NATIONAL SANSKRIT UNIVERSITY – TIRUPATI
Department of Sabdabodha Systems & Computational Linguistics

1. Title of the program – **MA Sanskrit (Sabdabodha Systems & Language Technology)**
2. Title and number of the course – MSLT 4 semesters ; 5 papers per semester
3. Total number of marks – Each paper 70 (External) + 30 (Internal) = 100 marks
4. Unitization with Course Objectives & Outcomes – **Attached** (**Annexure I**)
5. List of Reference Books – Attached in Syllabus per Course
6. List of teachers participated in BOS meeting – 03 (Proof of email and meeting attached)

    Prof VNK Pandurangi   External Member

    Dr KS Maheswaran   External Member

    Dr OGP Kalyana Sastry   Internal Member and HOD (i/c)

7. Question paper pattern: **Pattern of the Question Paper:**

Objective / One word Answers; 1* 10	=	10 marks	
2 (out of four) Essay Question; 2 * 15	=	30 marks	
2(out of four) short essay questions; 2*10	=	20 marks	
2(out of four) small questions; 2*5	=	10marks	
Total	=	**70 marks**	
Internal Assessment	=	30 marks	
Grand Total	=	**100 marks**	

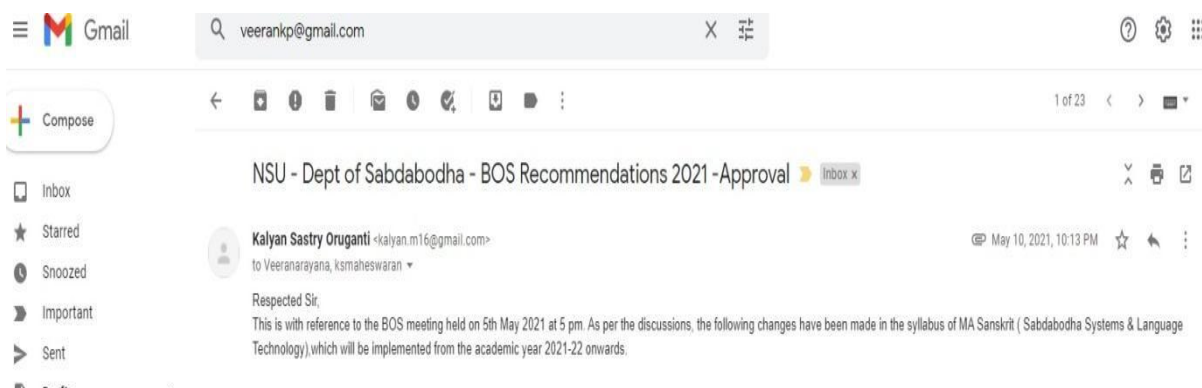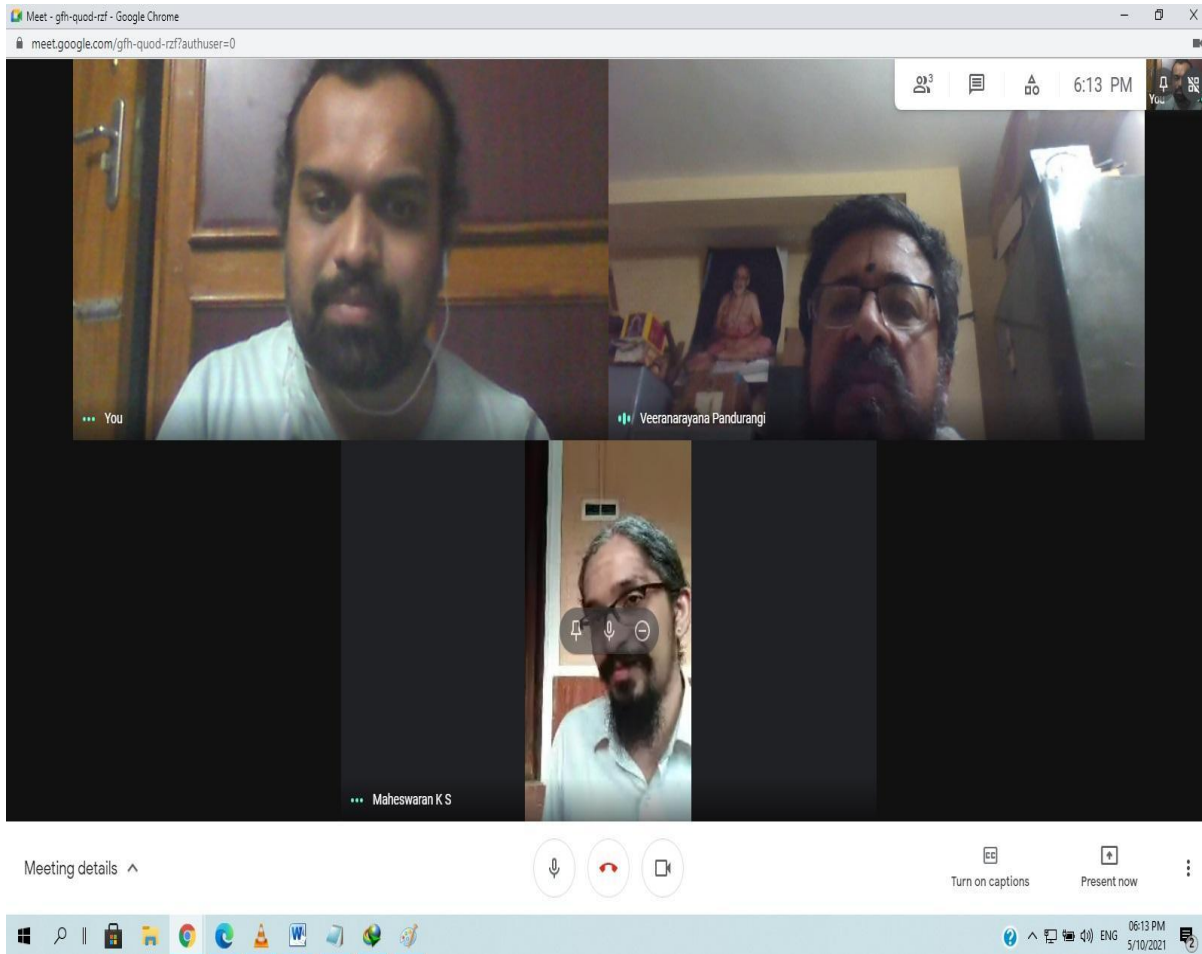8. Model question paper – **Attached** (**Annexure II**)

9. Date on which BOS meeting Held – 10/05/2020 5:00 pm

10. List of examiners

Dr. GSV Dattatreya Murthy, Kanchipuram (VYA)

Dr. S.Pavan Kumar, Chinmaya University, Kerala (VYA & Comp Ling)

Dr K.E.Gopaladesikan,Chinmaya University, Kerala (NYA)

Dr R.Naveen, RS Sansthan, Sringeri Campus (NYA)

Dr KE Srivenkatanathan, Karnatak Sanskrit University, Bengaluru(NYA)

Dr Shyam Sundar Bhat, RS Sansthan, Sringeri Campus (NYA)

Dr Vaithi Subramanian , Central University, Himachal Pradesh(VYA)

Dr Priyavrat Mishra , Darbhanga, Bihar (VYA)

For Computer Related Papers, Evaluators can be seen in the list given by Dept of Computer Science , National Sanskrit University

Screenshots of email communication and meeting

Veeranarayana Pandurangi
to me, kamaheswaran ▾

7:53 AM (1 hour ago) ☆ ↰

I have gone through it as discussed yesterday. it is approved.

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Veeranarayana N.K. Pandurangi
Dean, Faculty of Vedanta,
Karnakata Samskrita University,
Pampa Mahakavi Road,
Chamarajpet, Bengaluru.

अथ चेत्त्वमिमं धर्म्यं संग्रामं न करिष्यसि। ततः स्वधर्मं कीर्तिं च हित्वा पापमवाप्स्यसि।।
तस्मादुत्तिष्ठ कौन्तेय युद्धाय कृतनिश्चयः। निराशीर्निर्ममो भूत्वा युध्यस्व विगतज्वरः।। (भ.गी.)

http://www.ksu.ac.in
http://www.ksu.ac.in/en/dr-veeranarayana-n-k-pandurangi/
https://groups.google.com/forum/?hl=en&fromgroups#!forum/bvparishat

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Re: NSU - Dept of Sabdabodha - BOS Recommendations 2021 - Approva ⟩ Inbox ×   🖶 ↗

K S maheswaran
to me ▾

9:21 AM (17 minutes ago) ☆ ↰ ⋮

I have gone through it as discussed yesterday. it is approved.

Minutes of BOS meeting of Dept of Sabdabodha Systems & Communicational Linguistics held online on 10th May 2021 at 5pm

AGENDA of the meeting:

To look into the syllabus and recommend any new revisions / additions necessary, keeping in mind the spirit

of NEP 2020.

To update the Computer Programming related papers in sync with M.Sc Computer Science and Sanskrit

Language Technologies as Computer related papers are dealt by Dept of Computer Science, NSU

To incorporate '**Course Objectives**' and '**Course Outcomes**' for various courses revised in previous BOS

[September, 2020]

To properly arrange reading material into '**Prescribed Texts'** and '**Reference Texts**' (wherever necessary) with

complete details like Author / Publisher etc

Any Other Item

The BOS meeting of the Dept of Sabdabodha Systems & Computational Linguistics was held online on 10th May 2021 at 5pm and the members and convenor discussed and reviewed the syllabus of the courses offered by the Department. Following are the resolutions.

1.   To make the following changes Semester wise in the syllabus

SEMESTER 2

✔ **Course** I.
   MSLT121   -   Introduction to Paninian Grammar & Etymology
   Addition of the topic वेदाङ्गानां सामान्यपरिचयः in Unit 5

✔ **Course V.**
   MSLT125   Introduction to Paninian Grammar
● Rearranging of the Unit Division
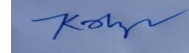● Addition of the topic न्यायसिद्धान्तमुक्तावली – दिनकरी Pages 281- 282 in Unit-I

SEMESTER 3
✔ **Course II**
   MSLT212   Introduction to Verbal suffixes
● Introduction of some more Verbal suffixes in Unit 3 & 4
● Addition of the topic परमलघुमञ्जूषा – धात्वर्थविचारः in Unit 5

✔ **Course III**
   MSLT213   Language and Linguistics
● Unit – IV - Replacing the existing topic of Phonetic Laws with Introduction of Morphology

2.   To Update Computer Science papers in accordance with the changes made in M.Sc Computer Science and Sanskrit Language Technologies Program.

3.   To Incorporate '**Course Objectives**' and '**Course Outcomes**' for all the courses.

The following changes will be incorporated and the updated syllabus will be sent to the Academic Section for further necessary action.

HOD i/c
Dept of Sabdabodha Systems & Computational Lingusitics

COURSE OUTLINE
M.A. Sanskrit (Sabdabodha Systems and Language Technology)

Semester 1

Course No.	Course Name	Credits
MSLT111	Introduction to Paninian Grammar	4
MSLT112	Introduction to Process of Sentence understanding	4
MSLT113	Introduction to Navya Nyāya	4
MSLT114	OBJECT ORIENTED PROGRAMMING WITH JAVA	4
MSLT115	Language & Speech Processing I	4
Software Lab - 1	NLP Tools	

Total = 20

Semester 2

Course No.	Course Name	Credits
MSLT121	Introduction to Paninian Grammar & Etymology	4
MSLT122	शाब्दबोधप्रक्रियापरिचय:	4
MSLT123	Introduction to Paninian Grammar	4
MSLT124	NLP WITH PYTHON	4
MSLT125	Language & Speech Processing II	4
Software Lab	NLP & Python	

Total = 20

Semester 3

Course No.	Course Name	Credits
MSLT211	Detailed Study of Samasas	4
MSLT212	Introduction to Verbal suffixes	4
MSLT213	Language and Linguistics	4
MSLT214	Corpus Linguistics	4
MSLT215	Language & Speech processing -III	4
Software Lab	Natural Language Processing – Resources	

Total = 20

Semester 4

Course No.	Course Name	Credits
MSLT221	Sabdabodha Text – I	4
MSLT222	Computer Programming – PERL	4
MSLT223	Sabdabodha Text – II	4
MSLT224	Major Project Work	8

Total = 20

Grand Total = 80

ANNEXURE -I

Detailed Course Description with Unit division

SEMESTER 1

Course I. *MSLT111 - Introduction to Paninian Grammar*

Course Objectives
1. To introduce the rich tradition of Grammar to the learners
2. To introduce the concept of **Sandhi** (Ach-sandhi only)
3. To introduce the concept of Case-endings and the various meanings they carry, especially the ***Karaka theory***

Unit No.	Unit Title	Objectives
I	1.व्याकरणशास्त्रसामान्यपरिचयः 2. अष्टाध्यायीपरिचयः 3.संज्ञाप्रकरणम् - लघुसिद्धान्तकौमुदी	*This unit deals with general introduction to the Vyakarana Sastra, important books and authors, historicity etc and orients the learners in learning the important saṃjñās*
II	अच्सन्धिः- लघुसिद्धान्तकौमुदी	*Deals about the phonetic changes between vowels.*
III	हल्सन्धिः- लघुसिद्धान्तकौमुदी विसर्गसन्धिः–लघुसिद्धान्तकौमुदी	*Deals about the phonetic changes between consonants and visarga.*
IV V	विभक्त्यर्थाः- लघुसिद्धान्तकौमुदी असिद्धत्वविचारः - सामान्यपरिचयः (पूर्वत्रासिद्धम्, असिद्धं बहिरङ्गमन्तरङ्गे) परनित्यान्तरङ्गापवादानामुत्तरं बलीयः	*Introduction to the meaning of case-endings and the Karaka theory and various sutras dealing with it* *Special focus on two important meta-rules in Paninian Grammar which decide the hierarchy of the sutras*

Course Outcomes
After finishing the course, the learner would be able to
1. Know the rich tradition of Indian Grammar
2. Know the important authors and the texts in the Grammar tradition
3. Know the different types of Ach-sandhis

4. Know and identify the various Karakas in a basic Sanskrit sentence

Prescribed Texts
1. लघुसिद्धान्तकौमुदी – वरदराजः – गीताप्रेस – गोरखपूर
2. व्याकरणशास्त्रेतिहासः - पं. वेङ्कटरामशास्त्री

Reference Texts
1. वैयाकरणसिद्धान्तकौमुदी – with the commentaries बालमनोरमा – तत्त्बोधिनी –Motilal Banarassidas – 2010 Edition
2. अष्टाध्यायी of Panini
3. The Laghukaumudi of Varadaraja with an English Commentary of JR Ballantyne
4. कारकम् – महाबलेश्वर भट्टः – संस्कृतभारती – बेङ्गलूरू - 1999

Course II. *MSLT112 - Introduction to the Process of Sentence Understanding*

Course Objectives
1. To introduce the concept of Sabdabodha to the learners
2. To introduce the concept of Vrutti and its types
3. To introduce the various theories propounded by various schools of thought with respect to *śakti lakṣaṇā* and *vyañjanā*
4. To introduce the secondary factors involved in the rise of Verbal Cognition

Unit No.	Unit Title	Objectives
I	परमलघुमञ्जूषायाम् -स्फोटभेदाः, वृत्तिस्वरूपम् – तद्भेदाः	*Introduction to Paramalaghumañjūṣā, Sphota Theory and types of Sphota. Introduction to vṛtti and its classification*
II III	शक्तिस्वरूपम्, मतान्तरनिरासः, शब्दार्थायोः तादात्म्यम्, अपभ्रंशेषु शक्तिविचारः, शक्तिभेदाः, विशेषार्थनिर्णायकाः संयोगादयः	*Concept of śakti according to different philosophies, classification and methods to know it.*
IV	लक्षणानिरूपणम् - न्यायमते लक्षणापदार्थः, लक्षणानिमित्तानि, लक्षणाबीजम्, लक्षणाभेदाः, लक्षणानिरासः व्यञ्जनानिरूपणम्	*Concept of lakṣaṇā according to various schools, its classification* *Concept of vyañjanā is known*
V	शाब्दबोधसहकारिकारणानि	*Secondary factors for Verbal cognition are known*

Course Outcomes

After finishing the course, the learner would be able to
1. Know the process involved in the rise of Verbal Cognition

2. Know, analyze and compare the different schools of thought and the process involved in the rise of Verbal Cognition
3. Understand the various standpoints put forth on the topic *Vṛtti* by various schools of thought.

Prescribed Texts

    1. परमलघुमञ्जूषा – नागेशभट्टविरचिता – भावप्रकाशिका(संस्कृत) – बालबोधिनी (हिन्दी)व्याख्योपेता – कृष्णदास अकादमी, वाराणसी

Reference Texts

1. न्यायसिद्धान्तमुक्तावली   –   विश्वनाथपञ्चाननविरचिता   – श्रीकृष्णवल्लभाचार्यकिरणावलीव्याख्योपेता
   Chaukhambha Sanskrit Sansthan, Varanasi, 2018 Reprint

Course III. *MSLT113   Introduction to Navya Nyāya*

Course Objectives

1. To introduce the learner to the world of *Saptapadarthas*
2. To familiarize the learner with concept of Prameyas and Pramanas
3. To acquaint learners with the various technical terms of *Navya Nyāya*

Unit No.	Unit Title	Objectives
I	तर्कसंग्रहः प्रत्यक्षखण्डे आरम्भात् द्रव्यप्रकरणपर्यन्तम्	*In-depth text reading and explanation of the Dravyas of the Pratyaksa chapter*
II	गुणनिरूपणमारभ्य प्रत्यक्षखण्डान्तम्	*In-depth text reading and explanation of the Gunas to the end of the Pratyaksa chapter*
III	अनुमानखण्डः, उपमानखण्डः	*In-depth text reading and explanation of the Anumāna and Upamāna chapters*
IV	शब्दखण्डः	*In-depth text reading and explanation of the Śabda chapter*
V	नव्यन्यायभाषाप्रदीपः धर्मस्वरूपम्, तद्भेदौ जातिरुपाधिश्च, सम्बन्धस्वरूपम्, साक्षात्परम्परासम्बन्धभेदौ, वृत्तिनियामकतदनियामकसंबन्धस्वरूपम्, वृत्तिनियामकसंबन्धाः समवायादयः। निर्दिष्टविषयानामध्ययनम् -प्रतियोग्यनुगिभावः, आधाराधेयभावः, व्याप्यवृत्तिः अव्याप्यवृत्तिश्च अभावः, अवच्छेद्यावच्छेदकभावः, विशेषणविशेष्यभावः, सविकल्पकनिर्विकल्पकज्ञानस्वरूपम्, विषयविषयिभावः	*Introduction and In-depth analysis of the concept of relation in Navya Nyāya Language, various classifications and divisions associated with Relations.*

Course Outcomes

After finishing the course, the learner would be able to

1. Know and classify materials into the seven fold classification of *Padarthas*
2. Know and understand the concept of *Lakshana* and do the *samanvaya*
3. Acquire competence in the technical jargon of *Navya Nyāya* and comprehend them.

Prescribed Texts

1. तर्कसंग्रहः - अन्नंभट्टः
2. नव्यन्यायभाषाप्रदीपः – महेषन्यायरत्न – Hare Press - Calcutta

Reference Texts

1. Language of Logic, Navya Nyāya Perspective (By Dr.Tirumala Kulkarni & Jaideep Joshi, Published by Manipal University- ISBN 13 - 978-9382460046 - 2013)
2. A Primer of Navya Nyaya Language and Methodology – Navya nyaya bhasapradipa of Maheshchandra Nyayaratna –English Commentary of Ujjwala Jha –Asiatic Society
3. Navyanayabhasapradipa of Mahesh Chandra Nyaya Ratna – Suprabha Commentary of Kalipada Tarkacharya – Sanskrit Colleg,Calcutta - 1956

Course IV. *MSLT114*   Object Oriented Programming with Java

Course Objectives:
1. Provide an introduction to Object oriented programming in JAVA
2. Introduce the reader to various kinds of expression and operators
3. Orient learners to the usage of looping statements and inheritance in JAVA programs

Unit I

Fundamentals of Object Oriented programming: Object Oriented paradigm – Basic concepts of Object Oriented Programming – Benefits of OOP – Applications of OOP.
Java Evolution: Java Features – How Java differs from C and C++ - Java and Internet – Java and World Wide Web – Web Browsers – Hardware and Software Requirements – Java Environment. Overview of Java Language: Simple Java Program – Java Program Structure – Java Tokens - Java Statements – Implementing a Java Program – Java Virtual Machine – Command Line Arguments. Constants, Variables and Data types: Constants – Variables – Data types – Declaration of Variables - Giving Values to variables - Scope of Variables - Symbolic Constants - Type Casting.

Unit II

Operators and Expressions: Arithmetic Operators – Relational Operators - Logical Operators – Assignment Operators – Increment and Decrement Operators – Conditional Operators – Bitwise Operators – Special Operators – Arithmetic Expressions – Evaluation of Expressions – Precedence of Arithmetic Operators – Operator Precedence and Associatively.

Unit III

Decision Making and Branching: Decision Making with If statement – Simple If Statement - If else Statement - Nesting If Else Statement - the Else If Ladder - The switch Statement – The ?: operator.
Decision Making and Looping: The while statement – The do statement – The for statement – Jumps in Loops.
Class, Objects and Methods: Defining a Class – Fields Declaration – Methods Declaration – Creating Objects – Accessing class members – Constructors – Methods Overloading – Static Members – Nesting of Methods – Inheritance – Overriding Methods – Final Variables and Methods – Final Classes – Abstract Methods and Classes – Visibility Control.
Arrays, Strings and Vectors: One - dimensional Arrays - creating an Array – Two dimensional Arrays – Strings – Vectors – Wrapper Classes – Enumerated Types.

Unit IV

Interfaces: Multiple Inheritance: Defining Interfaces – Extending Interfaces – Implementing Interfaces – Accessing Interface Variables.

Packages: Java API Packages – Using system Packages – Naming Conventions – Creating Packages – Accessing a Package – Using a Package – Adding a Class to a Package – Hiding Classes – Static Import.

Unit V

Multithreaded Programming: Creating Threads – Extending the Thread Class – Stopping and Blocking a Thread – Life Cycle of a Thread – Using Thread Methods – Thread Exceptions – Thread Priority – Synchronization.

Managing Errors and Exceptions: Types of Errors – Exceptions – Syntax of Exception Handling Code – Multiple Catch Statements – Using Finally Statement – Throwing our own Exceptions – Using Exceptions for debugging.

Course Outcomes

After finishing the course, the learner would be able to
1. Gain basic insights into the OOPs with JAVA
2. Have a clear idea about various expressions and operators used in JAVA
3. Write small programs based on various features of JAVA , build small API packages

Prescribed Text Books

1. E.Balaguruswamy, Programming with Java A primer 4e, TATA McGraw - Hill Company.

Reference Books

1. John R. Hubbard, Programming with Java Second Edition, Tata McGraw-Hill.
2. Jana, Java and Object Oriented Programming Paradigm, PHI. (ISBN 9788120327757)
3. Deitel & Deitel. Java: How to Program, 7thEdition, PHI.

Course V. *MSLT115*   Language & Speech Processing

Course Objectives:
1. Provide an introduction to NLP.
2. Give a sound introduction to various areas of NLP
3. Orient learners to Morphology and Parsing

Unit I

Introduction to NLP: Achievements and Brief history - Open Problems–Major Goal Language Structure and Language analyzer: Introduction to Language Structure, Overview of Language analyzer: Morphological Analyzer, Local word grouping (LWG), Core Parser.

Unit II

Words and their Analyzer: Introduction to Morphological Analysis (MA), MA using Paradigms– Speeding up of MA by compilation–Local Word Grouping: Verb groups, Noun groups, Strategy for grammar Development.

Unit III

Paninian Grammar: Introduction to Paninian grammar – Semantic model - Paninian theory: Karaka Relations–Active Passive: Karaka to Vibhakti Mapping, Karaka shares.

Unit IV

Paninian Parser: Introduction, Core Parser: Constraints – Preferences over Parses - Lakshan charts for Sense Disambiguation.

Unit V

Machine Translation: Introduction, Anusaraka or Language Accessories

Course Outcomes

After finishing the course, the learner would be able to
1. Gain basic insights into the basic concepts of NLP
2. Know about Morphology / LWG / Parsing
3. Write Karaka / Vibhakti mapping charts

Prescribed Text Book

Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, Natural Language Processing – A Paninian Perspective, PHI

SEMESTER 2

Course I. *MSLT121   Introduction to Paninian Grammar & Etymology*

Course Objectives:
1. Provide an introduction to feminine suffixes.
2. Give a sound overview of the Karaka Theory
3. General Introduction to Six Limbs of Vedas with special focus on Nirukta

Unit No.	Unit Title	Objectives
I	स्त्रीप्रत्ययाः – लघुसिद्धान्तकौमुदी	*Feminine suffixes of words are dealt with in this unit*
II	वैयाकरणासिद्धान्तकौमुदी कारकप्रकरणम्(उपपदविभक्तीः वर्जयित्वा) प्रथमा एवं द्वितीया विभक्ति:	*In-depth knowledge of the first and second case-endings in the Karaka chapter are gained*
III	तृतीया एवं चतुर्थी विभक्ति:	*In-depth knowledge of the third and fourth case-endings in the Karaka chapter are gained*
IV	पञ्चमी एवं सप्तमी विभक्ति:	*In-depth knowledge of the fifth and seventh case-endings in the Karaka chapter are gained*
V	1. निरुक्तम् - प्रथमाध्याये प्रथमपादः 2. वेदाङ्गानां सामान्यपरिचयः	*1.Introduction to Nirukta and etymology of words is gained 2.A Brief introduction to the six Vedangas are also taught*

Course Outcomes

After finishing the course, the learner would be able to
1. Have a basic knowledge on feminine suffixes
2. Have a keen knowledge on the various Karakas
3. Possess a basic idea of the Vedangas and their contribution to the Vedic Lore

   Prescribed Texts
1. लघुसिद्धान्तकौमुदी – वरदराजः – गीताप्रेस – गोरखपूर
2. वैयाकरणसिद्धान्तकौमुदी – with the commentaries बालमनोरमा – तत्त्बोधिनी –Motilal Banarassidas – 2010 Edition
3. निरुक्तम् - यास्काचार्यकृतम्

Course II. *MSLT122*   शाब्दबोधप्रक्रियापरिचय:

Course Objectives:
1. Provide a basic introduction to the process of Sabdabodha
2. Give an in-depth knowledge of the Sabdabodha process for sentences from Tarkasangraha Text

Unit No.	Unit Title	Objectives
I	तर्कसंग्रहशाब्दबोधः द्रव्यप्रकरणे मङ्गलश्लोकात् उद्देश्यप्रकरणपर्यन्तम्	*Sabdabodha of the mentioned topics are taught in this unit*
II	पृथिवीग्रन्थात् वायुनिरूपणपर्यन्तम्	*Sabdabodhas from Pruthivi - Vayu are taught*
III	आकाशग्रन्थात् मनोनिरूपणपर्यन्तम्	*Sabdabodhas from Aakasa – Manas are taught*
IV	पञ्चावयवाः एवं पञ्चहेत्वाभासाः	*Sabdabodhas of the Panchavayavas and the Hetvasbhasas are dealt with*
V	शब्दखण्डः	*Sabdabodhas of the Sabda part are taught.*

Course Outcomes
After finishing the course, the learner would be able to
1. Have a basic knowledge on the process of Sabdabodha
2. Chart out Sabdabodha diagrams for most of the sentences of Tarkasangraha
3. Apply this process of making Sabdabodha charts to other sentences in Nyaya / Vyakarana / Mimamsa philosophies

Prescribed Texts
1. तर्कसंग्रहः शाब्दबोधसहितः- गिर्याचार्यव्याख्या – श्रीराघवेन्द्रस्वामिमठः – मन्त्रालयः - 1980

Course III. *MSLT123   Introduction to Paninian Grammar*

Course Objectives:
1. Provide a basic introduction to the concept of Nominal Stems(नामार्थ:) according to various schools of thought
2. Introduce Nominal Declensions and their word-building process.

Unit No.	Unit Title	Objectives
I	1. परमलघुमञ्जूषा – नामार्थविचारः 2.शब्दशक्तिप्रकाशिका कारिका 14 – 18 3. न्यायसिद्धान्तमुक्तावली – दिनकरी Pages 281- 282	*The meaning of a name or a nominal stem according to Vyakarana and Nyaya theories and their classifications are taught*
II	लघुसिद्धान्तकौमुदी अजन्तपुंलिङ्गप्रकरणे अर्थवद्धातुरप्रत्ययः प्रातिपदिकम् इति सूत्रात् आदेशप्रत्यययोः इति सूत्रपर्यन्तम्	*General introduction to nominal stems and word-building processes pertaining to masculine gender are discussed*
III	सर्वादीनि सर्वनामानि इति सूत्रात् पतिः समास एव इति सूत्रपर्यन्तम्	*Word building process of Pronouns are discussed*
IV	बहुगणवतुडति संख्या इति सूत्रात् अजन्तपुंलिङ्गप्रकरणान्तम्	*Word building process of some more pronouns and special words are discussed*
V	अजन्तस्त्रीलिङ्ग – नपुंसकलिङ्गप्रकरणानि	*Word building process of feminine and neuter gender words are discussed*

Course Outcomes

After finishing the course, the learner would be able to
1. Have a basic knowledge on Nominal Declensions
2. Able to know the declension process for masculine vowel-ending words
3. Able to know the declension process for feminine and neuter gender vowel-ending words

Prescribed Texts

1. लघुसिद्धान्तकौमुदी – वरदराजः – गीताप्रेस – गोरखपूर
2. शब्दशक्तिप्रकाशिका
3. न्यायसिद्धान्तमुक्तावली दिनकरी-रामरूद्रीसहिता - Chaukhambha Sanskrit Sansthan, Varanasi - 1997

Reference Texts

1. वैयाकरणसिद्धान्तकौमुदी – with the commentaries बालमनोरमा – तत्त्बोधिनी –Motilal Banarassidas – 2010 Edition

Course IV. *MSLT124   NLP with Python*

Course Objective :
1. Understanding fundamentals of python programing for Text processing.
2. Get a clear idea of Functions and data structure usage which help to understand data usage.
3. To initiate learners to the concept of Tagging using Python

Unit – I

Language Processing and Python: Computing with Language: Texts and Words. Handling Text using Python List. Computing with Language: Simple Statistics- Frequency Distributions etc. Making Decisions and Taking control using Python. Automatic Natural Language Understanding

Unit II

Accessing Text Corpora and Lexical Resources: Accessing Text Corpora-Gutenberg Corpus,Web and Chat text, Brown Corpus, Reuter Corpus,Inaugural Address Corpus -Corpora in other Languages. Conditional Frequency Distributions. Lexical Resources-Wordlist Corpora, Pronouncing Dictionary, Comparative Word Lists, Shoebox and Toolbox Lexicons. WordNet: The WordNet Hierarchy, Lexical Relations, Semantic Similarity

Unit III

Processing Raw Text: Accessing Text from the Web and from Disk- Electronic Books-Dealing with HTML, Processing Search Engine Results, Processing RSS Feeds, Extracting Text from PDF, MSWod and other Binary Formats. Strings:

Text Processing at the Lowest Level: Basic operations with strings Accessing Individual Characters, Accessing Substrings, More operation Strings, The Difference between Lists and Strings. Text Processing with Unicode. Regular Expressions for Detecting Word Patterns. Useful Applications of Regular Expressions Extracting Word Pieces, Finding Word Stems, Searching Tokenized Text. Normalizing Text: Stemmers, Lemmatizations. Segmentation- Formatting: From Lists Strings

Unit IV

Supervised Classification, Examples of Supervised Classification, Evaluation, Decision Trees, Naive Bayes Classifiers, Maximum Entropy Classifiers, Modeling Linguistic Patterns

Unit V

Categorizing and Tagging Words: Using a Tagger, Tagged Corpora,Mapping Words to Properties Using Python Dictionaries, Automatic Tagging,N-Gram Tagging, Transformation-Based Tagging,How to Determine the Category of a Word

Course Outcomes
After finishing the course, the learner would be able to
1. Know the fundamentals of Text processing using Python
2. Know, distinguish and use various types of expressions and control statements basing on the given task
3. Understand various types of tagging

Prescribed Text Books

1. Natural Language Processing with Python, Steven Bird, EDwan Lein and Eduward Loper, O'reilly(ISBN 978-0-596-51649-9)

Reference Books

1.   Text Analytics with Python, Dipanjan Sarkar

V. *MSLT125Language & Speech Processing- II*

Course Objectives
1. Provide an introduction to NLP.
2. Give a sound introduction to various areas of NLP
3. Orient learners to Morphology and Finite State Automata

Unit I

Introduction to NLP: Knowledge in Speech and Language Processing–Ambiguity–Models and Algorithms –

Language, Thought and Understanding – Brief History

Unit II

Finite state automata, Using FSA to recognize sheep talk, Non - deterministic FSAs, Using an NFSA to accept strings, Relating Deterministic and Non - Deterministic Automata.

Unit III

Morphology and Finite State Transducers: English Inflectional and Derivational Morphology, Finite state Morphological parsing, Combining FST Lexicon and Rules, Lexicon - Fee FST–Porter Stemmer, Human Morphological Processing

Unit IV

Discourse: Reference resolution–Text Coherence - Discourse Structure–Psycholinguistic studies of Reference and coherence - Dialogue and Conversational Agents: What makes dialogue different–Dialogue Acts–

Unit V

Automatic Interpretation of Dialogue Acts–Dialogue Structure and Coherence–Dialogue managers in conversational Agents

Course Outcomes

After finishing the course, the learner would be able to
1. Gain basic insights into the basic concepts of NLP
2. Know about Morphology / Finite State Automata
3. Various procedures involved in Text and Speech Processing

Prescribed Textbook:
1. Speech and Language Processing–Danial Juafsky, James H. Martin.

Course I *MSLT211*   *Detailed Study of Samasas*

Course Objectives:
1. Introduction to the concept of compounds
2. Introduce the various kinds of compounds with examples.

Unit No.	Unit Title	Objectives
I	लघुसिद्धान्तकौमुदी 1.केवलसमासः 2. अव्ययीभावः	*Basic introduction to the process of Samasa and knowledge of Avyayibhava compounds are gained in this chapter*
II	तत्पुरुषः	*Knowledge of Tatpurusa compounds are gained in this chapter*
III	बहुव्रीहिः	*Knowledge of bahuvrihi compounds are gained in this chapter*
IV	द्वन्द्वः	*Knowledge of dvanda compounds are gained in this chapter*
V	समासशक्तिविचारः भूषणसारे केचित् निर्दिष्टविषयाः	*An introduction to the Concept of Samasa in different Philosophies as per Bhusanasaram is given in this chapter*

Course Outcomes

After finishing the course, the learner would be able to
1. Identify the different types of Samasas
2. Gain knowledge of Samasa-saktivada, wherein ideas of different schools of thought on Samasasakti are discussed

Prescribed Text Book:

1. लघुसिद्धान्तकौमुदी – वरदराजः – गीताप्रेस – गोरखपूर
2. वैयाकरणभूषणसारः - कौण्डभट्टकृतः

Reference Texts
1. वैयाकरणसिद्धान्तकौमुदी – with the commentaries बालमनोरमा – तत्त्बोधिनी –Motilal Banarassidas – 2010 Edition
2. समासपारिजातः – Dr C.Poornananda Sastri – 2003
3. समासः - महाबलेश्वर भट्टः – संस्कृतभारती – बेङ्गलूरू - 2006

Course II *MSLT212   Introduction to Verbal suffixes*

Course Objectives:
1. Introduction to the concept of verbal conjugations
2. Introduction to some important /commonly used verbal suffixes with examples.
3. Give insight to the meaning of a Dhatu according to various schools of thoughts

Unit No.	Unit Title	Objectives
I	लघुसिद्धान्तकौमुदी भ्वादात्प्रक्रिया	*Knowledge about the verbal conjugations of the verb -Bhu*
II	एधधात्प्रक्रिया	*Knowledge about the verbal conjugations of the verb -Bhu*
III	1.णिच् 2.सन् 3. यङन्त 4.यङ्लुक् 5.नामधातवः	*Knowledge of various suffixes like nich, san,yan, yanluk etc is gained*
IV	1.आत्मनेपदप्रक्रिया 2 परस्मैपदप्रक्रिया 3.भावकर्मप्रक्रिया 4. कर्मकर्तृप्रक्रिया 5. लकारार्थेप्रक्रिया 6.कृदन्ते कृत्यप्रकरणम्	*Knowledge of various suffixes used in specific usages like Bhavakarma, krdanta krt pratyaya etc is gained.*
V	1."फलव्यापारयोः धातुः" – भूषणसारकारिकाव्याख्या 2. परमलघुमञ्जूषा – धात्वर्थविचारः	*Definition of Dhatu according to Bhusanasara and the meaning of a Dhatu as expounded in Paramalaghumanjusa are known.*

Course Outcomes

After finishing the course, the learner would be able to
1. Gain a thorough insight into verbal conjugations
2. Possess a sound knowledge on the most commonly used suffixes
3. Know what a Dhatu means and the various discussions related to its meaning

Prescribed Text Book:

1. लघुसिद्धान्तकौमुदी – वरदराजः – गीताप्रेस – गोरखपूर
2. वैयाकरणभूषणसारः - कौण्डभट्टकृतः
3. परमलघुमञ्जूषा – नागेशभट्टविरचिता – भावप्रकाशिका(संस्कृत) – बालबोधिनी (हिन्दी)व्याख्योपेता – कृष्णदास अकादमी, वाराणसी

Reference Texts
1. वैयाकरणसिद्धान्तकौमुदी – with the commentaries बालमनोरमा – तत्त्वबोधिनी –Motilal Banarassidas – 2010 Edition

Course III *MSLT213   Language and Linguistics*

Course Objectives:
1. General introduction to the study of languages
2. Introduction to Sanskrit Language from a Linguistic perspective
3. General insight into Morphology, Phonology and Phonetic changes in Sanskrit

Unit No.	Unit Title	Objectives
I	1. Definition and Classification of Languages. Morphological Classification Genealogical Classification	*General introduction to language, process of communication and classification of languages into various families are dealt in this unit*

II	1. Theories on the origin of Languages.
	Old and Modern.
	
	Bow Vow, Pooh Pooh, Ding Dong, Ye-he-ho theories.
	
	2. History of Indo-Aryan Languages.
	    1. Old Indo Aryan
	    2. Middle Indo Aryan
	    3. Modern Indo Aryan
		Theories on origin of languages and history of the indo- Aryan languages and their respective divisions

III	Phonology.
	  1. तालव्यादिस्थानानि
	  2. तालव्यादिवर्णाः
	  3. आभ्यन्तरप्रयत्नः
	  4. बाह्यप्रयत्नः
	  5. स्पर्शाः अन्तः स्थाः, ऊष्माणः, स्वराः, अनुनासिकाः
	  6. ध्वनिपरिवर्तनकारणानि
		Basic introduction to phonology. Equivalent terms in Sanskrit Grammar and reasons for phonetic changes are known

IV	Introduction of Morphology	*Introduction to the concept of Morphology*
V	A) Types of Phonetic Changes 1. लोपः	*Various types of phonetic changes and*

	2. आगमः 3. विपर्ययः (Metathesis) 4. समीकरणम् (Assimilation) 5. विषमीकरणम् (Dissimilation) 6. सन्धिः 7. अनुनासिकता (Nasalization) 8.वर्णागमो वर्णविपर्ययश्च द्वौ चापरौ वर्णविकारनाशौ । धातोस्तथार्थातिशयेन योगस्तदुच्यते पंचविधं निरुक्तम्॥ B) Semantics Primary meaning, Secondary meaning, semantic changes. (अर्थसंकोचादयः), causes of semantic changes.	*similar concepts in Sanskrit Grammar are known*

Course Outcomes

After finishing the course, the learner would be able to
1. Gain basic knowledge in Linguistics
2. Know about the origin and classification of languages
3. Know about the place of Sanskrit in the classification of languages
4. Gain thorough understanding about the various phonetic changes occurring in Sanskrit

Prescribed Text Book:

1. An Introduction to Sanskrit Linguistics, M.Sriman Narayana Murti by D.K. Publications, Delhi
2. लघुसिद्धान्तकौमुदी – वरदराजः – गीताप्रेस – गोरखपूर

Reference Texts

1. भाषाशास्त्रप्रवेशिनी – RS Venkatarama Sastri – Kuppuswami Research Institute – Madras - 1996
2. Language – Bloomfield – Motilal Banarasidass
3. भाषाशास्त्रसंग्रहः – STG Varadacharya
4. Theories of Language: Oriental and Occidental – Prof Korada Subramanyam
5. इन्द्रविजयः - Prof Madhusudhan Ojha

Course IV *MSLT214:* Corpus Linguistics

Course Objective:
1. A gentle and accessible introduction about how corpus linguistics has developed and is employed as a methodology.
2. Provide an overview of the various important concepts in Corpus Linguistics
3. Highlight the usual problems encountered by researchers while using corpora

Unit I

Introduction to Corpus Linguistic, Mode of communication, Corpus-based versus corpus-driven Linguistics, Data collection regimes, Annotated versus unannotated corpora, Total accountability versus data selection, Monolingual versus multilingual corpora

Unit II

Accessing and analyzing corpus data, Corpus annotation, Introducing concordances, A historical overview of corpus analysis tools, Statistics in corpus linguistics. The web, laws and ethics, The web and legal issues, Ethical issues

Unit III

English Corpus Linguistics: University College London (UCL), Lancaster University, University of Birmingham, Université Catholique de Louvain, University of Nottingham, Northern Arizona University and the USA

Unit IV

Corpus-based studies of synchronic and diachronic variation: Diachronic change from Old English to Modern English, Diachronic variation in contemporary Modern English, The multi-dimensional approach to variation, Corpora and variationist sociolinguistics

Unit V

Neo-Firthian corpus linguistics: Collocation, Discourse, Semantic prosody and semantic preference, Lexis and grammar. Corpus-as-theory versus corpus-as-method, Sinclair's contribution to corpus linguistics Corpus methods and functionalist linguistics: Functionalism in linguistics: a brief overview, Corpus-based research from a functionalist perspective, Corpora and typology, Corpora and cognitive approaches to linguistics, Corpora in the analysis of metaphor

Course Outcomes

After finishing the course, the learner would be able to
1. Gain basic knowledge in Corpus Linguistics
2. Learn about the usual problems while working in the domain of Corpus Linguistics

Prescribed Text Books

Corpus   Linguistics: Method,   Theory   and   Practice, TONY   MCENERY   AND

Course V **MSLT215:** Language & Speech Processing - III

Course Objectives
1. Provide orientation to important concepts like Morphology, POS Tagging etc in the area of NLP
2. Give a clear picture of Semantics, Pragmatics in the domain of NLP.

Unit I

Words : Regular Expressions and Automata – Regular Expressions – Finite State Automata – Regular Languages and FSAs – Morphology and Finite-State Transducers**:** Survey of English Morphology – Finite-Stage Morphological Parsing – Combining FST Lexicon and Rules – Lexicon-Free FSTs – Human Morphological Processing

Unit II

Word Classes and Part-of-Speech Tagging : English Word Classes – Tagsets for English – Part-of-Speech Tagging – Rule-Based Part-of-Speech Tagging – Stochastic Part-of-Speech Tagging – Transformation –Based Tagging – Other issues: Multiple Tags and Multiple Words – Unknown Words – Class-based N-grams.

Context-Free Grammars for English : Constituency – Context-Free Rules and Trees – Sentence-Level Constructions – The Noun Phrase – Coordination – Agreement – The verb Phrase and Sub categorization – Auxiliaries – Grammar Equivalence and Normal Form – Finite-State and Context-Free Grammars – Grammars and Human processing

Unit III

Lexical Semantics : Relations Among Lexemes and Their Senses – WordNet – The Internal Structure of Words – Creativity and the Lexicon.

Word Sense Disambiguation and Information Retrieval : Selectional Restriction-Based Disambiguation – Robust Word Sense Disambiguation – Information Retrieval – Other Information Retrieval Tasks

Unit IV

Pragmatics : Discourse – Reference Resolution – Text Coherence – Discourse Structure – Psycholinguistic Studies of Reference and Coherence.

Unit V

Dialogue and Conversational Agents : What Makes Dialogue Different – Dialogue Acts – Automatic Interpretation of Dialogue Acts – Dialogue Structure and Coherence – Dialogue managers in Conversational Agents.

Course Outcomes

After finishing the course, the learner would be able to
1. Know and understand the concepts of Morphology, POS tags etc thoroughly
2. Get a clear picture of Semantics and Pragmatics and their use in the field of NLP

Prescribed Text Book:

1.Daniel Jurafsky, James H. Martin, Speech and Language Processing 2nd Edition, Pearson Publications, 2009

SEMESTER 4

Course I MSLT221   Sabdabodha Text – I

Course Objective:
1. In-depth knowledge of the Sabdakhanda portion of Siddhantamuktavali
2. Know about the process of Sabdabodha,Vritti and its classification
3. Introduce the secondary factors for Sabdabodha

Unit No.	Unit Title	Objectives
I	न्यायसिद्धान्तमुक्तावली शब्दखण्डः– ● पदज्ञानं तु करणमिति कारिकाव्याख्यानम् ● शक्तिस्वरूपम् ● शक्तिग्राहकानि ● आख्यातशक्तिवादः ● घटादिपदानां कार्यान्वितघटादौ शक्तिविचारः ● जातिशक्तिवादः ● यौगिकादिपदभेदाः	*In-depth knowledge on the process of Verbal Testimony. Definition of Sakti and methods of Saktigraha are known*
II	लक्षणास्वरूपम् - तद्भेदाः	*In-depth knowledge on the denotative function of words and the classification of Laksana is known*
III	समासे लक्षणानिरासः	*Analysis of Laksana in various compunds words in done*
IV	शाब्दबोधकारणानि आकाङ्क्षादीनि	*Secondary causes for Verbal Testimony are known*
V	व्युत्पत्तिवादः मूलम् Pages 1 – 10	*In-depth knowledge of the cause effect status of Akansha on Sabdabodha and the nature of Abhedasamsarga is known*

Course Outcomes

After finishing the course, the learner would be able to
1. Gain proper exposure into the process of Verbal Cognition
2. Know about the various levels in the process of Verbal Cognition and the various contributing factors
3. Know about the cause-effect theory between Akamsha and Sabdabodha as per Vyutpattivada

Prescribed Text Books :

1. न्यायसिद्धान्तमुक्तावली–   विश्वनाथपञ्चाननविरचिता श्रीकृष्णवल्लभाचार्यकिरणावलीव्याख्योपेता Chaukhambha Sanskrit Sansthan, Varanas, 2018 Reprint
2. व्युत्पत्तिवादः – गदाधरभट्टाचार्यकृतः – NS Ramanujacharya कृतविद्वद्मनोरमाटीकासहितः- RS Vidyapeetha,Tirupati
3. व्युत्पत्तिवादसिद्धान्तमाला - गोदवर्मन्

Course II
MSLT222   Computer Programming - PERL

Course Objective:
1. Introduce PERL as a programming language
2. Give an insight into the various conditional, relational and logical operators and commands
3. Familiarize Arrays

UNIT – I

Introduction to Perl – Sample Perl Program – Perl Program Execution - Scalar Variables and Constants – Reading Scalar Variables – printing Scalar Variables – Comment Statement

Objective of UNIT I: This section introduces a brief introduction to Perl Programming.

UNIT–II

Conditional statements: Relational operators – Logical operators – if statement – Loops – Loop Controls

Objective of UNIT II: After basic introduction, this unit deals with advanced and complex operation on numbers and string called relational Operators and loop controls.

UNIT–III

Array Variables: Reading Array Variables – Printing Array Variables-Array Manipulation

Objective of UNIT III: This unit focuses on Arrays and its implementation

UNIT–IV

Hash (Associative Arrays) Variables: Reading Hash Variables – Printing Hash Variables – Regular Expressions

Objective of UNIT IV: This unit focuses on Hash variables and its implementation

UNIT–V

File Handling: Opening a file for reading – File Attributes – Reading a file – Printing a file – Closing a file – Opening a file for writing – Basic Input and Output File Handles

Objective of UNIT V: This unit discuss about file handling in PERL

Course Outcomes

After finishing the course, the learner would be able to
1. Gain sufficient command on PERL
2. Write programs using conditional / relational operators and commands
3. Perform File Handling tasks with ease

Prescribed Textbooks:
1. Prof.R.J.Ramasree, PERL Programming, R.S.Vidyapeetha, Tirupati.

Reference Books:
1. Larry Wall, Tom Christiansen and Randal L.Scwartz Programming Perl, Second edition, Shroff Publishers and Distributors Pvt. Ltd.
2. C.Herrmann, Mastering Perl 5, BPB Publications, New Delhi.
3. Randal L. Schwartz and Tom Christiansen, Learning Perl Second edition, Shroff Publishers and Distributors Pvt. Ltd.

Course III

MSLT223 Sabdabodha Text – II (शाब्दबोधमीमांसा – एन्.एस्.आर्.ताताचार्यः)

Course Objective:

1. To give an overall picture of Sabdapramana as per various schools of thought
2. Introduce the various definition of terms like Sabda,Vakya, Vakayartha etc as per different philosophies and authors
3. Give insight into concepts like *Abhihitanvaya and Anvitaabhidaana*

(प्रथमभागः – भूमिकामात्रम्)

Unit No.	Unit Title	Objectives
I	1.शब्दस्याप्रामाण्यनिरासः 2. न्यायदर्शने शब्दस्य पृथक् प्रामाण्यम् 3. शब्दस्यानुमानत्वमिति दिङ्नागमतखण्डनम् 4. शब्दस्य प्रमाणान्तरत्वसाधनम्	*Various topics relating to Sabda and the need to accept it as an independent means of valid knowledge are known*
II	1. शब्दलक्षणम् – विभिन्नमतपरिचयः 2. वाक्यस्वरूपपरिचयः	*Definition of Sabda and Vakya according to various philosophies are known*
III	वाक्यार्थविचारः – विभिन्नमतसामान्यपरिचयः	*Definition of Vakyartha according to different philosphies is known*
IV	मतभेदेन स्फोटतत्खण्डनपरिचयः	*Concept of Sphota and various theories relating to it are known*
V	1.अभिहितान्वय – अन्विताभिधानवादपरिचयः 2.मतत्रयरीत्या एकस्मिन् वाक्ये शाब्दबोधः 3.शाब्दबोधे मुख्यविशेष्यविचारः	*The conepts of Abhihitanvaya and Anvitaabhidaana are known. The concept of the Viseshya according to various philosophies is also known*

Course Outcomes

After finishing the course, the learner would be able to

1. Know about importance of Sabdapramana
2. Distinguish between the different definitions of various schools of thought
3. Have a clear picture of important concepts of Verbal Cognition like *Abhihitanvaya and Anvitaabhidaana*
4. Comprehend the definitions of secondary factors of Sabdabodha according to different philosophies

Prescribed Textbooks:

1. शाब्दबोधमीमांसा - एन्.एस्.आर्.ताताचार्यः – Part 1 – Institut Franciasde Pondicherry/ RS Vidyapeetha-2006

Course IV *MSLT224   Major Project Work*

Course Objective:
In this course, students carry out project work on the various concepts they have learned during the previous courses. The project work acts as a testing bed to the various theories and computational concepts learnt by them and helps them gain new insights in the field of Sanskrit Computational Linguistics

ANNEXURE II

MODEL QUESTION PAPER

I. एकेन वाक्येन उत्तरं ददत   **1*10= 10**
1. तर्कसङ्ग्रहस्य कर्ता कः ?
2. तर्कसङ्ग्रहस्य मङ्गलश्लोकः कः
3. सामान्यम् कतिविधम्
4. विभुत्वं नाम किम्
5. वायोः किं लक्षणम्
6. सुखाद्युपलब्धिसाधनमिन्द्रियं किम्
7. संयोगनाशको गुणः कः
8. गुरुत्वलक्षणं किम्
9. कारणं कतिविधम्
10. इन्द्रियार्थसन्निकर्षजन्यं ज्ञानं किम्

II. द्वयोः समाधानं लिखत   2*15 = 30

1. कारणत्रैविध्यं सविस्तरं विवेचयत
2. षड्विधसन्निकर्षान् प्रतिपादयत
3. अनुमानद्वैविध्यं निरूपयत
4. शाब्दबोधप्रक्रियां तत्सहकारिकारणानि च प्रतिपादयत

III. द्वयोः समाधानं लिखत   2*10 = 20
1. शाब्दबोधसहितं ससमन्वयं पृथिवीलक्षणं लिखत
2. सप्रभेदं स्पर्शं निरूपयत
3. कालं निरूपयत
4. सव्यभिचारं सप्रभेदं निरूपयत

IV. द्वयोः समाधानं लिखत   2*5 = 10
1. व्याप्तिलक्षणं लिखत
2. अन्वयव्याप्तिं निरूपयत
3. व्यतिरेकव्याप्तिं निरूपयत
4. उपमितिं निरूपयत