□ Webinars	
	☑ Project	
	□ Experiment	
	□ Other	
	☑ Exercises	
	☑ Homework	
CH8	□ Webinars	
СПо	☑ Project	
	□ Experiment	
	□ Other	
	☑ Exercises	
	✓ Homework	
CH9	□ Webinars	
СПЭ	☑ Project	
	□ Experiment	
	□ Other	
	☑ Exercises	
	☑ Homework	
CH10	□ Webinars	
CHIO	☑ Project	
	□ Experiment	
	□ Other	
	☑ Exercises	
CH11	✓ Homework	
CHII	□ Webinars	
	☑ Project	



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	☐ Experiment	
	□ Other	
	☑ Exercises	
	☑ Homework	
CH12	☐ Webinars	
CH12	□ Project	
	☐ Experiment	
	□ Other	

#### 8. References:

- Jurafsky, Daniel, and James H. Martin. 2009. Speech and language processing: an introduction to natural language processing, computational linguistics, and speech recognition. London: Prentice Hall, Pearson Education International.
- Hobson Lane, Hannes Hapke, Cole Howard. 2019. Natural Language Processing in Action: Understanding, analyzing, and generating text with Python. Manning Publications.
- Jacob Benesty, M. Mohan Sondhi, Yiteng Huang (Eds.) 2008. Springer
   Handbook of Speech Processing. Springer
- Tomas Quatieri, 2002. Discrete Time Speech Signal Processing principles and practice, Printice Hall signal Processing Series.