

INT344

Natural Language Processing

Lecture #0

The kick start session

House Keeping Rules

- Students must sit according to their Roll numbers starting from the leftmost column.
- Keep mobile phones on silent or switched off unless needed for class work. Use electronic devices only for educational purposes.
- Arrive on time and bring all necessary materials.
- Treat everyone with respect and use polite language.
- Pay attention during lessons. Participate in discussions and activities.
- Ask questions if you do not understand something.



Table of Content

- Vision
- Mission
- Program Educational Objective (PEO), Program Outcomes (PO), and Program Specific Outcomes (PSO)
- Course Objectives
- Course Outcomes
- Mapping of Course with Career Pathway
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- Star Course – INT344
- Course Assessment Model
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- EdRev

Vision

- To be a globally recognized school through excellence in teaching, learning and research for creating Computer Science professionals, leaders and entrepreneurs of future contributing to society and industry for sustainable growth.

Mission

- To build computational skills through hands-on and practice-based learning with measurable outcomes.
- To establish a strong connect with industry for in-demand technology driven curriculum.
- To build the infrastructure for meaningful research around societal problems.
- To nurture future leaders through research-infused education and lifelong learning.
- To create smart and ethical professionals and entrepreneurs who are recognized globally

Program Educational Objectives (PEO)

- The graduates shall demonstrate professional advancement through expanded leadership capabilities and technical accomplishment providing solutions to local and global societal issues through mindful engagement.
- The graduates shall undertake higher education or global certifications or exhibit impactful research accomplishment.
- The graduates shall extend global expertise in technology development and deployment by becoming an entrepreneur, consultant and innovator.
- Graduates shall embrace ethics and lifelong learning to adapt to a fast-changing world and enhance global employability in diverse work environments.



Program Outcomes

- **PO1**

Research and Problem Solving: Ability to independently carry out research /investigation and development work to solve practical problems.

- **PO2**

Technical Communication: Ability to write and present a substantial technical report/document.

- **PO3**

Comprehensive Discipline Knowledge: Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

- **PO4**

Modern tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

Program Outcomes (Cont.)

- **PO5**

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- **PO6**

Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



Program Specific Outcomes

- **PSO1**

Apply skills for configuring and operating complex software systems, packages, tools and applications for sustainability in various domains.

- **PSO2**

Acquire skills to model, design, develop, manage, and resolve issues related to robust computing applications and software solutions.

- **PSO3**

Able to practice and promote computing technologies for societal needs and contribute to advancement of computer technology by means of research and development.

Course Objectives

- The course brings forward the basic concept of Natural Language processing and the different models associated with the same.
- A thorough knowledge about this subject would enable one to understand the concept of perceptions of Logistic Regression, Classification, and Vector Spaces, Machine Translation, Probabilistic Models, Sequence Models, Attention Models in Natural Language Processing.
- This course will helps in applying different machine learning algorithms of Sentiment Analysis, Vector Space Models, Hidden Markov Models for Natural Language understanding and generation
- The course brings forward the principles of Visualizations, and Statistics to communicate the problems of English language for Natural Language Processing through Semantic and Syntactic analysis.
- A thorough knowledge about this subject would enable one to learn about NLP tools to Translate Words, Translate Languages, Text Generation, Summarize Text, Word Embeddings, Build Chat bots .

Course Outcomes

- CO1 :: study the fundamentals of Natural Language Processing, linguistic components, and basic text pre-processing tasks.
- CO2 :: elaborate vector space models and transformation techniques for semantic similarity, word relationships, and document search.
- CO3 :: determine the probabilistic models for tasks such as spell correction, POS tagging, and word prediction.CO4 :: investigate the classification-based models (Naïve Bayes, Logistic Regression) for sentiment analysis.
- CO5 :: evaluate sequence models (RNN, LSTM, Attention) and perform NLP tasks such as NER, POS tagging, and summarization.
- CO6 :: develop and evaluate end-to-end NLP systems using transformer-based architectures for applications like chatbots and QA systems.

Mapping of Course with Career Pathway

- Corporate Job
- Research



Mapping of Course with Cohort

- Data Science
- Machine Learning
- Higher Studies

Course details

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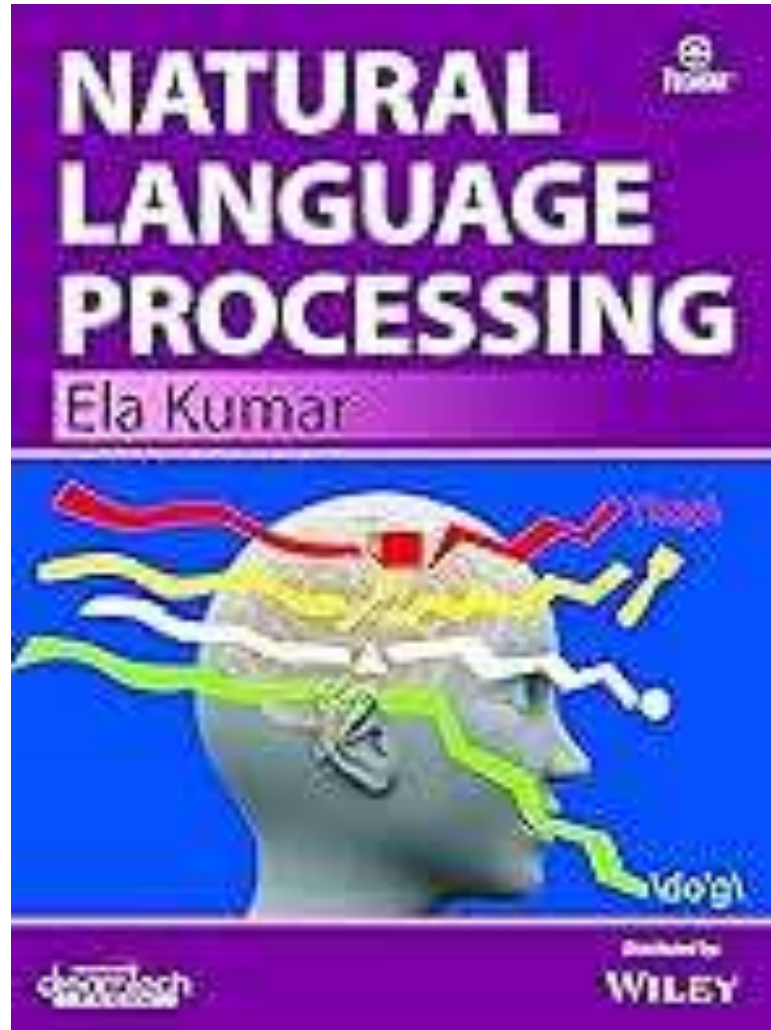
• **Credit: 3**

Text Books:

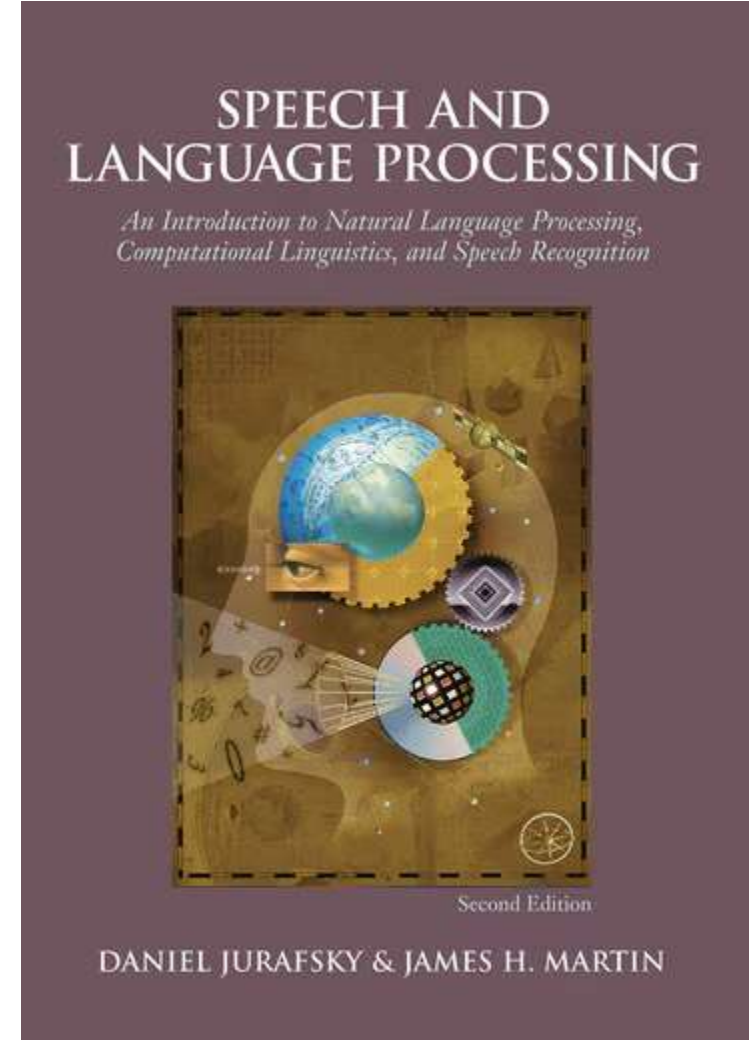
- NATURAL LANGUAGE PROCESSING by ELA KUMAR, DREAMTECH PRESS

References:

- SPEECH AND LANGUAGE PROCESSING: AN INTRODUCTION TO NATURAL LANGUAGE PROCESSING, COMPUTATIONAL LINGUISTICS AND SPEECH RECOGNITION by DANIEL JURAFSKY, JAMES H. MARTIN, PEARSON



Text Book



Reference Books

Course Assessment Model

Marks break up

• Attendance	5
• Continuous Assessment	45
• ETE	50
Total	<u>100</u>

- Academic Tasks (Both are mandatory)
 - Project
 - Test
- MTE(MCQ Based)
- End-term Examination (ETE) : 100% MCQ

Details of Academic tasks

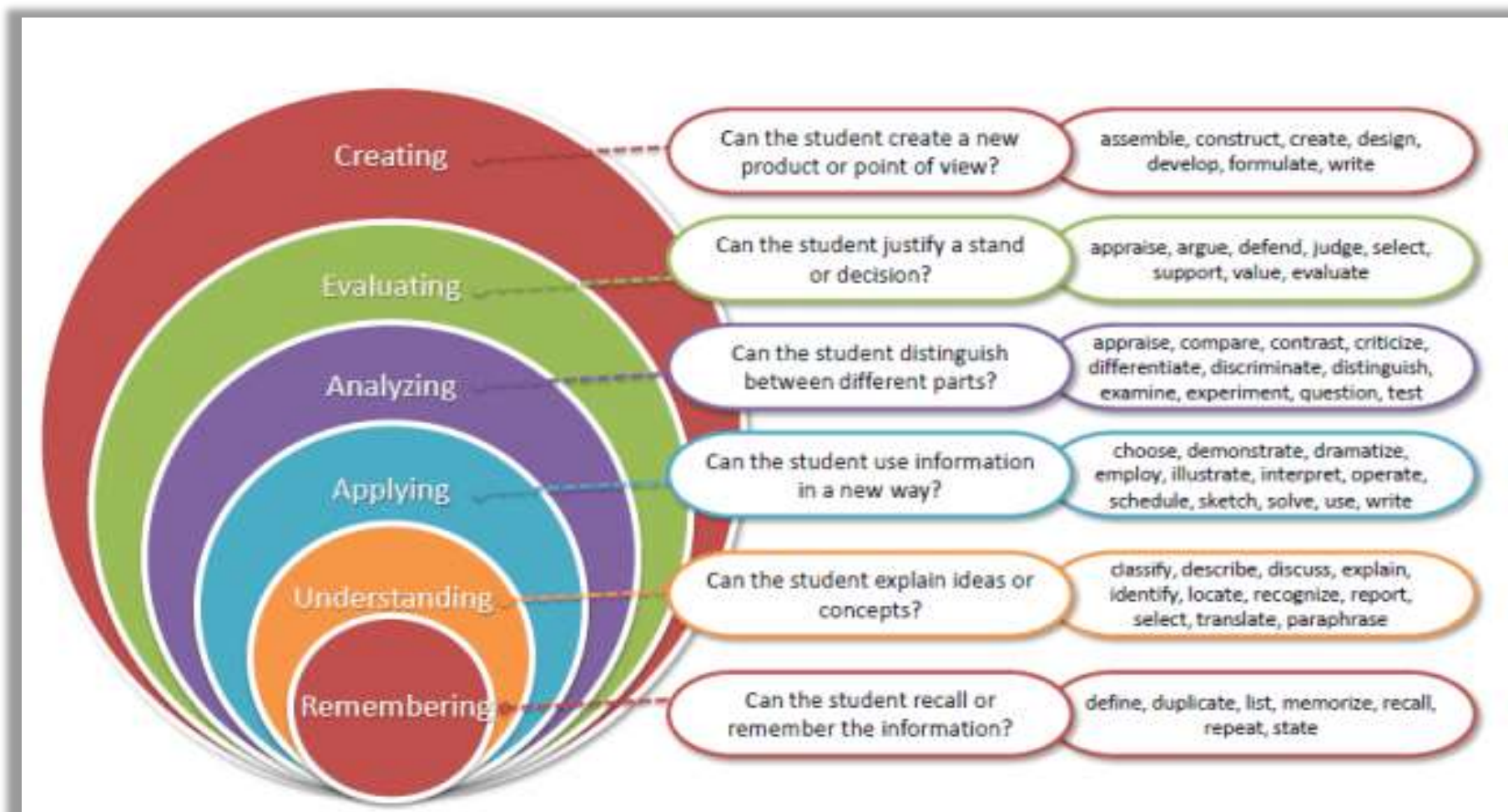
Academic Task	Objective	Detail of Academic Task	Nature of Task	Mode of Academic Task	Max Marks	Allotment Week	Submission Week	Evaluation Parameters	Is Rubric applicable	Mapped Outcomes/ Add-Ones		
Project	Student will be able to create project using NLP tool and write one quality paper for the same project	Project will be in group submission is online. Project carry 30 marks	Group	Online	30	3	12	Applicable	Yes	View Outcomes View Add-Ones	Edit	Delete
Test	Student will be able to learn the concept of Natural Language processing and different models associated with them.	Unit 1 and Unit 2 will be covered	Individual	Offline	30	5	6	Applicable	Yes	View Outcomes View Add-Ones	Edit	Delete



Rubrics of Project

- Project report(10 marks)
- Viva(10 marks)
- Presentation(10 marks)
- Total marks (30 marks)

Revised Bloom's Taxonomy





Before
MTE

Course contents

- UNIT I
- **Introduction to NLP and Text Processing** : NLP introduction, origin of NLP, Language and Knowledge, The challenges of NLP, Language and Grammar, NLP applications, Linguistic essentials, Morphology, Syntax, Semantics, Basic Text Processing, Tokenization, Lemmatization, Stemming, Stop words, Capturing word dependency using TF-IDF.

Before
MTE

Course contents

- UNIT II
- **Vector Space Models** : Vector Space Models, Capture Semantic Meaning, Continues Bag-of-Words, Relationships between, Relationships between Words, Capture Dependencies between Words, Visualize the Relationships in Two Dimensions Using PCA, Machine Translation and Document Search, Transform Word Vectors.



Course contents

- UNIT III
- **Natural Language Processing with Probabilistic Models** : Autocorrect: Minimum Edit Distance, Spellchecker to Correct Misspelled Words, Part of Speech Tagging and Hidden Markov Models: About Markov Chains and Hidden Markov Models, Part-Of-Speech Tags using a Text Corpus, Autocomplete and Language Models: N-gram Language Models work by Calculating Sequence Probabilities, Autocomplete Language Model using a Text Corpus, Word Embeddings with Neural Networks: Word Embeddings, Semantic Meaning of Words.



Course contents

After
MTE

- UNIT IV
- **Natural Language Processing with Classification Models** : Sentiment Analysis with Logistic Regression, Extract Features from Text into Numerical Vectors, Binary Classifier using a Logistic Regression, Sentiment Analysis with Naïve Bayes, Bayes' rule for Conditional Probabilities, Naïve Bayes Classifier.

After
MTE

Course contents

- UNIT V
- **Natural Language Processing with Sequence and Attention Models :** Introduction to Sequence Models, Recurrent Neural Networks and their limitations, Long Short-Term Memory (LSTM), Applications, POS Tagging, Named Entity Recognition, Neural Machine Translation, Shortcomings of a Traditional seq2seq Model, Introduction to Attention Mechanism.

After
MTE

Course contents

- UNIT VI
- **Building Models/ Case Studies** : Question Answering: Transfer Learning with State-Of-The-Art Models, T5 and Bert, Model for Answering Questions, Chatbot: Examine Unique Challenges, Transformer Models Face and their Solutions, Chatbot using a Reformer Model.



The hitch...

The three BURNING questions in mind...

- **Why are we learning NLP?**
- **What would we do with it?**
- **What will be the course outcome?**





Natural Language Processing

- NLP is the ability of a computer program to understand human language as it is spoken and written -- referred to as natural language. It is a component of artificial intelligence (AI).
- NLP has existed for more than 50 years and has roots in the field of linguistics. It has a variety of real-world applications in a number of fields, including medical research, search engines and business intelligence.



Natural Language Processing Applications

Chatbots

Autocomplete in search engines

Voice Assistants

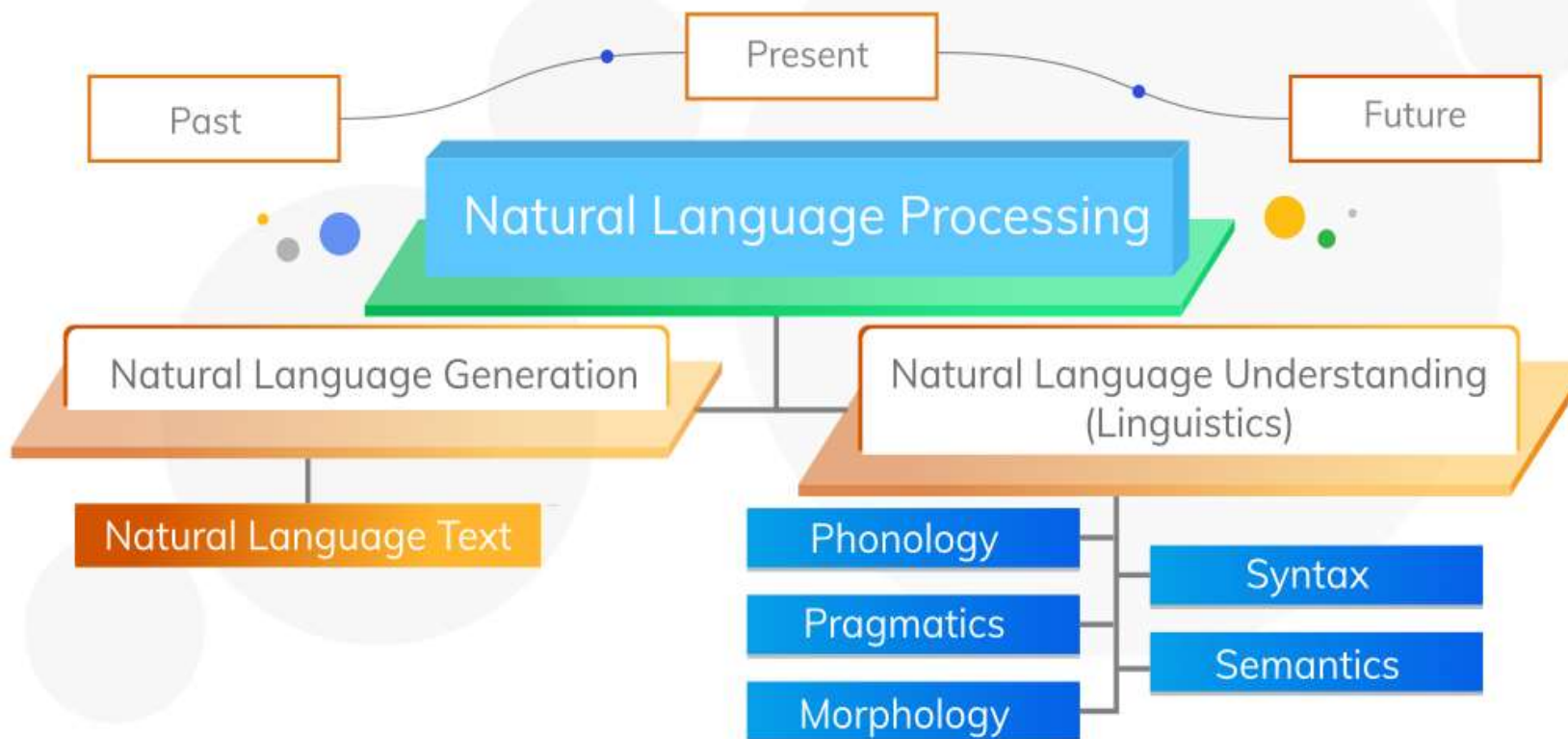
Language Translator

Sentiment Analysis

Email classification and filtering



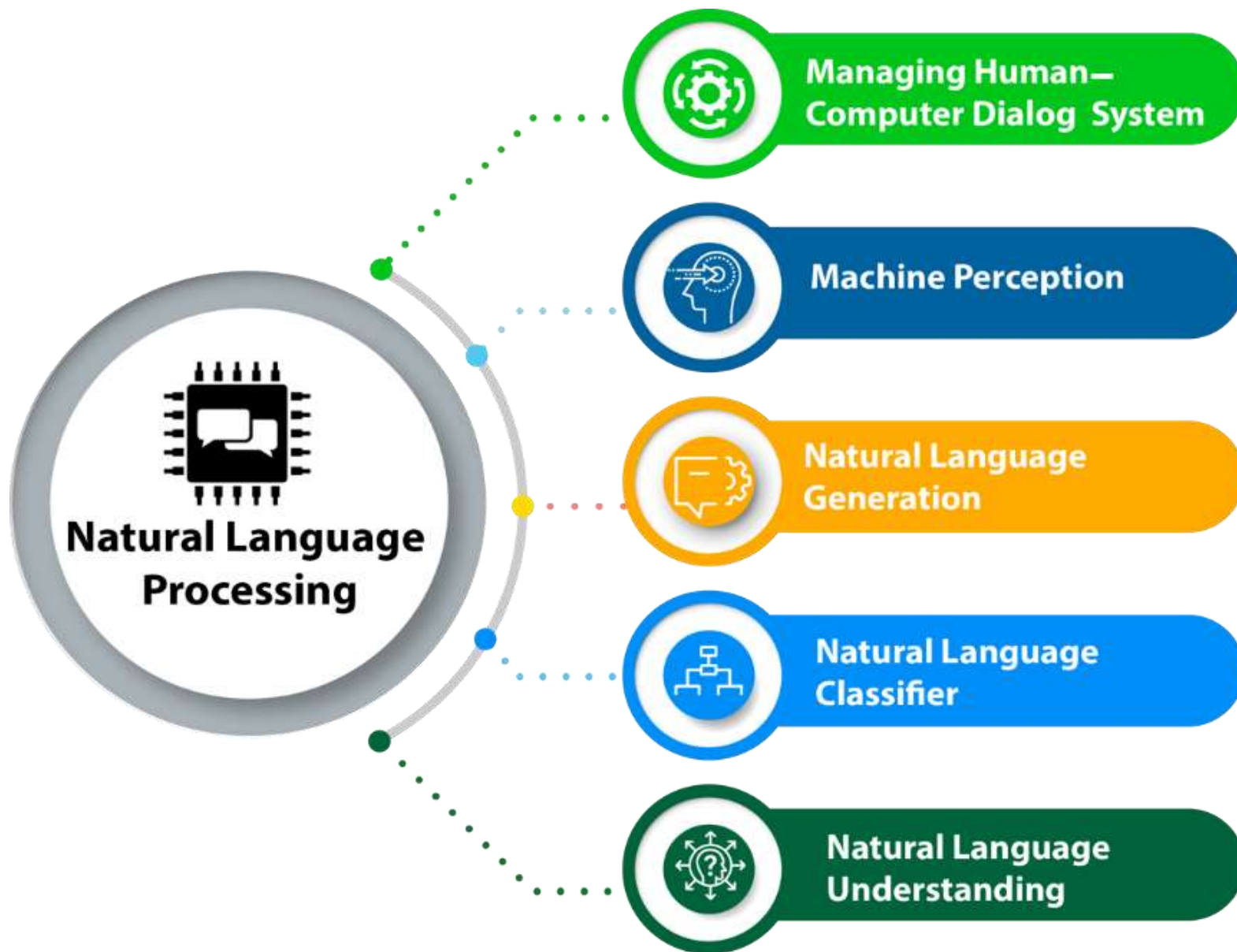
Evolution of NLP

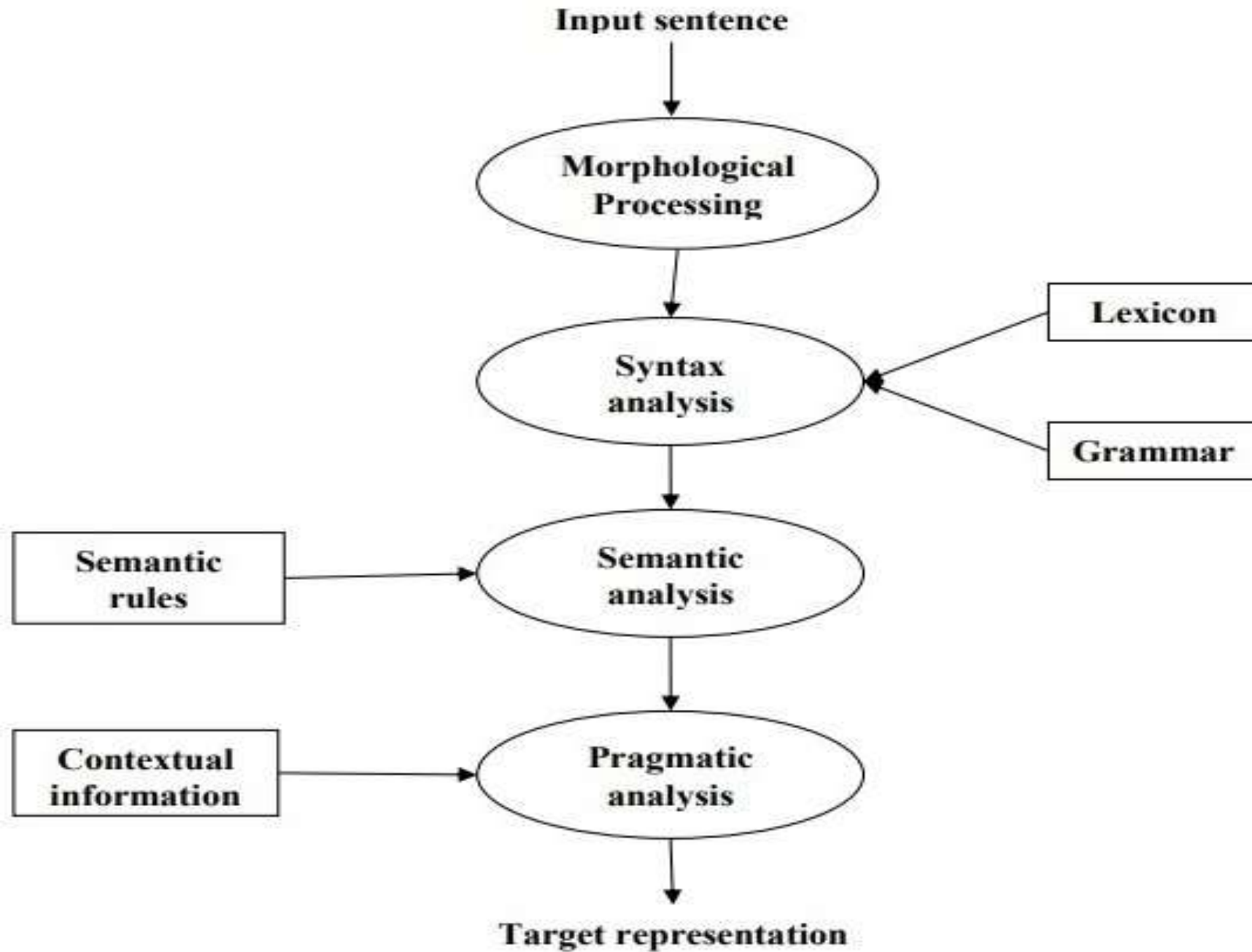




How does natural language processing work?

- NLP enables computers to understand natural language as humans do. Whether the language is spoken or written, natural language processing uses artificial intelligence to take real-world input, process it, and make sense of it in a way a computer can understand. Just as humans have different sensors -- such as ears to hear and eyes to see -- computers have programs to read and microphones to collect audio. And just as humans have a brain to process that input, computers have a program to process their respective inputs. At some point in processing, the input is converted to code that the computer can understand.
- There are two main phases to natural language processing: data preprocessing and algorithm development.





Information Retrieval

Doc A



Doc 1

Doc 2

Doc 3

Sentiment Analysis



Information Extraction



Machine Translation



Natural Language Processing

Question Answering



Human: When was Apollo sent to space?



Machine: First flight - AS-201, February 26, 1966



NLP Phases

- **Morphological Processing**

- It is the first phase of NLP. The purpose of this phase is to break chunks of language input into sets of tokens corresponding to paragraphs, sentences and words. For example, a word like “**uneasy**” can be broken into two sub-word tokens as “**un-easy**”.

- **Syntax Analysis**

- It is the second phase of NLP. The purpose of this phase is two folds: to check that a sentence is well formed or not and to break it up into a structure that shows the syntactic relationships between the different words. For example, the sentence like “**The school goes to the boy**” would be rejected by syntax analyzer or parser.



NLP Phases

- **Semantic Analysis**
 - It is the third phase of NLP. The purpose of this phase is to draw exact meaning, or you can say dictionary meaning from the text. The text is checked for meaningfulness. For example, semantic analyzer would reject a sentence like “Hot ice-cream”.
- **Pragmatic Analysis**
 - It is the fourth phase of NLP. Pragmatic analysis simply fits the actual objects/events, which exist in a given context with object references obtained during the last phase (semantic analysis). For example, the sentence “Put the banana in the basket on the shelf” can have two semantic interpretations and pragmatic analyzer will choose between these two possibilities.



Unit mapped	Broad topic	Sub Topic	Source Type	Source Title	*%age mapping (approx)	Source URL
Unit 1	Introduction to NLP and Text Processing	Introduction to NLP: NLP introduction, origin of NLP, Language and Knowledge, The challenges of NLP, Language and Grammar, NLP applications, Linguistic essentials: Morphology, Syntax, Semantics, Basic Text Processing: Tokenization, Lemmatization, Stemming, Stop words, Capturing word dependency using TF-IDF.	Reading material	Sentiment Analysis using Logistic Regression and Naive Bayes	70%	https://builtin.com/data-science/introduction-nlp



OPEN EDUCATIONAL RESOURCE

Unit 2	Vector Space Models	Vector Space Models: Vector Space Models Capture Semantic Meaning, Continues Bag-of-Words, Relationships between Words, Capture Dependencies between Words, Visualize the Relationships in Two Dimensions Using PCA, Machine Translation and Document Search: Transform Word Vectors, Machine Translation and Document Search	Reading material	Vector Space Models for NLP	70%	https://sabankara.medium.com/vector-space-models-7934a47a5f5 .
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Unit 3	Natural Language Processing with Probabilistic Models	Autocorrect: Minimum Edit Distance, Spellchecker to Correct Misspelled Words, Part of Speech Tagging and Hidden Markov Models: About Markov Chains and Hidden Markov Models, Part-Of-Speech Tags using a Text Corpus, Autocomplete and Language Models: N-gram Language Models work by Calculating Sequence Probabilities, Autocomplete Language Model using a Text Corpus, Word Embedding, Semantic Meaning of Words	Video	Natural Language Processing with Probabilistic Models	100%	https://www.coursera.org/learn/probabilistic-models-in-nlp?specialization=natural-language-processing
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Unit 4	Natural Language Processing with Classification Models	Sentiment Analysis with Logistic Regression: Extract Features from Text into Numerical Vectors, Binary Classifier using a Logistic Regression, Sentiment Analysis with Naïve Bayes:	Reading material	Sentiment Analysis with an Machine Learning,	50%	https://www.geeksforgeeks.org/what-is-sentiment-analysis/
		Bayes' rule for Conditional Probabilities, Naive Bayes Classifier				



Unit 5	Natural Language Processing with Sequence and Attention Models	Introduction to Sequence Models: Recurrent Neural Networks and their limitations, Long Short-Term Memory (LSTM), Applications: POS Tagging, Named Entity Recognition, Neural Machine Translation: Shortcomings of a Traditional seq2seq Model, Introduction to Attention Mechanism	Reading material	Introduction to Seq2Seq Models, Implementing Seq2Seq Models for Text Summarization With <u>Keras</u>	80%	https://www.analyticsvidhya.com/blog/2020/08/a-simple-introduction-to-sequence-to-sequence-models/ , https://blog.paperspace.com/implement-seq2seq-for-text-summarization-keras/
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Unit 6	Building Models/ Case Studies	Question Answering: Transfer Learning with State-Of-The-Art Models, T5 and Bert, Model for Answering Questions, Chatbot: Examine Unique Challenges, Transformer Models Face and their Solutions	Video	Natural Language Processing with Attention Models	90%	https://www.coursera.org/learn/attention-models-in-nlp?specialization=natural-language-processing
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Education Revolution(edrev)

Empowering Holistic Learning & Skill Development

- **What is EdRev?**

- A mandatory academic initiative for all students.
- Aims to enhance academic excellence and holistic development.
- Ensures learning beyond traditional classroom methods.

- **Categories:**

- Core Courses
- Non-Core Courses



Core Courses in EdRev

- Mandatory academic components essential for degree completion
- Ensure strong foundation in the chosen discipline
- Involves multiple recognized subcomponents for enhanced learning

Subcomponents:

- 1.RPL (Recognition of Prior Learning)
- 2.NPTEL / SWAYAM / Other MOOCs
- 3.Project-Based Learning
- 4.Grade Upgradation



RPL (Recognition of Prior Learning)

- Allows course exemption through prior experience or knowledge.
- Eligible sources:
 - Experience / Training
 - Certifications
 - Internships / Apprenticeships
 - Exam-based Exemptions

INT344 -
Natural Language
Processing

Sources of prior learning

Machine learning and NLP basics

INT248: Advanced Machine Learning

INT213:Python Programming

INT254:Fundamentals of ML



NPTEL / SWAYAM / Other MOOCs

- Online learning via reputed platforms.
- Must include proctored certification exams.
- Examples:
 - **NPTEL:** National Programme on Technology Enhanced Learning
 - **SWAYAM:** Study Webs of Active Learning for Young Aspiring Minds
 - AICTE MOOCs and other UGC-approved platforms

Course Code	MOOC course name	Agency	URL
INT344: Natural Language Processing	Natural Language Processing	NPTEL/SWAYAM	https://onlinecourses.nptel.ac.in/noc25_cs51/preview
	Deep learning for NLP	NPTEL/SWAYAM	https://onlinecourses.nptel.ac.in/noc25_cs22/preview

Project-Based Learning

- Involves real-world problem solving
- Mapped to academic objectives
- Examples:
 - Smart India Hackathon
 - Projects with ISRO, DRDO, NITI Aayog, Google, etc.



Details of Project

Course Code*	Title of Project*	Source*
INT344: Natural Language Processing	Conversational image recognition chatbot	Bharat Electronics Limited (BEL) SIH1604
	Learning App for Deaf and Mute and Sign-language – English / Gujarati converter	Government of Gujarat
	AI-powered student assistance chatbot for Department of Technical	Government of Rajasthan
	Create an annual report portal for institute where all the departmental reports can be integrated and customized.	Ministry of AYUSH
	Intelligent enterprise assistant : Enhancing organizational efficiency through AI-driven chatbot integration.	GAIL, Ministry of Petroleum and Natural Gas
	AI driven inspection of institutions.	AICTE
	Extraction and Verification of information from semi-categorized data.	Ministry of Defense
	Pulitzer center’s machine learning reporting grants	Pulitzer center

Grade Upgradation

- Opportunity to improve academic grades
- Based on:
 - NPTEL / MOOCs
 - Technical Competitions
 - Hackathons
 - Competitive Exams (e.g., GATE)

Category for mapping*	Course Code*	Description/Statement
Technical competitions/ Hackathon	INT344 : NATURAL LANGUAGE PROCESSING	Kaggle: Kaggle offers numerous NLP competitions on various topics, allowing you to learn and improve your skills
Technical competitions/ Hackathon		Analytics Vidhya: Analytics Vidhya hosts hackathons and blogathons, providing platforms for both beginners and experienced professionals to showcase their skills.
Technical competitions/ Hackathon		HackerEarth HackerEarth hosts various hackathons, including those focused on NLP and AI, offering opportunities to solve real-world problems.
Technical competitions/ Hackathon		NL40pt: NL4Opt hosts competitions focused on NLP for optimization tasks.
Recruitment/ Competitive exam		SAS Certified Specialist: Natural Language Processing and Computer Vision Using SAS Viya
Technical competitions/ Hackathon		IEEE DataPort: IEEE DataPort hosts hackathons focused on AI for knowledge discovery, Including NLP challenges.

Accessing EdRev on UMS

- To access Education Revolution (EdRev) resources:
 - **Go to:** UMS Portal
 - Navigate to: **LMS > Edu Revolution**



Division of International Affairs, LPU

Semester Exchange at LPU

LPU's Semester Exchange Program allows students to study abroad for one semester at a partner institution.

100% Scholarship
(On overseas Tuition Fees)
(Applicable in most cases)

Apply During
Feb/Aug

Duration
One Semester

Eligibility
6 CGPA
(No reappear/backlog)

Final Degree
From LPU

Avg. Budget
2.5 to 5 Lakh INR
(Living & Travel
Experience)



LPU's International Credit Transfer

The LPU International Credit Transfer Program allows students to begin their studies at LPU and seamlessly transfer to complete their degree at a foreign partner university

Bachelor's Degree
2+2

Master's Degree
1+1

1st & 2nd Year at LPU

1st Year at LPU

3rd & 4th Year at
Foreign University

2nd Year at Foreign
University

Final Degree from the Foreign Partner University

MBA students went to Chungnam National University, south korea for winter school program



Summer/Winter School Program

This program allows to spend 2-4 weeks for cultural exposure at partner university





Academic Mobility in CSE – Explore the World

Semester Exchange Program (100+ Partners)

- Staffordshire University, UK Glasgow
- Caledonian University, Scotland, UK
- University of Klagenfurt, Austria
- Memorial University of Newfoundland, Canada
- University of Lethbridge, Canada
- LeTourneau University, USA Livingstone College, USA
- University of Wisconsin-Madison, USA
- Curtin University, Australia University of Nantes, France Telkom University, Indonesia
- University of Chieti-Pescara, Italy Riga Technical University, Latvia Vilnius University, Lithuania University of Łódź, Poland Southern Federal University, Russia
- Woosong University, South Korea Universidad de Jaén, Spain
- Saint Petersburg Electrotechnical University "LETI", Russia

International Credit Transfer Program (20+ Partners)

- Murray State University, Kentucky, USA
- Rowan University, New Jersey, USA SUNY Oswego, New York, USA University of South Carolina Aiken, USA Tiffin University, Ohio, USA
- Trent University, Peterborough, Canada
- University of Lethbridge, Alberta, Canada
- Aivancity School for Technology Business & Society, Cachan, France
- Deakin University, Melbourne, Australia
- Swinburne University of Technology, Australia Victoria University of Wellington, New Zealand University of Waikato, New Zealand
- University of Plymouth, England, UK
- Manchester Metropolitan University, Manchester, UK University of Huddersfield, UK
- Heriot-Watt University Scotland, UK
- University of Strathclyde, Scotland, UK
- Solent University, Southampton, UK

Want to go global?
Scan to explore
more!



INTERNATIONAL CREDIT
TRANSFER PROGRAM
ENQUIRY FORM



SEMESTER EXCHANGE PROGRAM
ENQUIRY FORM

**FOR MORE DETAILS, VISIT BLOCK 32-310,
Division of International Affairs**

Your Seniors Went Global—Are You Next?



Thank You

