

SREE SANKARACHARYA UNIVERSITY OF SANSKRIT, KALADY

FACULTY OF SANSKRIT LITERATURE

DEPARTMENT OF

SANSKRIT GENERAL

SYLLABUS OF

ONE YEAR POST GRADUATE DIPLOMA

IN

SANSKRIT COMPUTATIONAL LINGUISTICS (PGDSCL)

(Project Mode Course)

February 2023

**Programme Specific Outcome (PSOs) for
Post Graduate Diploma in Sanskrit Computational Linguistics**

PSO1	Develop a scientific and innovative approach towards the Indic knowledge systems
PSO2	Develop multidisciplinary skills in research in the Indic systems of knowledge
PSO3	Represent Indic knowledge systems compatible with computational models
PSO4	Recognize the relevance of Pada-vākya-pramāṇa-śāstras in Knowledge engineering

Course Curriculum

Name of the Course	: Post Graduate Diploma in Sanskrit Computational Linguistics
Name of the Department	: Sanskrit General
Examination Type	: Yearly (Continuous Evaluation)
Programme Duration	: 01 year (2 semesters of 6 months each)
Eligibility	: Any Graduate with Basic knowledge in Sanskrit
Number of Seats	: 20

Curriculum Structure in Credit and Semester System (CSS) Outcum Based Teaching Learning and Evaluation (OBTLE)

Total Credits of the Programme	: 40 Credits
Classroom activities (Theory)	: 22 Credits
Project work	: 18 credits

Assessment Mode

Continuous Evaluation (Internal Evaluation)	: Assignment/Project (40%)
External Evaluation	: Written Exam/Online Exam/Viva-Voce/Practical Exam (60%)

Semester I

Sl. No.	Course	Hours		Credits
		Theory	Practical	
1.	Word Analysis	3	2*	4
2.	Sentential Analysis	3	2	4
3.	Śābdabodha I	3	2	4
4.	NLP with Python I**	2	4	4
	Basic Sanskrit***	4	0	
5.	Project I	0	8	4
	Total for Course A	11	18	20
	Total for Course B	13	14	
		Course A - 11 + 18 = 29 hrs/week Course B - 13 + 14 = 27 hrs/week		

* For practical, one credit for to two hours

** (Course A) NLP with Python for Students without programming background.

*** (Course B) Basic Sanskrit for students without prior knowledge in Sanskrit śāstras. (No practical sessions)

Semester II

Sl. No.	Course	Hours		Credits
		Theory	Practical	
1.	Techniques of Aṣṭādhyāyī	3	2	4
2.	Discourse Analysis	3	2	4
3.	Śābdabodha II	3	2	4
4.	NLP with Python II	2	4	4
5.	Project II	0	8	4
	Total	11	18	20
		11 + 18 = 29 hrs/week		

Semester : I

Credit	:	4
Teaching Hours	:	3
Practical Hours	:	2
Number of Contact Hours	:	5
Course Code	:	
Name of the Course	:	Word Analysis

Course Learning Outcome

CO1 Understand NLP in Indian and Western perspectives

CO2 Analyse the methodology, terminology and techniques of Indian Linguistics

CO3 Understand the morphological analysis and generation of Nominal and Verbal formation

CO4 Apply Tagging method of Sanskrit compounds

Module 1

Morphology, Sandhi rules in Aṣṭādhyāyī

Module 2

Word Generation (निष्पत्तिः) and Analysis (विश्लेषः), eg. सुबन्त and तिङन्त generation and analysis

Module 3

Word and paradigm model, Finite state automata

Module 4

Structure of Samāsa, Scheme of Tagging Samāsa

Recommended Book:

- Ashtadhyayi of Panini, Dr. Naresh Jha, Chaukhamba Surbharati Prakashan, 2014
- वैयाकरणसिद्धान्तकौमुदी with the commentaries बालमनोरमा – तत्त्वबोधनी, Motilal Banarassidas, 2010
- Annotation schemes for sandhi, morph and compound developed by Department of Sanskrit studies, University of Hyderabad
- The Sanskrit Language: An Overview - History and Structure, Linguistic and Philosophical Representations, by Pierre-Sylvain Filliozat
- The Word and the world : India's contribution to the study of language, Bimal Krishna Matilal, Oxford University Press, Newyork 1990
- NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, Prentice Hall of India, 1995
- Phonetics in Ancient India, W S Allen, 1971

Semester : I

Credit	:	4
Teaching Hours	:	3
Practical Hours	:	2
Number of Contact Hours	:	5
Course Code	:	
Name of the Course	:	Sentential Analysis

Course Learning Outcome

- CO1** Analyse the sentence construction in Sanskrit and other Indian languages
- CO2** Understand the Universality of Kāraka Theory
- CO3** Evaluate the distinction between the semantic structure of Sanskrit and other Indian languages
- CO4** Create the theory for semantic analysis of Indian languages

Module 1

Kāraka Theory, 0 Role

Module 2

आकाङ्क्षा, योग्यता, सन्निधि: in the perspective of computational analysis
Expectancy, Selectional Restriction, Proximity in Western Linguistics

Module 3

Importance of Tagging Scheme, Kāraka Tagging Schemes

Module 4

Annotation, Sentential Parsing

Note : Develop theories for sentential analysis of Malayalam/other Indian languages

Recommended Books:

- Indian Theories of Meaning, K. Kunjunni Raja, The Adayar Library and Research Center,
- Sanskrit Parsing : Based on the Theories of Shabdabodha, Amba Kulkarni. DK Print World
- Annotation guidelines developed by Sanskrit Consortium, TDIL, Ministry of Electronics & Information Technology, Govt. of India
- A Key to Karaka, Shivani V. and Santhosh More, CIFSS
- कारकम् – महाबलेश्वर भट्ट, संस्कृत भारती, बैंगलूरु , 1999
- Dimensions of Panini Grammar, Kapil Kapoor, D K Print World, 2020
- भाषाशास्त्रप्रवेशिनी, R S Venkatarama Shastri, Kuppaswami Research Institute, Madras, 1996
- Relevant research papers in the field of Machine Translation, Natural Language Processing, Computational Linguistics, Sanskrit Computational Linguistics, etc. (Updated Online resources)

Semester : I

Credit	:	4
Teaching Hours	:	3
Practical Hours	:	2
Number of Contact Hours	:	5
Course Code	:	
Name of the Course	:	Śābdabodha I

Course Learning Outcome

- CO1** Understand the process of conveyance of meaning
- CO2** Understand the theories of meaning in different śāstras
- CO3** Understand the concept of sentence in different śāstras
- CO4** Create the sentence mapping

Module 1

शाब्दबोधः, प्रमाणम्, शब्दः, कारणानि - आकाङ्क्षा, योग्यता, सन्निधिः

Module 2

शाब्दबोधोत्पत्तिक्रमः, पदज्ञानं तु करणम्, शक्तिग्रहोपायाः, पदम् - पदविभागाः, शक्तिः

Module 3

वाक्यम्, वाक्यलक्षणम्

Module 4

शब्दवृत्तयः - अभिधा, लक्षणा, व्यञ्जना

Recommended Books:

- शाब्दतरङ्गिणी, सुब्रह्मण्यशास्त्री,- Prof. KT Pandurangi, edition – 2006.
- शब्दशक्तिप्रकाशिका, जगदीश तर्कालंकार, कलिकता, १९०४
- शाब्दबोधमीमांसा, एन् अस् आर् ताताचार्य, Institute Franciasde Pondicherry/ RS Vidyapeeth 2006
- "The word and the world" - B.K.Matilal - 1992
- "Indian theories of Meaning" - Raja K. Kunjuni - 1963
- Philosophy of word and meaning, Gourinath Shastri - 1959
- "Sanskrit Philosophy of Language" JF Stall 1969
- "Logic, Language, Reality" - B.K. Matilal 1985
- Language and Logic, Navya Nyaya Perspective, Dr. Tirumala Kulkarni and Jaideep Joshi, Manipal University, 2013
- तर्कसङ्ग्रहः शाब्दबोधसहितः-गिर्याचार्यव्याख्या, श्रीराघवेन्द्रस्वामिमठः, मन्त्रालयः, १९८०

Semester : I

Credit	:	4
Teaching Hours	:	3
Practical Hours	:	2
Number of Contact Hours	:	5
Course Code	:	
Name of the Course	:	NLP with Python I

Course Learning Outcome

- CO1** Understand the different data types of Python
- CO2** Create simple Python programs using control structures
- CO3** Create programs using regular expressions in Python
- CO4** Create text tokenization, stemming, lemmatization.

Module 1

Introduction to Python programming language

Data types and data structures in Python

Module 2

Basic syntax and control structures in Python

Functions and modules in Python

Module 3

Introduction to Regular Expressions and Text Pre-processing

Searching and matching patterns in text using regular expressions

Module 4

Text pre-processing techniques: tokenization, stemming, lemmatization, stop-word removal

Handling special characters and encoding issues in text

Recommended Books:

- Text Analytics for Python (Updated online resources)
- Online tutorials for Python (Updated online resources)
- Python Natural Language Processing: Advanced machine learning and deep learning techniques for natural language processing

Semester : I

Credit	:	4
Teaching Hours	:	-
Practical Hours	:	8
Number of Contact Hours	:	8
Course Code	:	
Name of the Course	:	Project I

GUIDELINES

The project course is to work on a problem selected with the guidance of his/her supervising teacher to develop an application/tool and submit a monograph and the computational tool of the program at the end of the programme in order to fulfill the partial requirements of the programme. Internal review of the project work at the end of the semester.

Areas for Projects

1. Sanskrit Language Processing
2. Any language analysis based on śāstraic approach
3. Machine Translation (Malayalam/Sanskrit)
4. Word-sense-disambiguation (Malayalam/Sanskrit)
5. Speech processing and so on.

Semester : I

Credit	:	4
Teaching Hours	:	4
Practical Hours	:	0
Number of Contact Hours	:	4
Course Code	:	
Name of the Course	:	Basic Sanskrit

Course Learning Outcome

- CO1** Understand the linguistic principles of Nyāya, Vyākaraṇa and Mīmāṃsā
- CO2** Understand the basic concepts of Phonology of in Pāṇinīya Vyākaraṇa
- CO3** Understand the basic concepts of Morphology of Pāṇinīya Vyākaraṇa
- CO4** Understand the basic concepts of Semantics of Pāṇinīya Vyākaraṇa

Module 1

अक्षरसमाम्नायः(Phonology), पाणिनीयशिक्षा

Module 2

पदोत्पत्तिक्रमः(Morphology)

Module 3

अर्थविचारः(Semantics)

Module 4

Methodology of Nyāya, Vyākaraṇa and Mīmāṃsā

Note : A śāstras model application to be developed as an assignment.

Recommended Books:

- पाणिनीयशिक्षा
- Ashtadhyayi of Panini, Dr. Naresh Jha, Chaukhamba Surbharati Prakashan, 2014
- Dimensions of Panini Grammar, Kapil Kapoor, D K Print World, 2020
- वैयाकरणसिद्धान्तकौमुदी with the commentaries बालमनोरमा – तत्त्वबोधनी, Motilal Banarassidas, 2010
- अर्थसङ्ग्रहः
- तर्कसङ्ग्रहः
- मुक्तावली

Semester : II

Credit	:	4
Teaching Hours	:	3
Practical Hours	:	2
Number of Contact Hours	:	5
Course Code	:	
Name of the Course	:	Techniques of Aṣṭādhyāyī

Course Learning Outcome

- CO1** Understand the structure and methodology of Aṣṭādhyāyī
- CO2** Understand the meta-language and the meta-rules from Aṣṭādhyāyī
- CO3** Understand the prescriptive and generative rules of Aṣṭādhyāyī
- CO4** Apply the conflict resolutions in computing

Module 1

Computational aspects of Aṣṭādhyāyī, Concept of अनुवृत्ति, लाघव, गौरव, अधिकार

Module 2

शिवसूत्रजालम्, लिङ्गानुशासनम्, धातुपाठः

Module 3

इत्कार्यम्, अङ्गकार्यम्, concept of विभाषा

Module 4

विप्रतिषेधे परं कार्यम्, परनित्यान्तरङ्गापवादानामुत्तरोत्तरं बलीयः, असिद्ध principle

Recommended Books:

- Ashtadhyayi of Panini, Dr. Naresh Jha, Chaukhamba Surbharati Prakashan, 2014
- महाभाष्यम्
- वैयाकरणसिद्धान्तकौमुदी with the commentaries बालमनोरमा – तत्त्वबोधिनी, Motilal Banarassidas, 2010
- Panini : his work and its tradition, George Cardona
- Sivasutrajalam, Weibke Peterson
- Computational Concepts in Aṣṭādhyāyī, Sridhar. S.Y
- समासपारिजात, Dr. C Poornananda Sastri, २००३
- Dimensions of Panini Grammar, Kapil Kapoor, D K Print World, 2020

Semester : II

Credit : 4

Teaching Hours : 3

Practical Hours : 2

Number of Contact Hours : 5

Course Code :

Name of the Course : Discourse Analysis

Course Learning Outcome

CO1 Understand different types of śāstraic discourses

CO2 Understand the major methodological devices in śāstraic research

CO3 Understand the traditional and modern lexical resources and computational lexicography

CO4 Create the theory for word sense disambiguation

Module 1

Indian and Western theories of discourse

Module 2

Tantrayuktis – Ancient Indian Research Methodology

Module 3

Various Sanskrit Kośas, Amarakośa: Knowledge Structure, Digital Resources, Electronic Dictionaries and their linking, E-lexicons, WordNet, ConceptNet, PropNet, VerbNet

Module 4

Word Sense Disambiguation – Problems and its Various approaches

Lakṣaṇa Charts, Kāraka Charts

Causes of disambiguation according to Bhartṛhari (संयोगो विप्रयोगश्च...)

Recommended Books:

- Methodology of Ancient Indian Sciences, W. K. Lele
- Discourse Analysis of Sanskrit Texts: First Attempt Towards Computational Processing Thesis Submitted to University of Hyderabad by Monali Das
- Sanskrit Parsing : Based on the Theories of Shabdabodha, Amba Kulkarni. DK Print World
- Speech and Language Processing By Daniel Jurafsky and James H Martin• Amarakos ṣa: Sudhā Vyākhyāna

- Nirukta: Durgā vyākhyā,
- Nirukta: Lakṣman sarupa
- Lexicography: Ramadhara Simha
- Relevant research papers
- Online Lexical resources and their Documentation
- Philosophy of Word and Meaning, Gaurinath Shastri, 1959
- Linguistic Representations, Ramesh Chandra Pradhan, D K Print World, 2012
- Sabda, A Study of Bhartrhari's Philosophy of Language, Tandra Patnaik, D K Print World, 2017

Semester : II

Credit	:	4
Teaching Hours	:	3
Practical Hours	:	2
Number of Contact Hours	:	5
Course Code	:	
Name of the Course	:	Śābdabodha II

Course Learning Outcome

- CO1** Understand the components for semantic analysis
- CO2** Understand the perception of vakya in different śāstras
- CO3** Understand the semantic relations
- CO4** Evaluate the semantic structure for computing

Module 1

शाब्दबोधे मतानि, मुख्यविशेष्यः कः?, विशेषण-विशेष्यभावः, वाक्यार्थः, क्रिया-भावना-प्रथमान्तार्थ-मुख्यविशेष्यक-शाब्दबोधप्रकाराः

Module 2

अन्विताभिधान-वादः, अभिहितान्वय-वादः, संसर्गमर्यादा-वादः

Module 3

Representation of different relations - धर्मधर्मिभावः, आधाराधेयभावः etc.

Module 4

वाक्यभेदाः - According to न्याय, व्याकरण and मीमांसा

Recommended Books:

- मुक्तावली
- लघुशब्देन्दुशेखरः
- अर्थसङ्ग्रहः
- शाब्दबोधमीमांसा, एन् अस् आर् ताताचार्य, Institute Franciasde Pondicherry/ RS Vidyapeeth 2006
- Śābdabodha Rules in the context of Modern Language analysis: A Study, V. Sushama
- नव्यन्यायभाषाप्रदीप, महेश न्यायरत्न

Semester : II

Credit : 4

Teaching Hours : 3

Practical Hours : 2

Number of Contact Hours : 5

Course Code :

Name of the Course : NLP with Python II

Course Learning Outcome

CO1 Understand basic text processing task in NLTK and ILTK

CO2 Analyse text and stemming, stop-word removal etc.

CO3 Understand and apply Text classification using NLTK

CO4 Understand the general concepts of deep learning for NLP

Module 1

NLTK

Introduction to NLTK and its architecture

Reading and processing text data using NLTK

Exploring NLTK corpora and modules

ILTK

Module 2

Pre-processing Text Data using NLTK

Tokenization and stemming using NLTK

Part-of-speech tagging and chunking using NLTK

Dependency Parsing using NLTK

Text normalization and stop-word removal using NLTK

Module 3

Introduction to Machine learning

Introduction to supervised and unsupervised learning for text classification

Feature extraction and feature engineering for text data

Decision Tree algorithms and similar algorithm for text classification

Text classification using NLTK

Module 4

Basics of Deep learning Applications

Introduction to deep learning for NLP

Word embeddings and sentence embeddings

Recurrent Neural Networks (RNNs) for text classification

A brief overview of other techniques

Recommended Books:

- Natural Language Processing: Python and NLTK, Hardeniya Nithin, Jacob Perkins et. al.
Packt Publishing
- Natural Language Processing with Python, Steven Bird, Ewan Klein and Edward Loper.
Oreilly
- Explorations in Artificial Intelligence and Machine Learning, A CRC Press FreeBook,
Taylor and Francis Group

Semester : II

Credit : 4

Teaching Hours : -

Practical Hours : 8

Number of Contact Hours : 8

Course Code :

Name of the Course : Project II

GUIDELINES

The project course is to work on a problem selected with the guidance of his/her supervising teacher to develop an application/tool and submit a monograph and the computational tool of the program at the end of the programme in order to fulfill the partial requirements of the programme.